Morse Micro
reaching farther™

MORSECTRL GUIDE

APPNOTE-13

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1 Scope

This application note applies to products containing the ‘morsectrl’ Linux software package that is run on the Morse Micro MM6108 chip. The Morse Micro package ‘morsectrl’ is a tool created to send and receive commands from/to the Morse Micro chip. This document outlines the most frequently used commands.

Please note that ’morsectrl’ is designed for engineering testing and evaluation purposes only. Changing the configuration of the device can break regulatory compliance. For issues or questions, please contact support@morsemicro.com.

2 Frequently Used Commands

This section outlines the most frequently used commands in the 'morsectrl' package, including a brief description, usage and instructions.

2.1 Duty Cycle

```
duty_cycle <command>
configure duty cycle mode. omit command to retrieve settings.
enable <value> [options]
       <value> set duty cycle in % (0.01-100.00)
       -m <mode> mode of operation (0:spread, 1:burst). default:0
       -u <unit> time unit of each burst record entry (us)
       -o enables or disables omitting control responses from the
          duty cycle budget.
disable
airtime      return remaining airtime (us), (burst mode only)
```

The duty cycle is the percentage of time each device type operates or transmits on that channel. The command configures the duty cycle value along with the mode of operation to be used. The firmware supports two modes.

- Spread - If an end-device uses the channel to transmit a frame for period T_{air}, then the duty-cycle restrictions will delay further transmissions by a duration T_{off} such that the overall duty cycle is not exceeded

- Burst - This uses the concept of burst cycle. A burst cycle is a full cycle of T_{air} and T_{idle}. T_{burst} is a configurable duty cycle parameter, used to characterize the duration of a burst cycle. Using different values of T_{burst}, the duty cycle algorithm can be adjusted to address different use cases.

2.2 Version

```
version          prints firmware version
```

Dumps the version string of firmware and 'morsectrl'.

2.3 Serial

```
serial     reads the chip serial number from OTP (zeroes if none blown)
```

Reads the chip serial number.

2.4 MCS

```
mcs <value>    selects mcs mode(0~9) or type (auto) for auto rate control
```

Sets the MCS rate to use from 0-9. If 'auto' is selected, the MCS will be determined by the rate control algorithm. The *'mcs'* command will only fix the MCS index at which the packets are sent.

This command is deprecated and the *'txrate'* command should be used instead.

2.5 TX Rate

```
Usage:
morsectrl -i wlan0 txrate [enable|disable]
'enable' must always be included when configuring a parameter to force
'disable' will reset all forced rate parameters
   -m <value>    MCS index (0-10) or (-1) to use default in firmware
   -b <value>    tx bandwidth in MHz or (-1) to use default in firmware
   -f <value>    duplicate format (0, 1, 2) or (-1) to use default in
                 firmware
   -t <value>    traveling pilots (0, 1) or (-1) to use default in
                 firmware
   -s <value>    short guard interval (0, 1) or (-1) to use default in
                 firmware
```

The *'txrate'* command provides more control over the tx rate compared to the aforementioned *'mcs'* command. This command fixes the rates to use by fixing the MCS, guard interval, bandwidth, travelling pilots and the tx duplicate format.

2.6 JTAG

```
jtag <disable|enable> [GPIO]     disable|enable jtag through RPi GPIO pin
```

Enables or disables the JTAG pin on the chip

2.7 Statistics

```
stats [options]      reads/resets stats (all cores if none were
mentioned)
        -a     App core
        -m     Mac core
        -u     Uphy core
        -j     outputs stats in a json format
        -p     outputs stats in a human-readable json format
        -r     resets stats for mentioned cores (resets all if none
                    were mentioned)
        -f "key"    filters stats according to the given key (case
                    sensitive)
        -s filename    the location of the firmware ELF
```

The ‘stats’ command dumps the chip statistics from the app, mac and phy cores. Individual statistics of different core can be obtained by passing the following arguments to ‘*morsectrl stats*’:

- -m (for mac)
- -u (for phy)
- -a (for app)

If none of the above arguments is given then ‘morsectrl’ will dump the statistics from all the cores. Additionally the -r argument can be used to reset the chip statistics. This will reset the stats on all the cores. The -f command can be used to filter out any stats based on the key provided. The table below outlines all statistics dumped by the ‘*morsectrl stats*’ command.

NOTE: During power save operation the PHY statistics will reset each cycle

App Stats	
retry table: Retry Count Avg Time	Number of retries for a packet.
commands received	Commands received by the apps core
commands responded	Commands responded by the apps core
commands repeated	Number of commands that were repeated
commands failed	Number of times the device failed to send a command
commands response failed	Number of time the device failed to respond to a received command
commands pending	Number of commands pending to be processed
commands late	Number of times there is a late response for a command which will already have been timed out
last host ID	
total_fh_page_irq	Number of times the from host pager interrupt was fired
total_fh_pages	Number of time the device successfully got the data from host after the fromhost interrupt was triggered
total_th_page_irq	Number of times the to host pager interrupt was fired
total_th_pages	Number of time the device successfully sent the data to host after the to host interrupt was triggered
Aon clk long calibration	Number of times the Aon clock was calibrated
Aon clk frequency	Value of the Aon clock frequency in Hz
Aon sleep duration adjusted for clock tolerance	Increments if the aon-clk cant handle the sleep-duration
number of PS_sleep	Number of times the chip when to sleep
woke from PS (timer)	Number of times the chip woke up due to the timer set by the dynamic ps timeout value
woke from PS (pin)	Number of times the chip woke up by the host wake up pin

Pager from_host reaped	Number of times the from host page has been pushed back to the pager
Pager to_host reaped	Number of times the to host page has been pushed back to the pager
to_host pages dropped (host in standby)	
Invalid pages received	Total invalid pages received
Events to host sent	Number of events sent to the host
Events to host failed	Number of events the failed to be sent to the host
ARP requests detected	Information of the ARP packets. This will only be populated if the driver is loaded using enable_arp_offload modparam
ARP requests answered	
ARP requests dropped	
ARP requests let through	
No page for ARP response	
ARP table updated	
ARP gratuitous generated	
tx_status none to send	Increments when there is no tx status cached
tx_status couldnt get page	Increments when there is no cached page for tx status information
tx_status dropped	Increments if the tx status was dropped and not sent to host
tx_status buffer flushed	Number of times the tx status buffer was flushed as there were no pending tx status
tx_status transmission corrupted	Increments if the driver has inadvertently popped the same page twice for use in TX and has likely corrupted the original/new transmission
Wake action frames handled	
pageset stats:	
Pageset 0	Pages sent from the host to the chip

allocated	Number of from host pages used
total	Total number of from host pages used
Pageset 1	Pages sent to the host from the chip
allocated	Number of to host pages used
total	Total number of to host pages used
Apps main task unused stack (words)	
Apps timer task unused stack (words)	
RTOS heap free bytes	
IPv4 Packets received	Number of ipv4 packets received
TCP Packets received	Number of TCP packets received
UDP Packets received	Number of UDP packets received
DHCP Packets received	DHCP information. This will only be updated if the driver is loaded with enable_dhcpc_offload modparam
DHCP discoveries sent	
DHCP requests sent	
DHCP lease updates sent	
DHCP leases fully expired	
DHCP leases obtained	
DHCP leases renewed/rebound	
Standby wakeup frame rx	The standby mode requirements will be facilitated by powering off the host when not sending or receiving traffic. The host will be powered on by toggling a GPIO address.This can be enabled by morsectrl standby command
Standby status frame (standby) tx	
Standby status frame (awake) tx	
To mcu wake pin toggle	
Standby SA Query request tx	
RX corrupt dot11 action frames	Number of corrupted rx action frames

BSS keep alive tx	Number of keep alive frames transmitted
TWT failed to flush tx status before umac pause	Number of times the device failed to flush TX status buffer before sending TWT UMAC traffic update
System uptime (us)	
Mac Stats	
No A-MPDU candidate	Number of packets not send as an AMPDU
commands expired in MAC req	Number of requested command failed by mac core
commands expired in MAC resp	Number of responded command failed by mac core
MPE reset	Number of times the MPE was reset
DCF STF fired	Number of time the STF was fired
DCF LTF fired	Number of time the LTF was fired
DCF energy detect fired	Number of time the energy detect was fired
DCF aborted	Number of times the TX was aborted by the mac. This would trigger a backoff for the packet to be TX'ed
DCF granted	Number of time TX was allowed by the mac
DCF medium busy before tx	Number of time the chip decided to TX but the medium was busy
beacon loss	Number of time the beacon loss was reported back to the host
beacon changed	Number of times the beacon has been changed. This would update if short beacons were being sent along with full beacons
beacon rssi changed	Beacons rssi change comparing to the last beacon sent
aid in tim	Number of times the AID bit in the tim information element is set.
tim contains aid, but STA awake	Number of time the AID bit in the beacon is set but the station is not in sleep state
tim group address	Number of beacons with bitmap control field in the tim information element is set

tim nothing	Number of times the beacons do not indicate that there is traffic present for the station
tim populated	Number of beacons with the block info data in the tim information element
DTIM_sleep_stats	The number of DTIM beacons received by the station
CTS_sleep_stats	
CTS_PS frame arrived late	
AGG N aggregates total	Total number of packets that were allowed to be sent as AMPDU
AGG N aggregate rounds	Total number of AMPDUS sent
AGG N aggregates	This stats shows the number of aggregation for every packet sent. The chip supports sending an AMPDU with 16 MPDUS in them. From the stats 46 packets are sent without aggregation, 19 sent with 1 mpdu aggregated, 5 sent with 2 mpdu aggregated and so on
AGG TX rate is NULL	These stats represent the reasons why the chip has decided to break the aggregation.
AGG TX rate mcs not same	
AGG TX param mismatch	
AGG TX max txop exceeded	
AGG TX active txop exceeded	
AGG TX length exceeded	
AGG crosses tbtt	
AGG crosses twt sp end	
AGG crosses RAW slot	
AGG crosses scheduled tx ts	
RX Total	Total number of RX frames
RX Pass FCS	Total number of RX frames with correct FCS
RX Sig Field Err	Total number of RX frames with signal field errors

RX buffer unavailable	Number of times the chip did not have RX buffers available
RX MAC was too slow	Number of times the chip did not RX mac path was slow
TX Total	Total number of packets sent on air
TX Revoked	Total number of times the TX was rejected due to STF, LTF or energy present in the medium
TX non-contending NDP revoked	
TX Lifetime expired	Total number of times the lifetime timestamp of the packet that expired. This will unschedule and drop the packet
TX returned to UMAC due to power save	Total number of packet returned to the host for buffing as the station was asleep
TX dropped due to power save	
TX pkt lifetime us	Packet lifetime value in microseconds
TX Malformed frame	Number of packets with invalid mac header length
TX QoS NULL	Number of QOS null frames sent
TX ACK Valid	Number of times the TX packet was acknowledged with a valid ACK
TX ACK Timeout	Number of times the ACK timeout for the packet sent
TX CTS Timeout	Number of times the CTS was timeout for the RTS frame sent
Longest delayed TX ACK (in uS):38	Record the longest delayed ACK time
TX ACK already finished	The transmission of ACK packet was finished but ack timeout was triggered
TX ACK Invalid (FCS)	Number of times the ACK is invalid due to FCS failure
TX ACK Invalid (scrambler)	Number of times the ACK is invalid due to ackid scrambler value was wrong
TX ACK Invalid (orphaned)	Number of times the chip saw and ACK not meant for it
TX ACK lost	Total number of ACK that was not received by the device for the packet it sent
TX CTS lost	Total number of CTS that was not received by the device for the RTS packet it sent

TX fragment	Total number of packets sent as fragments
TX BlockAck	Total number of blockack sent
RX BlockAck	total number of blockack received
TX NDP ACK	total number of ndp acks (not blockacks) sent
TX round-trip success %	Percentage of the data sent that were successfully acked by a NDP ack or a blockack
TX requests	Total number of time the mac has requests the phy to send the packet
TX avg backoff slots	Average of accumulated backoff slots
TX medium collisions	Number of times the packet was sent was not acked.
TX Encryptable pkts	Number of time the chip prepared a frame for encrypted transmit
TX ReEncryptable pkts	Number of times the chips tries to encrypt the frame that has already been encrypted
TX Unencryptable pkts	Number of times the chips was not successful in finding a key AND the host marked this packet as being protected
RX transaction(s) dropped	Number of times the RX frames was dropped
RX Undecryptable ccmp pkts passed to host	Number of times the frame wasn't decryptable and was passed up to the host. Could be an encrypted frame that chip was unable to find a key for
RX Decryptable pkts	Total number of RX frames decrypted
RX Undecryptable pkts	Total number of times the chips was not able to decrypt the RX frames
Unexpected crypto	Invalid
RX MPDU delimiters Invalid	Number of delimiters that was corrupted when receiving MPDU's
RX MPDU delimiters	Number of valid MPDU delimiters
BEACONS RX	Number of beacons received
BEACONS TX	Number of beacons sent

BEACONS TX delayed	Number of beacons that were delayed to be sent on air
BEACONS late from host	Number of beacons sent late by the host to chip to go out on air eventually
BEACONS late from host delay (avg uS)	Average time of beacon when the host was late to send it to the chip
TX NDP Probe Req	Number of NDP probe request sent
RX NDP Probe Req	Number of NDP probe request received
TX RTS/CTS max attempts reached	Number of time the chips reached it maximum retry limit for RTS/CTS exchange
TX RTS	Total RTS frames sent
TX CTS	Total CTS frames sent
RX RTS	Total RTS frames received
RX CTS	Total CTS frames received
RX CTS Invalid (orphaned)	Number of CTS frames that were not meant for the device that received it
TX RTS/CTS success	Percentage of successful RTS CTS exchange
MPE started	Invalid
MPE Rx peeked for key	Invalid
RX no key found in key inspection	Invalid
MPE Rx loaded key	Invalid
MPE Rx done	Invalid
MPE IRQ count	Number of time the MPE interrupt was fired
MPE YDS in-queue pre-start	Invalid
RX transaction(s) total	Number of times the phy informed the mac of an available RX packet
RX NDP total	Number NDP packets received
RX A-MPDU/S-MPDU	Number of AMPDU/SMPDU that were received

RX Non-A-MPDU/Non-S-MPDU	Number of packets received that were not AMPDU's/SMPDU's
Total RX MPDUs found by MPE	
Total RX empty delims	Number of MPDU with their delimiter empty
RX transactions without any MPDUs to process	
RX no valid first frame	Number of times the first MPDU receives is not valid
RX MPDUs with FCS fail	Number of times the RX MPDU failed with wrong FCS
RX MPDUs with MIC fail	Number of times the RX MPDU failed with wrong MIC
RX MPDUs with unknown MAC header	RX with invalid mac header
RX YDS alloc fail	Invalid
RX PV1 MPDUs	Invalid
MPE RX which could be decrypted with a 2nd pass	Invalid
RX transactions without any response	Invalid
RX MPDUs not for us	Number of frames that were not meant for the device receiving it.
RX AMPDU bitmap 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Number of bits set in the bitmap field of the blockack received.
TXOP: TXOP count	Number of packets that are in TXOP
Total TXOP time	This is the TXOP end time minus the TXOP start time
Average TXOP time	This is the average TXOP end time minus the TXOP start time for all packets
Total TXOP Tx packets	Number of packets that are in TXOP
Average TXOP Tx packets	Average number of packets that are in TXOP
RAW:	
RAW Assignments	

Valid	Number of RAW assignments. Currently only supporting up to 8 assignments
Truncated by tbtt	Number of times an assignments that get truncated due to the next tbtt
Invalid	Number of invalid assignments (/unsupported) observed
Already past	Number of assignments that are valid but system time has already passed
Delayed due to RAW	
From aci queue	ACI delayed frames due to RAW
From bc/mc queue	Broadcast / Multicast delayed frames due to RAW
From abs time queue	Absolute time frames delayed due to RAW
Frame crosses slot	Frames that could've been sent in the RAW but were too long for slot
CALIB:	
Managed Calibration	
Quiet calibration granted	A quiet calibration was granted
Quiet calibration rejected	A quiet calibration was rejected
Quiet calibration cancelled	A quiet calibration was in progress, but then cancelled
Non-Quiet calibration granted	A non-quiet calibration was granted
Calibration complete	A quiet/non-quiet calibration completed
Duty Cycle:	
Duty Cycle Target (%)	Configured duty cycle restriction
Duty Cycle TX On (us)	Total transmitter 'on air' (Tair) time in usec
Duty Cycle TX Off (Blocked) (us)	Total transmitter 'blocked' (Toff) time in usec
Duty Cycle Max toff (us)	Maximum time the t_off timer is started for
Duty Cycle Early Frames	Number of packets ignoring duty cycle restrictions

Duty Cycle illegal transmission	Increments if there was a transmission outside the duty cycle used
Duty Cycle traffic dropped (NDP)	Number of NDP frames dropped because of duty cycle restrictions
Duty Cycle traffic dropped	Number of non NDP frames dropped because of duty cycle restriction
WUP QosNull not acked	Number of times the QOS Null frames was not acked
QosNull resent	Number of times the QOS null frames was re transmitted
QosNull queued behind another	Number of times there are multiple QOS null framed queued to be sent
QosNull tx backing off	Number of times QOS null frame fails before the MAC gives up on trying to send PS updates
MAC State:	These are the states that the mac core stores internally.
RX state	
TX state	
Channel config	
Managed calibration state	
Powersave enabled :1	
Dynamic powersave offload enabled :1	
STA PS state	
Is waiting on dynamic powersave timeout	
TX blocked by host cmd	
Is waiting for medium sync	
N packets in QoS queues	
Stale AID removed	

MAC main task unused stack (words)	
MAC timer task unused stack (words)	
TWT sta num sp entered	Number of times the device enters the TWT service period
TWT sta enters sp too early	Number of times the device enters the TWT service period early
TWT sta missed sp (already over)	Number of times the device completely missed the TWT service period
TWT sta missed start of sp (already started)	Number of times the device missed the start of the service period
TWT sta sp already active on ps wake	Number of times the device is in active TWT and is out of powersave
TWT announcement delay from sp start (avg us)	Average time for the service period delayed from its start
TWT operation halted	Number of times the TWT operations is halted
TWT operation resumed	Number of times the TWT operations is resumed
TSF for sta has been (re)set	TSF timer has been reset
Standby exit from wakeup frame	Standby frames stats
Standby exit for association	
Standby exit from userspace	
Standby SA Query response rx	
Standby SA Query response timeouts	
Standby deep sleep enter	
Standby deep sleep exit (assoc)	
Standby deep sleep exit (no assoc)	
Vendor IEs matching OUI filter	Increments if the vendor information element has a matching oui (Organizationally unique identifier)

PHYPSM MAC IRQ status zero count	Invalid
PS scheduled after beacon miss	Number of times the device would go into power save if it misses a beacon
PS scheduled after pin wake	Number of times the device would go into power save after the host indicated to be awake via the wake pin
Phy Stats	
Temperature(Celcius):45	Temperature of the chip
Vbat(mV)	Shows the voltage of the battery. This is updated every 60 second and should remain constant
PMU Switched to Vbat setting (mV)	VBAT calibration and sets the PMU settings accordingly
Vbuck Trim	Shows the stats for buck voltage, for transmission (TX) it should be highest 12, for ideal or receiving (RX) state it should be 5 and for power save mode it should be 0.
Current RF frequency Hz	Current channel information
Current Operating BW MHz	
Current Primary Channel BW MHz	
DCF medium went busy after go	Number of times the medium went busy after the PHY decided to transmit the frame
DCF medium went busy during start	Number of times the medium went busy when the PHY decided to transmit the frame
DCF time in past	Number of times the time for the frame to be sent was in the past
MPE RX overflow	Number of time the RX source buffer overflowed
MPE RX underflow	Number of time the RX source buffer underflowed
RX detected less than guard IFS	Shows that the receiver detects the data faster and not enough Interface frame spacing.
TX Scrambler Init Value	The TX scrambler init value

RX Scrambler Decoded Byte	Shows the decoded scrambler value which is based on the TX Scrambler Init Value in the received packet.
Signal Field Error	Signal field errors reported from PHY
Packet Detect Fired STF	Number of times the STF was fired
Packet Detect Fired LTF	Number of times the LTF was fired
Packet Detect Timestamp (us)	Time at which the last packet detect was triggered
Non-NDP PSDU Rx	Number of PSDU that are not NDP
Coarse Frequency Offset	Shows the coarse frequency offset as an angle. Coarse frequency offset in Hz
Final Frequency Offset:-540	Shows cores + fine value and it shows the Frequency Offset of local oscillator, unit (Hz).
Detected Sub-Band	Winning STF Correlator. If a wrong correlator is triggered, the classification algorithm corrects it for LTF search and before writing to statistics.
Corr0 Power	The accumulated max peak power of every peak detected up to STF triggering
Corr1 Power	
Corr2 Power	
Corr3 Power	
Corr4 Power	
Corr5 Power	
Corr6 Power	
Corr7 Power	
Corr8 Power	
AGC Gain	Value of the AGC gain used
AGC LNA Status	Value of the LNA status
AGC FEM Rx Gain	Value of FEM rx gain
AGC LNA Bypass	If LNA bypass is used

AGC Interference Detected	If interference was detected by the AGC
Received Power:-37	Signal strength of the last received frame
Detected Channel BW	This is the detected channel bandwidth (also referred to as Primary channel bandwidth) of the received signal
STF Status	This parameter indicates which correlators reached min peaks by the STF triggering time and it's been used in mode classification algorithm
Energy Meter Reading	This parameter denotes the total in-band energy for a Rx signal at the time of STF triggering
Energy Meter threshold	Energy meter threshold value used
Noise dBm	Noise level of the medium
Detected RX Mode	The format of the packet received by the device. The values can be s1g format, Duplicate 1MHz format, Duplicate 2MHz format or a long format
Oper BW Indicator	Denotes the detected operating channel bandwidth of the received signal
Corr2S Energy	Indicates the energy in the secondary 2MHz subchannel.
Corr4S Energy	Indicates the energy in the secondary 4MHz subchannel.
Noise Metric 2	This is the noise metric for correlator C2P
Signal Metric 2	This is the signal metric for correlator C2P
Range Select	This parameter indicates the starting bit position to select 8 bit range out of the 16 bits as the input range for packet detect
TX Abort(s)	if value is greater than 1, it's the number of times tried for transmission and aborted. The value will be 0 is transmission was successful
TX Stale(s)	Increments if a stale TX is detected
TX Underflow(s)	Shows how many times the mac that requested date to TX to the PHY and the PHY was unable to get the data fast enough
RX Filtered	Number of time the PHY received data that was not meant for it

DGC Energy Meter Pwr dB	Invalid
DGC Inband Pwr dB	Invalid
DGC Diff Pwr dB	Invalid
DGC BackOff Pwr dB	Invalid
DGC CoffFactor Pwr dB	Invalid
DGC Multiplier	Invalid
DGC Shift	Invalid
TX Traveling Pilots	Number of times the packet was transmitted using traveling pilots
Max Stack Used	
min_neset	The minimum noise estimate of the medium
NB INTRF Detected	If there was interference detected
NB INTRF Subc nulled	Shows that the sub carrier are null or not.
NB INTRF Num Subc nulled	Shows how many sub carrier are null.
NB INTRF Index	Shows which sub carrier is determined by interference detection to have interference.
NB INTRF Num	Shows how many times we have detect interference.
NB INTRF SIR dB	Shows the signal to interference ratio , unit (dB).
NB INTRF Power dBm	Shows the received interference power on a narrow band in dBm.
FSG tx rounds	shows the count of fast symbol generator transmit.
DC locked state I	Shows the state of the high pass filter for I (IQ samples).
DC locked state Q	Shows the state of high pass filters and Q (IQ samples).
LTF Corr Power	Shows the power of a long training field.
STF number of peaks	shows the number of peaks on a short training field.
Avg ring osc freq mhz	show the average frequency of ring osc which is used to identify the process corner chips.

ring osc0 count	show the count of ring osc 0 which is used to identify the process corner chips
ring osc1 count	show the count of ring osc 1 which is used to identify the process corner chips
ring osc2 count	show the count of ring osc 2 which is used to identify the process corner chips
ring osc3 count	show the count of ring osc 3 which is used to identify the process corner chips
ring osc4 count	show the count of ring osc 4 which is used to identify the process corner chips
Tx subband centre frequency Hz	Invalid
Tx subband operating BW MHz	Invalid
Tx subband primary channel BW MHz	Invalid
Tx subband primary index	Invalid
Tx subband channel changed count	Invalid
SIG_FIELD_FAIL BAD STF	Number of bad STF detected
SIG_FIELD_FAIL BAD LTF	Number of bad LTF detected
SIG_FIELD_FAIL CRC Error	Number of failed CRC check
Servo Gain	Invalid
I trim	Invalid
Q trim	Invalid

2.8 Channel

```
channel [options]
sets channel parameters or read associated or full channel frequency if none
of [-c|-o|-p|-n] given
 -a            prints all the channel i.e. Full, DTIM and current
 -c <value>    channel frequency in kHz
 -o <value>    operating bandwidth in MHz
 -p <value>    primary bandwidth in MHz
 -n <value>    primary 1 MHz channel index
 -r     ignores regulatory max tx power
 -j     prints full information in easily parsable JSON format
```

The 'channel' command is used to set or dump the channel information for the device. If no options are given then the command will dump the current channel information that is being used by the device. If the above arguments are used then the command will configure the device to use the specified channel information.

2.9 FSG (Fast Symbol Generator)

```
fsg <command>
        enable <iterations> <duty cycle> [ifs]
               iterations   number of transmissions, set to -1 for
                            infinite
               duty cycle   the duty cycle to maintain between
                            transmissions %(0.01-99.99)
               ifs          inter-frame spacing between PSDUs in
                            microseconds  (default:160us)
        disable
```

For FCC and other regional-specific certification testing at high duty cycle and is enabled by using the testing firmware version titled 'mm6108_dvt.bin". This command will configure the firmware to transmit data at the given duty cycle with the provided IFS either indefinitely or for the given number of iterations.

The content of the transmission contains valid LTF+STF+SIG fields, but not necessarily valid 80211 data. PSDU content can be random or pseudo-random (i.e. incrementing, non-zero).

2.10 MAC Address

WARNING: Once set, this is not reversible

It is important that VDDIO be provided as 2.5V before writing the MAC address. For more information, please refer to the 'MAC OTP Read and Write' guide.

```
macaddr [-w <mac_addr>]    reads the MAC address of the chip if -w was
                           not passed
       -w <mac_addr>       writes the given 'XX:XX:XX:XX:XX:XX' MAC
                           address to the chip (this is not reversible)
```

Read and write the MAC address that the WLAN interface will be configured to.

```
Example usage:

# morsectrl macaddr -w 0c:bf:74:05:dc:71
Chip MAC address: 0c:bf:74:05:dc:71

# ifconfig
wlan0     Link encap:Ethernet  HWaddr 0C:BF:74:05:DC:71
          inet addr:192.168.1.2  Bcast:192.168.1.255  Mask:255.255.255.0
```

2.11 Wakeaction

```
wakeaction <destination mac address> <hex string payload>
             sends a wake action frame of given payload to a
             destination mac address.
```

This command sends a wakeaction frame from the AP to the desired station. On reception of the wake action frame a GPIO can be toggled which in turn could be used to wake the host up. This command requires the GPIO to be set by the Board Configuration File (BCF).

2.12 DHCP

```
dhcpc [enable | discover | get | clear | renew | rebind | update]

configure DHCP client
   enable - enable DHCP client
   discover - do a discovery and obtain a lease
   get - get the current lease
   clear - clear the current lease
   renew - renew the current lease
   rebind - rebind the current lease
   update - send a lease update to the driver
```

This command is only applicable if the driver has been loaded with enable_dhcp_offload modparam. With this feature enabled the leases can be renewed without having to wake up the host processor. Through this method, assuming a DHCP server is running somewhere on the network, the station should receive, and automatically apply, an IP address within 10 seconds of associating. If currently leased address needs to be updated, it can be triggered with the following 'morsectrl' command:

```
# morsectrl dhcpc update
```

Note that this will only apply a lease if enable_dhcpc_offload is set to 1.
The lease can be obtained manually as well but note that this is intended only for testing and verification purposes and should not be used in normal operations. The steps to manually do this:

- On an associated, running station, enable the DHCP client with the following 'morsectrl' command:

```
# morsectrl dhcpc enable
```

- Within 10 seconds, the client should automatically perform a discovery and obtain a lease.
  To shortcut this, and perform a discovery now, execute the following command:

```
# morsectrl dhcpc discover
```

- The lease can be retrieved using:

```
# morsectrl dhcpc get
```

- To force a DHCP renewal or rebinding sequence with the following commands:

```
# morsectrl dhcpc renew
# morsectrl dhcpc rebind
```

Note that if the DHCP client is enabled and does not have a lease, it will attempt a discovery sequence every 1-10 seconds, as per the RFC.

2.13 QoS

```
qos [options] <queue_ID>   sets/reads QOS parameters for given queue ID
   -c  <value>    number of AIFS slots to wait for
   -t  <value>    maximum possible TX OP in us
   -m  <min> <max>    contention window MIN,MAX values
```

This command sets access category parameters or reads the current values of the different access categories. There are 4 access categories that can be read or configured :-

0. Best effort
1. Background
2. Video
3. Voice

If configuring the access category the following options can be uses along with the queue that wants to be configured:

- -c: AIFS slots (Arbitration Inter Frame Spacing) - The minimum wait time before accessing the medium.
- -t: TX OP - The Transmission Opportunity (TXOP) is an interval of time, in milliseconds, when a client has the right to initiate transmissions towards the AP.
- -m: Contention window values - The window defines the min and max contention time of various stations who contend with each other for access to channel

2.14 Random Packet Generator (RPG)

```
rpg <command>
   start [options] starts rpg
   -l            listening mode (other options are overlooked)
   -c <value>    number of packets to send (default unlimited)
   -s <value>    specifies the size of the packets to be sent (min: 24).
                 Random if not specified.
   -d            disables random packet contents (for casim)
   stop          terminates rpg (if started)
   stats [options]         reads rpg stats collected (if started)
   -r                       reset the rpg stats (if started)
   srcaddr [mac address]   sets source mac address of rpg packets
   dstaddr [mac address]   sets destination mac address of rpg packets
   ampdu [number]          force using ampdu with [number] mpdu
```

This is a random packet generator (RPG) that is enabled by using the testing firmware version titled 'mm6108_dvt.bin". This feature is mainly used for test, debugging and development purposes. When using RPG, TX packets originate from the Apps core - not from the driver. On the RX side it counts the number of packets that were received and were successfully decoded.

2.15 Bandwidth

```
bw <value>    sets bandwidth(1|2|4|8) or reads current bandwidth if no
              arguments were given
```

Sets the bandwidth value. Once the devices are associated the bandwidth value cannot be changed. This is deprecated.

2.16 TX Scaler

```
txscaler <value>    scales tx power (takes values -15 to +15 dB)
```

The 'txscaler' command is used mainly for bench evaluation and experimentation purposes. This command takes the values in dB and boosts or backs off the default transmit power by the given

value. It can take the values from -15 dB to +15 dB. Note that this should not be used for normal operation as it can break region specific regulatory rules.

2.17 OTP

WARNING: It is important that VDDIO be provided as 2.5V before writing to OTP. For more information, please refer to the 'MAC OTP Read and Write' guide.

```
otp <bank_num> [-w <bank_val>]   read/write OTP bank given from chip
       bank_num            bank number to read/write from/to. eg.: for
                           610x [0-7]
       -w <bank_val>       burns the value to the OTP bank
```

The 'otp' command can be used to read and write the OTP bits programmed to the chip.

```
# morsectrl otp 0
OTP Bank(0): 0x0
```

To read the OTP bits for all the banks [0-7]:

```
# morsectrl otp [0-7]
Output:
OTP Bank(0): 0x0
OTP Bank(1): 0x0
OTP Bank(2): 0x800000
OTP Bank(3): 0x0
OTP Bank(4): 0x0
OTP Bank(5): 0x60daf38d
OTP Bank(6): 0x0
OTP Bank(7): 0x0
```

To write the bits in decimal value:

```
# morsectrl otp 3 -w 4194304
Output:
OTP Bank(3): 0x400000 (Hex value)
```

To write the bits in hex value:

```
# morsectrl otp 0 -w 0x700000
Output:
OTP Bank(0): 0x700000
```

2.18 A-MPDU

```
ampdu [enable|disable]
       'enable' will enable AMPDU sessions. Must be run before
                association.
       'disable' will disable AMPDU sessions. Must be run before
                association.
```

The ‘ampdu’ command is responsible for enabling or disabling the AMPDU feature in the chip. This command should be executed before the device is associated. The command will show no effect if executed after association.

3 Revision History

Release Number	Release Date	Release Notes
01	26/06/2023	Initial document release
02	16/12/2024	Revised document formatting

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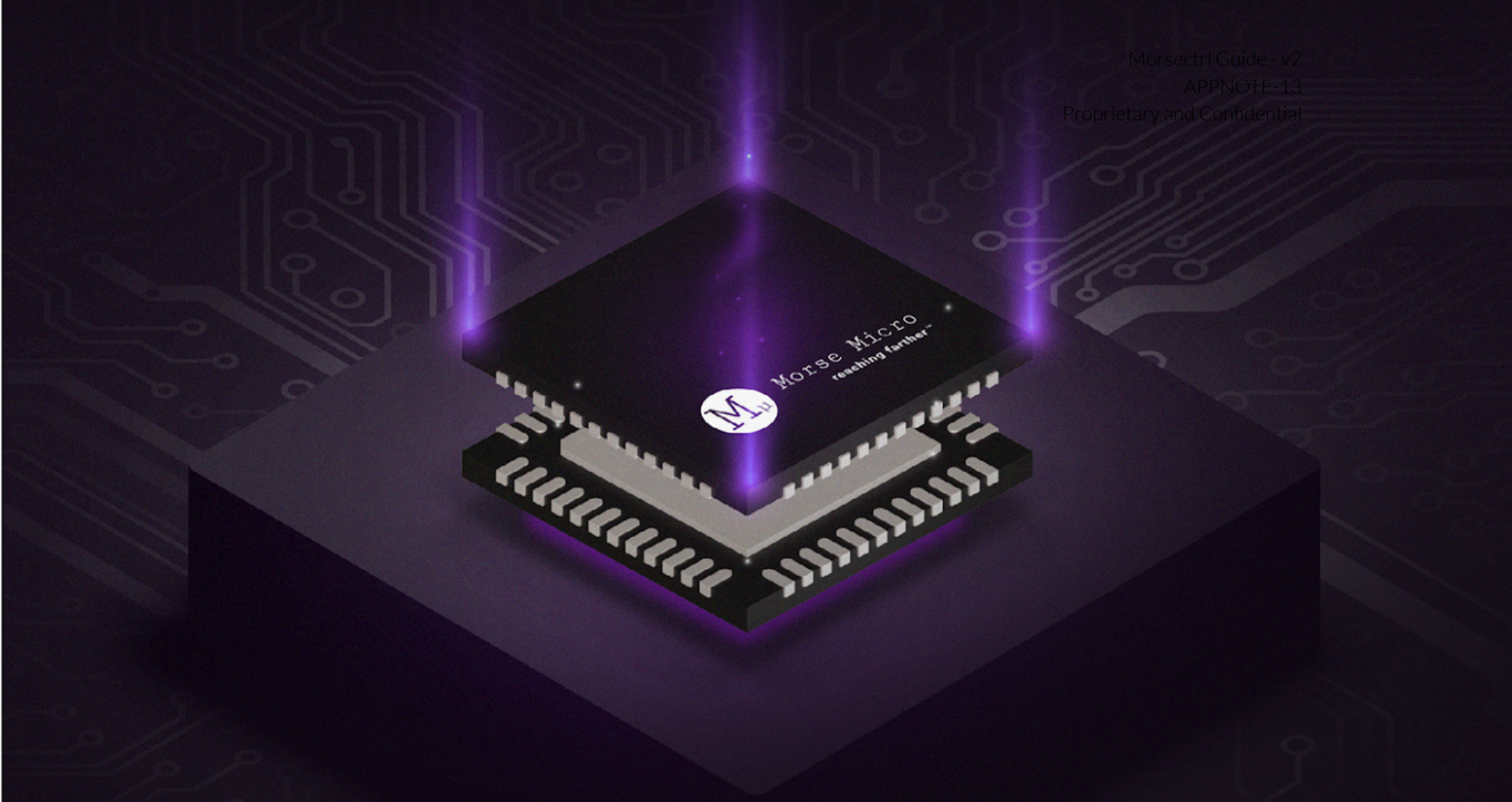
About Morse Micro

Morse Micro is producing IEEE 802.11ah / Wi-Fi HaLow solutions for Internet of Things (IOT) - based on a newly certified Wi-Fi standard called HaLow. Morse Micro is a VC-backed Startup headquartered in Sydney, Australia. Learn more at www.morsemicro.com



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