

Transmitter Duty Cycle and Digital Modes

by AF4MT

What is Duty Cycle? Duty cycle is the ratio of time a load or circuit is ON compared to the time the load or circuit is OFF

Unfortunately most radio manufactures do not provide the duty cycle information for their transmitters so lets create a fictitious HF radio that we can work with and call it the Z100. The Z100 is a 10m - 160m HF radio. Below is the Duty Cycle information for the Z100.

Wattage	100w	75w	50w	30w	<=25w
Duty Cycle	50%	60%	70%	80%	100%
Duty Cycle Period (DCP)	10min	10min	10min	10min	10min
SWR	1:1	1:1	1:1	1:1	1:1.5
Ambient Temp (°F)	<°85	<°85	<°85	<°85	<°90
VOD	13.8	13.8	13.8	13.8	13.8
Carrier	Constant	Constant	Constant	Constant	Constant
Frequency Range	Full	Full	Full	Full	Full

If you look below at the FT8 characteristics the duty cycle of FT8 is 42% which is within the Z100's duty cycle rating at 100 watts. But here is the problem with that, the radio's DCP and FT8's DCP are different. The radio's duty cycle chart states that we can transmit for 5 minutes straight with a constant carrier but then we must let the radio cool/rest for 5 minutes straight to safely operate given we have met the other variables . Even if FT8's duty cycle is within the radio's specs the time period is not. The radio may be able to fully cool down in 5 minutes after a 5 minute transmission but the radio may not be able to cool sufficiently in a 15/15 second continuous cycle at 100 watts. The good thing is that FT8's DCP is lower than the Z100's DCP. Had this been the other way around you would be in trouble because as the chart states the radio cannot transmit for more then 5 minutes at 100 watts with a constant carrier (CC).

Constant Carrier (CC) Amplitude vs Dynamic Carrier (DC) Amplitude

There are some debates on the internet regarding “Digital vs Analog” and SSB HF radio duty cycle’s. For example here is a forum on QRZ.com. One individual stated that digital modes have a constant carrier and therefor they have a 100% duty cycle and this is simply not true because FT8 has a 30 second DCP and the actual duty cycle is 42%. Now for the question of voice modulated SSB/AM and duty cycle, when using voice SSB the amplitude fluctuates and therefor the power output does as well.

So how can we compare CC to DC? We can do this with average wattage (AW) and peak wattage (PW) measurements. CC transmissions have the same AW and PW while DC transmissions do not. So for the purpose of checking duty cycle ratings for DC transmissions you will need to use your average wattage (AW). This is tough on voice because different people have different speaking patterns (pauses etc.). Lets say the average 100 watt SSB voice (DC) transmission has an AW of 65 watts, We would then use 65 watts to see the duty cycle.

FT8 is a common digital mode on the HF bands and has 4 time slots per minute which completes a QSO or “frame” to use the term loosely .

Duty Cycle: 42%

Duty Cycle Period: 30 seconds

Carrier: Constant

Frame Duration: 1 minute

Time Slots per Frame: 4

RX Slots per Frame: 2

TX Slots per Frame: 2

Time Slot Duration: 15 seconds

Time Transmitting Per Slot: 12.6 seconds

TX Slot Duty Cycle: 84% over 15 seconds

Time Transmitting per Frame: 25.2 seconds

Hopefully this cleared the air for a lot of hams out there! Unfortunately without duty cycle information for our transceivers we wont know what the real duty cycle limits are! For any questions or comments, email Turnermason@gmail.com .

73,

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