



Getting started with Digital Modes

From Hardware & Software Basics to all one needs to get started in the most common modes.

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No need to stress about links & tech heavy content. This PowerPoint is on the NCDXC Website as well as my personal one.

Northern California DX Club

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23 Sep 2017 7:00 PM (PPT Slides 16183)	Introduction To HF Operation	Mike, KB3RF	@ PDF	Recording
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Track I. General Class License Preparation

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October 21, 2017 (= or - one week)	General Class Rules and Regulations	Jim, KB3RK	@ PDF	
November 4, 2017 (= or - one week)	General Class Operating (Bands, Modes, etc.)	Jim, KB3RK	@ PDF	

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Pacificia, CA

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Friday, November 18, 2016

Thank you for Visiting!

A Quick word or two

Grid Square: CM27jg | FTU Zone: 8 | EQ Zone: 3
 Local Time: PST (GMT - 8:00) DST Observed
 QTH: City of Pacifica, San Mateo County, California, USA
 Latitude: 37.649448 | Longitude: -122.476240

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I am always trying to improve content so if something is not clear and/or you have a question please let me know!

You can also email me later at: w6aer@arrl.net

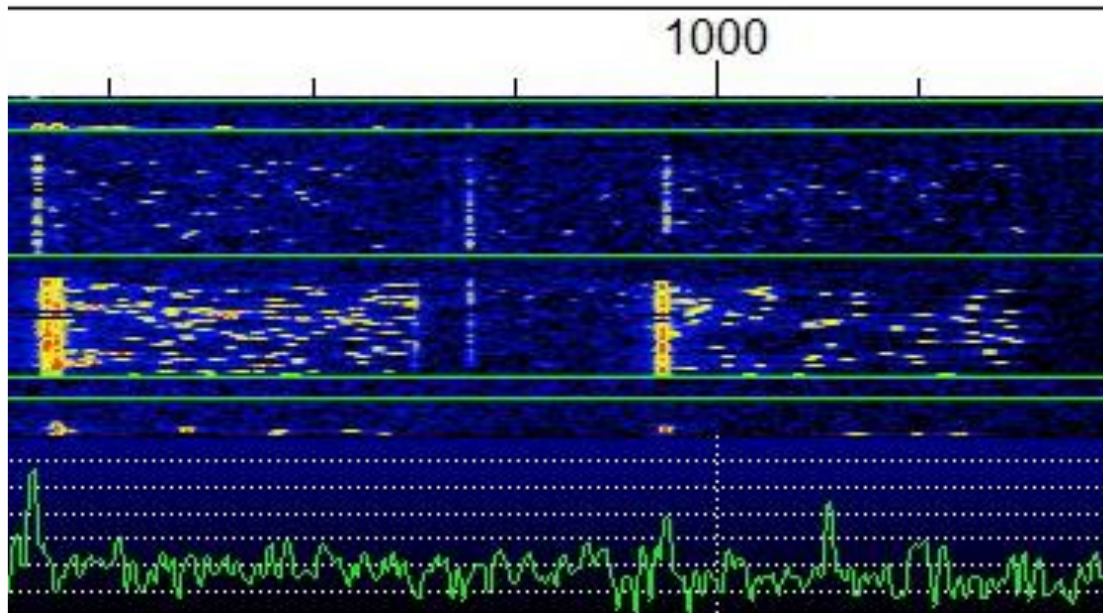


What will be covered Today:

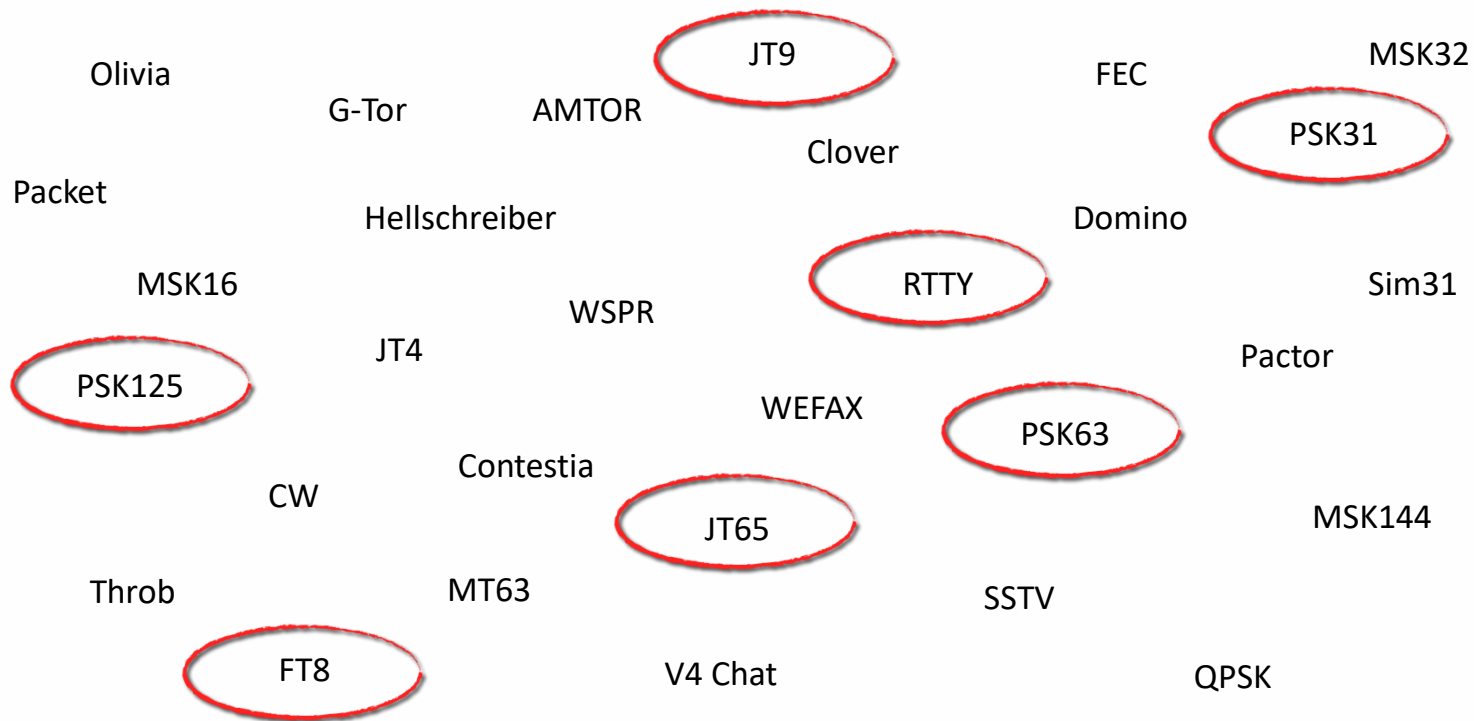
- **PART 1:** Why use digital modes & What is meant by “*digital modes*”
 - Not to be confused with VOICE digital modes like D-star, Fusion, etc.
 - Getting started in Digital Modes
 - Software / Hardware & My findings from years of experimenting
 - Every ham shack is different, so I will keep it somewhat general
- **PART 2-4:** Overview of the most common Digital Modes in 3 parts
 - **RTTY**, One of the Earliest Modes
 - The JT modes (**JT65/9 & FT8**)
 - The PSK Modes (**PSK31, 63, 125 & Variants**)
 - Why I like them and where to use them
 - Learn from my/others mistakes as well as Tips
 - DX-ing / Weak Signal Tips for these modes
- **PART 5:** Links, Tips and Additional Resources
 - Modes are evolving, likely lifelong learning
 - New ones are introduced, some stick some don't
 - *Not a radio recommended for Digital
(Just liked the picture)*



PART 1: HF Digital Overview



What digital modes are out there?



Question of the Day:

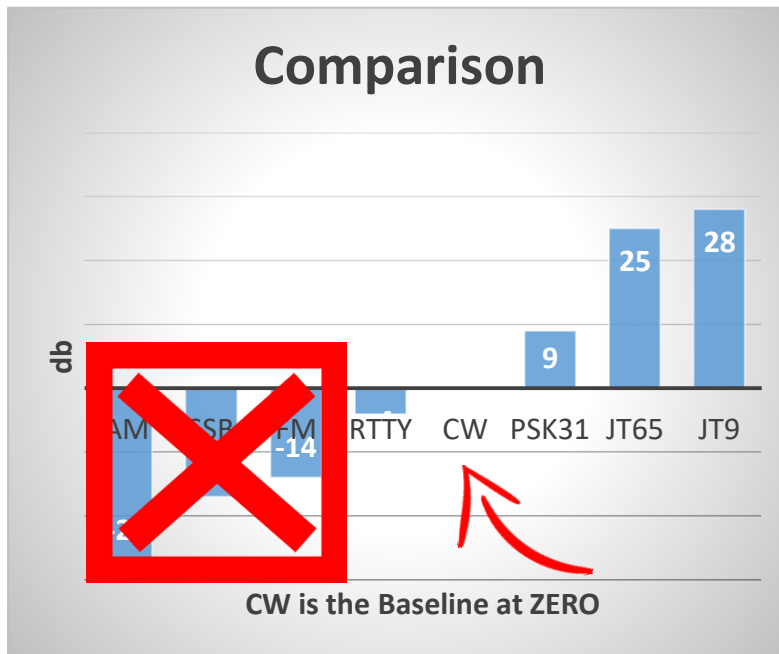
What the most common Digital Modes

- Most common mode is RTTY when it comes to DX Expeditions and contests (Besides CW if you want to get technical) although some would argue this is changing. I am one of those who will say YES.
- RTTY, at least for *decent* DX, often needs an amp & larger antennas. Not very forgiving when conditions are poor or sun is not co-operating (I will Prove it on the next slide)
- Other common modes as of this presentation are FT8 being the newest along with JT65, JT9 and the PSK modes. Pretty much in this order.
- APRS on 2m is also widely used (and sometimes on HF which many do not know) but will NOT be covered here due to time.



Why Go Digital in General?

Let's look at the numbers!



Source: "How Much 'Punch' Can You Get from Different Modes?" by Siwiak and Pontius, December, 2013 QST

Using CW as the Baseline - ZERO

Original Article:

<http://www.qsl.net/k4fk/presentation/Mode-sensitivity-2013-Dec-QST-Siwiak-Pontius-1.pdf>

FT8 came out after this, It would fall in the same range as the JT modes approximately.



So....Why Go Digital?

- When conditions get worse (Lack of Sun Spots), *some modes* will be still widely available as seen in previous slide.
- Can work from Apartments & HOA Restricted locations
 - Most modes don't require much power at all
 - Smaller or even indoor Antennas are plenty good
 - Vertical loops work very well
 - AOR LA-800 RX Pictured (This is receive only)
 - Dipoles and a few watts go very far
 - If you have a full sized antenna, you will be in heaven!
 - I use a combination of different antennas for various bands



Yet more reasons...

As with CW, easier to work the lower bands (160,80,40 & 30) with JT65/9 & FT8

Many seem to think 30m is CW only

WRONG! - JT65/9, FT8, PSK31, WSPR, etc.

Let's not forget the 60m band

Most do...Digital is also OK here

JT65 is very active at times!

This past year (2017) digital overtook CW

On 6m band during spring/summer

Openings. Check it out!



Always someone to work, 24/7!





W6AER has worked TU5MH on 2 out of 21 band slots

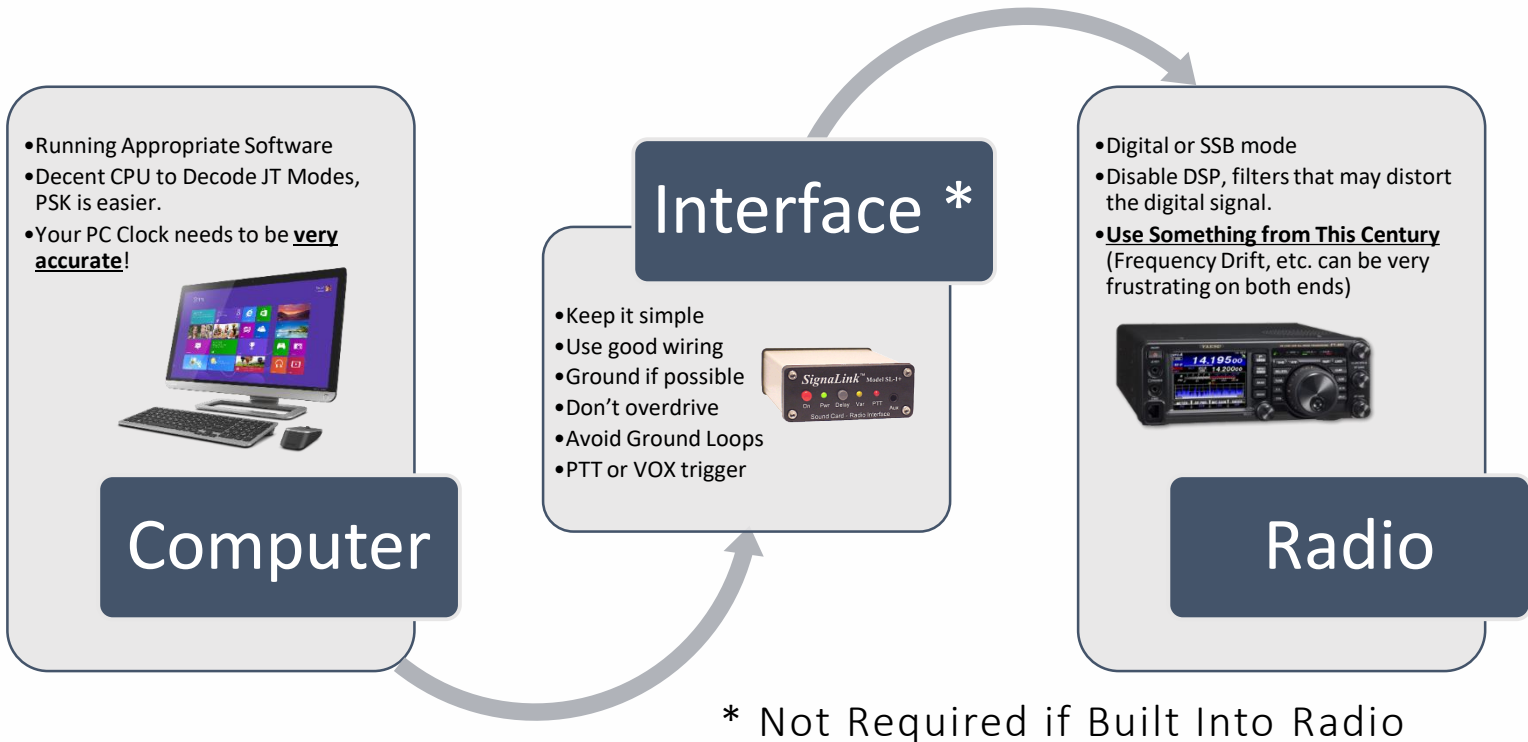
Propagation from [UNITED STATES OF AMERICA \(Z3\)](#) / [USA W6](#) / [STATE:CA](#) / [ZONE: 3](#) / [Geo Propagation Map](#)

	10m	12m	15m	17m	20m	30m	40m	80m	160m
CW	NEW	NEW	✓	NEW	NEW	NEW	✓	NEW	NEW
PH			NEW	NEW	NEW		NEW		
RTTY			NEW	NEW	NEW	NEW	NEW		
JT65				NEW					
PSK				NEW					
PSK63F					NEW				

- Some DX Expeditions are branching out with the modes they use. I was very happy to see the above JT65 and PSK used in the Ivory Coast DX expedition, even if I did not get a chance to use it. This opens doors for many “little guns”
- SIDE NOTE: PSK63F is a faster version of PSK31 with Forward error correction. More on PSK later!

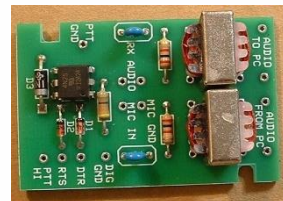


What is Required for Digital?



Selected Interface Comparison

Model	Ease of Use	Cost + Extras	Performance	Build Quality	Added Features	Designed For
Tigertronics Signalink	10	\$110+cable	8	8	No	Causal User
Timewave Navigator	6	\$300+cable	10	10	Yes	Casual/Advanced
Homebrew	8-10	With box under \$20	Varies, shielding, etc	Varies	Varies	DIY & Budget Users
Radio Integrated	Varies	Possible higher cost	Varies but usually good	Varies	Varies	Casual/Advance



The above all do AFSK, some also do FSK which is really only used in RTTY for the purpose of this presentation. I will go into more detail on this in the RTTY section.



Disclaimer

A magnifying glass with a black handle and a silver frame is positioned over the word 'Disclaimer'. The lens of the magnifying glass is focused on the letter 'D'.

- There is a lot of software out there. The ones I picked are for reasons of variety and/or because I have used them.
- If software was left out, does not mean it is not good or not recommended. (*Trying not to get hate mail*)
- Not going to cover all in detail...impossible! Each can be it's own presentation. But will provide links, resources in case one grabs your attention. I will also let you in on what I currently use.



Selected Software Comparison

Will use Examples in mode specific slides

Package	My Rating	Cost + Extras	Performance	Ease of Use	Ease of Setup	Modes
WSJT-X	10	FREE	10	9	6	JT65/9, FT8 Modes (Also JT4, Echo and WSPR)
FLDigi	6	FREE	10	10	8	Many modes but no JT or FT8 Modes
Ham Radio Deluxe DM780	8	V.5 Free V.6 Paid	8 9	Varies	6 6	Most but no JT modes or WSPR
JT65-HF	8	FREE	6	10	10	JT65 ONLY (no JT9) No longer Developed
JTDX	10	FREE	10	8	6	Based on WSJT-X, Good
MMTTY	8	FREE	10	5	5	Works the best for RTTY but not for those with heart issues or no patience
MultiPSK	7	FREE	8	6	8	Works but not compact, GUI can be improved
WinWarbler	8	FREE	8	8	8	Very well designed, part of a larger suite
GRITTY	10	FREE	8	10	10	RTTY ONLY but easy and clean, not as good at receiving as MMTTY



Additional Software:

- **MixW** - \$70, from the Ukraine
- **MultiPSK** – FREE, from France
- **CocoaModem** – FREE, Mac OSX, from USA



Not a heavy user of the above other than trying them, so can't comment much but these are all alternatives! NONE of these do JT65/9 or FT8 but all do PSK and many other modes including RTTY. Many other options out there, new ones coming out all the time.



One last thing before we cover the modes... "*GRID SQUARES*" Anyone?

AR	BR	CR	DR	ER	FR	GR	HR	IR	JR	KR	LR	MR	NR	OR	PR	QR	RR
AQ	BQ	CQ	DQ	EQ	FQ	GQ	HQ	IQ	JQ	KQ	LQ	MQ	NQ	OQ	PQ	QQ	RQ
AP	BP	CP	DP	EP	FP	GP	HP	IP	JP	KP	LP	MP	NP	OP	PP	QP	RP
AO	BO	CO	DO	EO	FO	GO	HO	IO	JO	KO	LO	MO	NO	OO	PO	QO	RO
AN	BN	CN	DN	EN	FN	GN	HN	IN	JN	KN	LN	MN	NN	ON	PN	QN	RN
AM	BM	CM	DM	EM	FM	GM	HM	IM	JM	KM	LM	MM	NM	OM	PM	QM	RM
AL	BL	CL	DL	EL	FL	GL	HL	IL	JL	KL	LL	ML	NL	OL	PL	QL	RL
AK	BK	CK	DK	EK	FK	GK	HK	IK	JK	KK	LK	MK	NK	OK	PK	QK	RK
AJ	BJ	CJ	DJ	EJ	FJ	GJ	HJ	IJ	JJ	KJ	LJ	MJ	NJ	OJ	PJ	QJ	RJ
AI	BI	CI	DI	EI	FI	GI	HI	II	JI	KI	LI	MI	NI	OI	PI	QI	RI
AH	BH	CH	DH	EH	FH	GH	HH	IH	JH	KH	LH	MH	NH	OH	PH	QH	RH
AG	BG	CG	DG	EG	FG	GG	HG	IG	JG	KG	LG	MG	NG	OG	PG	QG	RG
AF	BF	CF	DF	EF	FF	GF	HF	IF	JF	KF	LF	MF	NF	OF	PF	QF	RF
AE	BE	CE	DE	EE	FE	GE	HE	IE	JE	KE	LE	ME	NE	OE	PE	QE	RE
AD	BD	CD	DD	ED	FD	GD	HD	ID	JD	KD	LD	MD	ND	OD	PD	QD	RD
AC	BC	CC	DC	EC	FC	GC	HC	IC	JC	KC	LC	MC	NC	OC	PC	QC	RC
AB	BB	CB	DB	EB	FB	GB	HB	IB	JB	KB	LB	MB	NB	OB	PB	QB	RB
AA	BA	CA	DA	EA	FA	GA	HA	IA	JA	KA	LA	MA	NA	OA	PA	QA	RA

(c) E1B1C



So what are “GRID SQUARES” ?

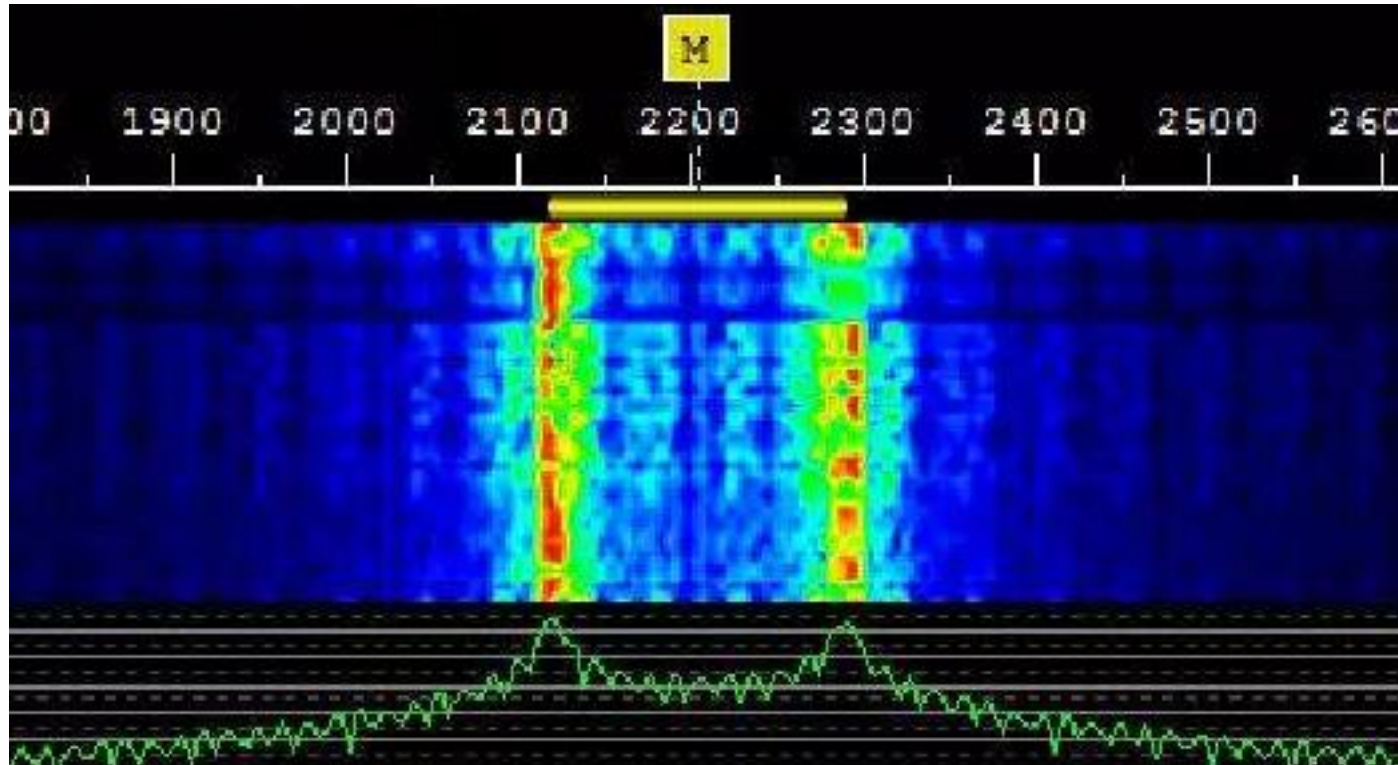
- A grid square measures 1° latitude by 2° longitude and measures approximately 70 × 100 miles in the continental US.
- A grid square is indicated by two capital letters (the field) and two numbers (the square), followed by an optional lower case letter for more precise location.
- Pacifica, CA (My QTH) is CM87sp
- For JT65/9 I just need CM87 General area
- Also used in weak signal modes on VHF/UHF
- Always used in Satellite Communication
- You can look up yours here:



http://www.levinecentral.com/ham/grid_square.php

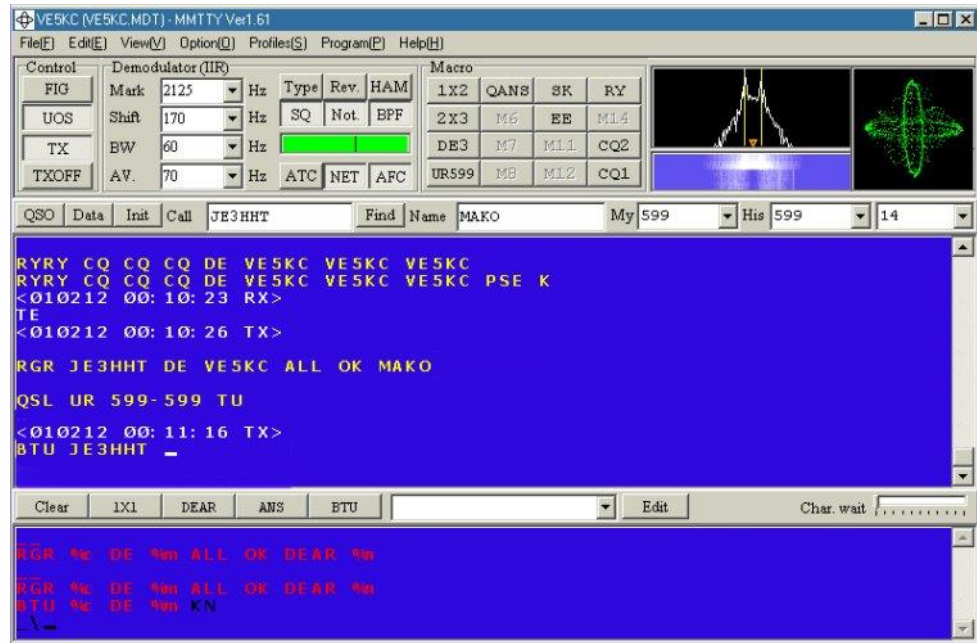


PART 2: One of the earliest modes, RTTY

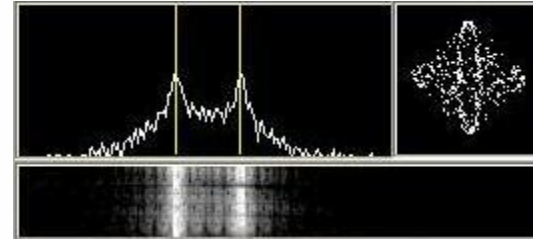


What do I use for RTTY mode?

I use **DM780** from Ham Radio Deluxe, **MMTTY** by JE3HHT Makoto Mori and Lately have been playing with **GITTY** from VE3NEA Alex Shovkoplyas who has done some amazing things!



The Basics of RTTY



- FSK and AFSK

- Frequency Shift Keying vs. AUDIO Frequency Shift Keying
- AFSK uses Audio the FSK is an ON/OFF signal which causes the shift. Often done via a serial cable and not much to adjust.
- I use AFSK, it is nearly impossible to tell the difference although I heard this argued. AFSK also supports mode modes!
- Some consider FSK more robust, might be some truth to this. But AFSK is more common 2:1 per a recent magazine survey.
- It really is like the “PC vs. Mac” or “Ford vs. Chevy” argument.
- The hardware I mentioned earlier will all do AFSK, Some radios and the Timewave Navigator (Formerly AEA), RigBlaster, MicroHAM, and Kantronics products as well as many others will also do FSK if you prefer to set this up. See your Manual for specifics.



Basic RTTY QSO Flow

These are just examples and can will based on contest of DX station style

- **DX QSO**

- CQ CQ K1N K1N UP
- **W6AER W6AER**
- W6AER 599 K1N
- **K1N 599 W6AER**
- TU QRZ K1N UP

RED = Response

- **Contest QSO**

- CQ TEST W6AER W6AER CQ
- **K6BV K6BV**
- K6BV 599 CA CA W6AER
- **W6AER 599 CA CA K6BV**
- K6BV QSL TU 73 W6AER QRZ?

UP = Split / Not same Frequency

QRZ = Who is calling

QSL - Confirmed



More good to know basics...

- Mark, Space & Shift:
 - Mark is your operating frequency
 - The carrier shifts between 2 points (frequencies).
 - The LOWER RF frequency is known as the SPACE frequency and the UPPER RF frequency is known as the MARK frequency. The difference between the two is known as the SHIFT. For hams 170hz, but you will see non ham signals that look like really wide RTTY on the non-ham bands.
 - You do not need to know the technical specs really. Software takes care of it.
- Also note that there is no lower or upper case in RTTY. Remember that it uses Baudot, five data bits so 32 characters. Doubles with shift, still no room for upper and lower case given 26 letters, 10 digits plus symbols, shifts (2), line feed and space.
- Data Rate is 45 Baud...Those that recall dial-up modems know that this is very slow especially with today's broadband saturated world.



Other FAQ about RTTY

- RTTY is 170hz and you need about 225-250hz for proper copy so there is a reference area for the decoder software. I use 600hz or 300hz roofing filters but not always the best option.
- During contest I also run in “*Narrow*” mode. No need to see 3Khz at the time.
- I run SSB mode not Data...Another “*PC vs. Mac*” topic. Spots are often done in Data mode, so adjust 1.5khz when tuning.
- Visual indicators are your friend so use them when tuning and determining how much you want to filter and where.
- RTTY is 100% duty cycle. Do not run 100W on a 100W unit unless you like fixing it. Use an amp if needed or do not exceed 50W on the regular basis.



Activity & Band Plans for RTTY

160 meters: 1.820-1.850

80 meters: 3.580 – 3.650

40 meters: 7.080 – 7.100 (*wider during contests, check your local rules*)

30 meters: 10.110 to top of band

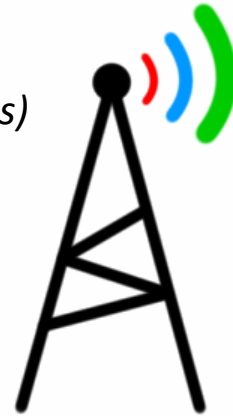
20 meters: 14.080 – 14.099 (*avoid the NCDXF beacons at 14100*)

15 meters: 21.080 – 21.100

10 meters: 28.080 – 28.100

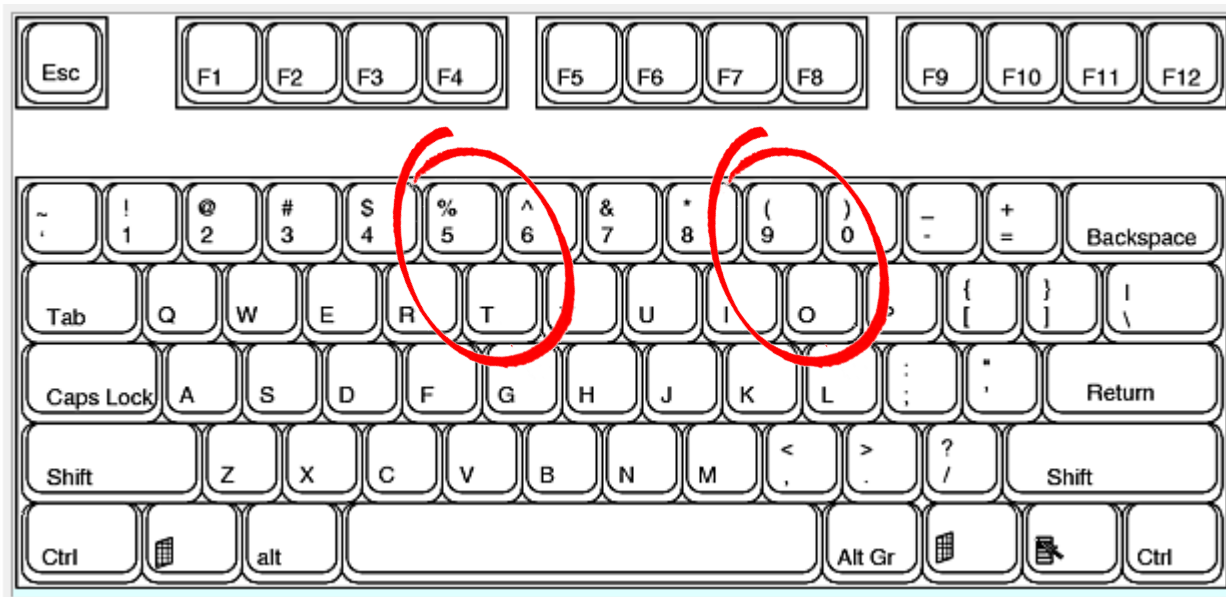
During contests you will have much more activity, but no contests on the WARC bands (12,17 and 30m) or on 60m.

DX will nearly almost call split, please pay attention to this!



Things I learned contesting

- Sometimes RTTY does not decode properly, perhaps a shift command gets lost in the noise.
- TOO is often the 599
- Looking at your keyboard QWERTY is 123456 when upshifted, so easy to reverse engineer contact numbers for example.



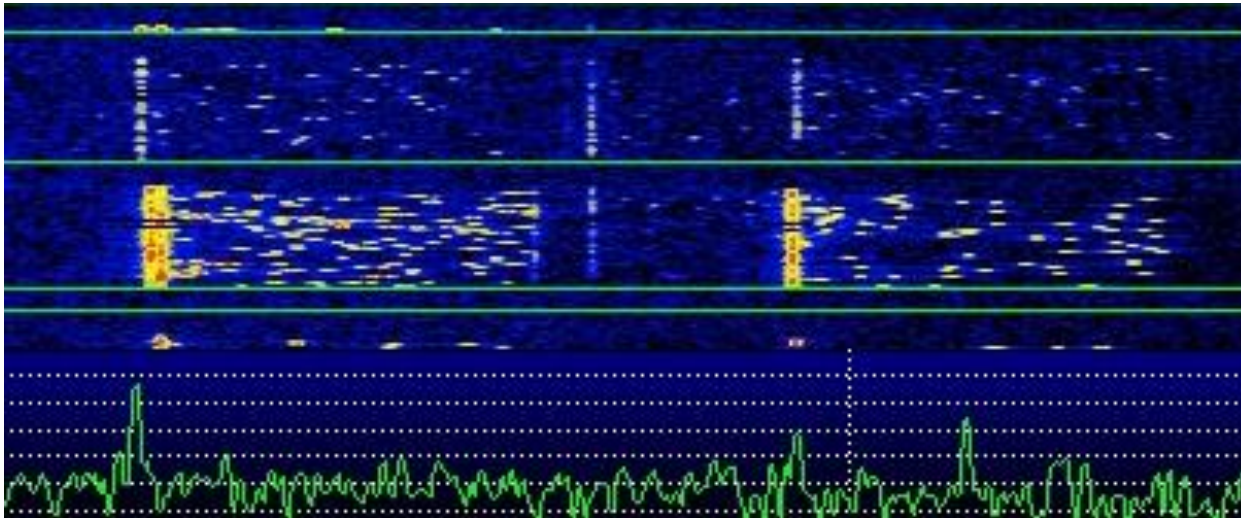
PART 3: So....Let's talk JT



No, not the singer....modes!



The sounds of “JT modes”



JT65 & JT9 Together



Comparing The “JT/FT” digital modes for HF:

Mode	Sensitivity	Bandwidth	CPU Usage
JT65 (a)	Great	Under 300hz	High
JT9	Excellent 2-3 dB Better than JT65(a)	Under 50hz	High
FT8	Great, similar to JT65	Around 50Hz	Very High

There are other WSJT-X modes as well like WSPR, MSK144, etc. but not going to cover these at this time.

All very low power modes – No AMP!
No more than 25-40W (Depending on your cable runs, antennas, etc.)

JT65/9 have been compared to *watching grass grow*...but they WORK! Each exchange is 47 seconds, starts on the minute.



QSO Length is about the same for both modes, typical length is about 6 minutes is all goes well. FT is 4 times faster at under 15 seconds per cycle but with a compromise.



The screenshot shows the WSJT-X v1.6.0 interface. The top window displays 'Band Activity' with columns for UTC, dB, DT, Freq, and Message. It lists various call signs and their locations, such as '0007 -21 -0.3 1434 # CQ JA8HWX QN03 -Japan'. Below this is a control panel with buttons for 'Log QSO', 'Stop', 'Monitor', 'Erase', 'Decode', 'Enable Tx', 'Halt Tx', and 'Tune'. A frequency display shows '14.076 000'. A 'Unique Callsigns TX/RX per Band (NA)' table is visible, showing counts for various bands (160m, 80m, 60m, 40m, 30m, 20m) and call signs like 'CX2UI W6AER C' and 'TNX 73 GL'. At the bottom, there's a 'JTAlertX 2.8.4 W6AER [20m,HRD6+,#1] [Updates!]' window showing a list of call signs and their locations, including 'CX2UI', 'JR1NH1', 'N6PF - CA', 'XE2YWB', 'JA3KBS', 'JR3IIR - B4', 'K6CLS - CA', 'R0JE - B4', and 'Russia (AS)'. A 'First QSO' table is also present at the bottom left.

WSJT-X with JTAlertX Running

Now 1.8 is out as of end of 2017 and covers FT8 mode as well as some other new ones!

- Shows basic QSO, running JT Alert Under it with pop-up.
- Allows to color code, Shows worked "B4" (add-on)
- Writes directly to my HRD log
- Now...What does all this mean?



Typical JT9 QSO (Same as JT65 or FT8)

UTC	dB	DT	Freq	Message
2359	-21	0.8	2594	@ CQ DX R0JF P030
0000	Tx		2594	@ R0JF W6AER CM87
0002	Tx		2594	@ R0JF W6AER CM87
0003	-19	0.8	2593	@ W6AER R0JF -23
0004	Tx		2593	@ R0JF W6AER R-19
0005	-19	0.8	2593	@ W6AER R0JF RR73
0006	Tx		2593	@ R0JF W6AER 73

- @ = JT9
- # = JT65
- ~ = FT8
- Same Process for ALL 3 modes!

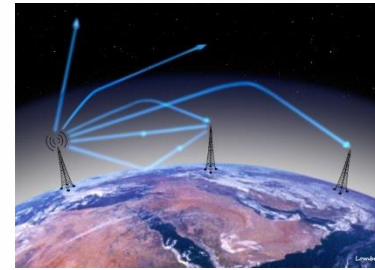
1. Station Calls CQ with HIS GRID
2. I respond with MY GRID
3. He Sends his report (-23, *I was very weak, can decode to -26*)
4. I send his with an R (Roger) and he is at -19 (Better then me)
5. RR73 and my 73
6. In the log! 6 Min. if all goes well

Each cycle is 47 seconds, starts automatically at the top of the minute via macros. Check your Clock!

Note the use of R or RRR, not OOO. This is used only on EME so not to be confused in online literature.



...Things to know about FT8



- It is quite often worked split when DX. HOLD the shift key and click the waterfall to move **TX (RED)** and you click without shift to move **RX (GREEN)**
- Check “**Auto Seq**” and “**Call 1st**” to Auto answer and Sequence.
- And as ALL modes: Listen for 2 (TWO) Cycle so make sure the spot/frequency is not in use before calling CQ!



Did you say Macros?

- Yes, I did....Here is all you need to know!
- If YOU are calling CQ left side
- If you are ANSWERING a CQ use right side
- **DONE!** No, really that is it!
- PS: You can generate your own very short text in “Free msg” but keep it short

Calling CQ	Answering CQ
CQ	Grid
dB	R +dB
RRR	73

CQ W6AER CM87

Gen msg

TNX 73 GL

Free msg

You will need to enter your call sign and your grid square (*remember those*) when you setup your software and your macros are ready to go!



But if you are Hunting DX like Antarctica!

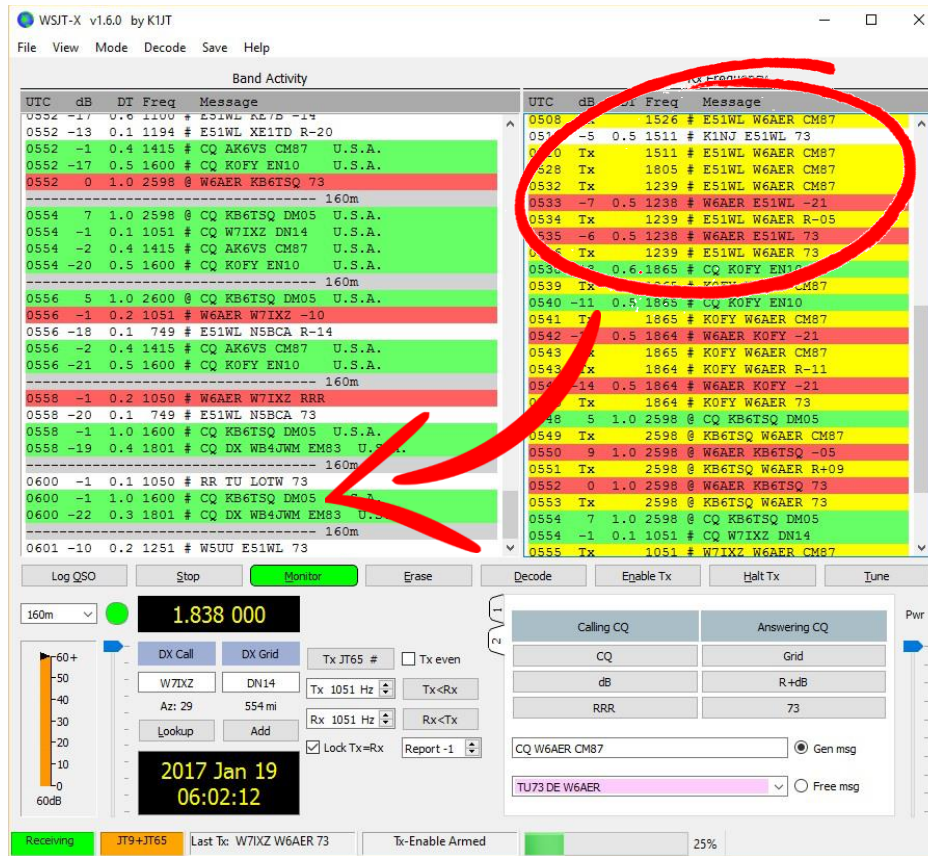
UTC	dB	DT	Freq	Message
0442	-19	-2.9	1526 #	XE2JS RI1AND RR73
0443	Tx		1527 #	RI1AND W6AER CMB7
0444	-18	-2.9	1525 #	W6AER RI1AND -20
0445	Tx		1525 #	RI1AND W6AER R-18
0446	-20	-2.9	1525 #	W6AER RI1AND RR73
0447	Tx		1525 #	RI1AND W6AER 73
0448	-20	-2.9	1525 #	NT2A RI1AND -12



- THE RULES CAN BE BENT!
- Don't wait for a CQ, likely will not see one! Everyone, their neighbor and dog (likely unlicensed) will want to work him!
- See how I followed the XE (Mexican) Station and NT2A (New York) followed me
- Can work split, but not needed on this one. FT8 DX tends to me split more at the writing of this PPT.
- All 3 of us got Antarctica in the log on 40m JT65 mode



Remember how I said JT65/9 (and FT8) are great on the lower bands?



WSJT-X v1.6.0 by K1JT

Band Activity

UTC	dB	DT	Freq	Message
0532	-17	0.6	1100	# ES1WL XE1TD R-14
0552	-13	0.1	1194	# ES1WL XE1TD R-20
0552	-1	0.4	1415	# CQ AK6VS CM87 U.S.A.
0552	-17	0.5	1600	# CQ KOFY EN10 U.S.A.
0552	0	1.0	2598	# W6AER KB6TSQ 73
----- 160m -----				
0554	7	1.0	2598	# CQ KB6TSQ DM05 U.S.A.
0554	-1	0.1	1051	# CQ W7IXZ DN14 U.S.A.
0554	-2	0.4	1415	# CQ AK6VS CM87 U.S.A.
0554	-20	0.5	1600	# CQ KOFY EN10 U.S.A.
----- 160m -----				
0556	5	1.0	2600	# CQ KB6TSQ DM05 U.S.A.
0556	-1	0.2	1051	# W6AER W7IXZ -10
0556	-18	0.1	749	# ES1WL NSBCA R-14
0556	-2	0.4	1415	# CQ AK6VS CM87 U.S.A.
0556	-21	0.5	1600	# CQ KOFY EN10 U.S.A.
----- 160m -----				
0558	-1	0.2	1050	# W6AER W7IXZ RRR
0558	-20	0.1	749	# ES1WL NSBCA 73
0558	-1	1.0	1600	# CQ KB6TSQ DM05 U.S.A.
0558	-19	0.4	1801	# CQ DX WB4JWM EM83 U.S.A.
----- 160m -----				
0600	-1	0.1	1050	# RR TU LOITW 73
0600	-1	1.0	1600	# CQ KB6TSQ DM05 U.S.A.
0600	-22	0.3	1801	# CQ DX WB4JWM EM83 U.S.A.
----- 160m -----				
0601	-10	0.2	1251	# W5UU ES1WL 73

Log QSO Stop Monitor Erase Decode Enable Tx Halt Tx Tune

160m 1.838 000

DX Call: W7IXZ, DX Grid: DN14, Az: 29, 554 mi

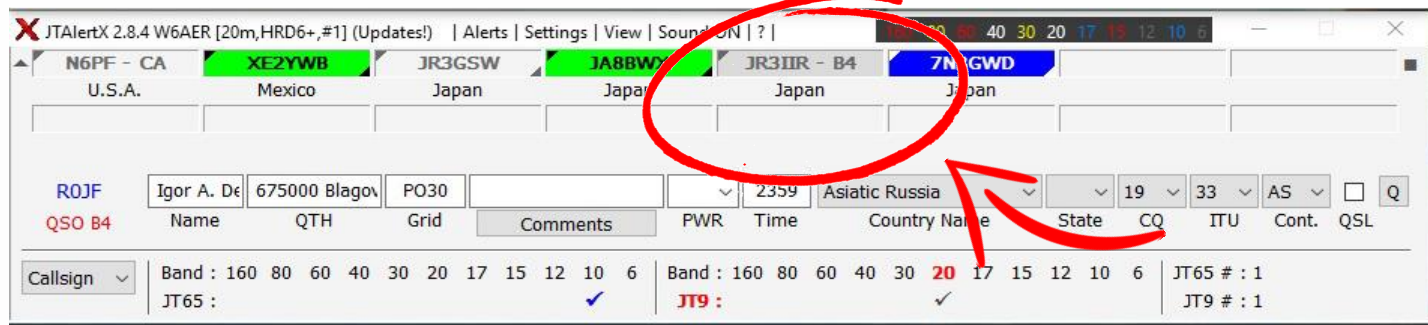
2017 Jan 19 06:02:12

Receiving JT9+JT65 Last Tx: W7IXZ W6AER 73 Tx-Enable Armed 25%

160m QSO

- E51WL (North Cook Island) using 25W and a Butternut Vertical Antenna & 140 feet of coax!
- Got report of -05 he was -21
- I like to keep things around -10 or so but personal preference

OPTIONAL ADD-ON: JTAlertX Helping me see what I need



B4 – Means I have worked it before

GREEN – Station not worked and calling CQ

YELLOW (Not Pictured) – Needed Entity (State/Country/Etc. as you defined)

BLUE – Needed Prefix (if you are a prefix hunter for CQ award)

These can be all setup based on YOUR Preference



0006 Tx 2593 @ R0JF W6AER 73
 0008 -20 -0.1 1733 # CQ CX2UI GF26
 0009 Tx 1733 # CX2UI W6AER CM87

JTAlertX 2.8.4 Settings - W6AER - [Logging Enabled - HRD V5/V6]

Alerts

- Own Call
- CQ and QRZ
- Wanted Prefix
- Wanted CQ Marathon
- Wanted US State
- Wanted DXCC
- Wanted Continent
- Wanted CQ Zone
- Wanted Grid
- Miscellaneous Alerts
- Alerts Priority
- Worked B4
- LoTW / eQSL(AG) Flags
- Filters
- Logging
- Applications
- Window
- Miscellaneous
- Web Services
- Scan Log and Update
- Sound Card
- Station Callsign
- Program Updates
- About

Quick Enable / Disable Audio and Visual Alerts

- ON Own Call
- OFF Wanted Callsign
- ON Wanted US State
- ON Wanted DXCC
- ON Wanted CQ Zone
- OFF Decode Keywords
- ON CQ and QRZ
- ON Wanted Prefix
- ON Wanted Grid
- OFF Wanted Continent
- OFF Wanted CQ Marathon
- OFF User Defined Alert

Quick Enable / Disable Audio only Alerts

- OFF Out of Shack
- OFF Start of TX Period
- ON TX Watchdog
- OFF End of TX/RX Period
- OFF Rx Frequency

Quick Enable / Disable Visual only Alerts

- ON Worked B4
- ON LoTW Stripe/Flag
- OFF Ignored Callsign
- ON Band Activity Display
- ON eQSL(AG) Stripe/Flag

Decoded Callsign Data Tooltip

- ON Enable
- ON Show distance in Miles
- ON Show all triggered Alerts

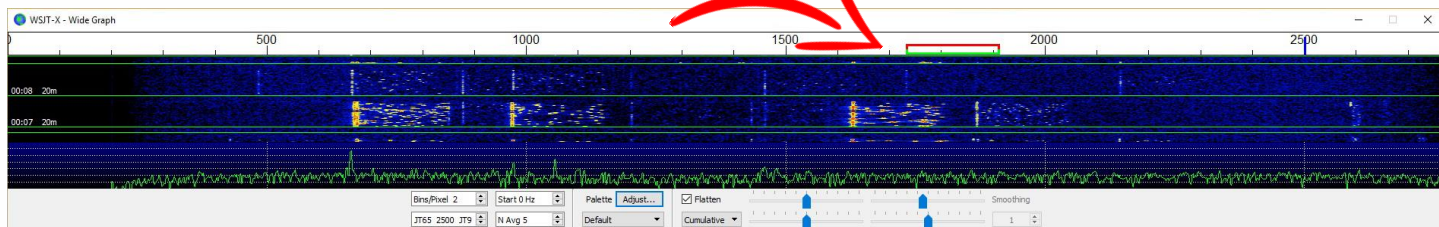
JTAlert by VK3AMA

Help OK Cancel Save



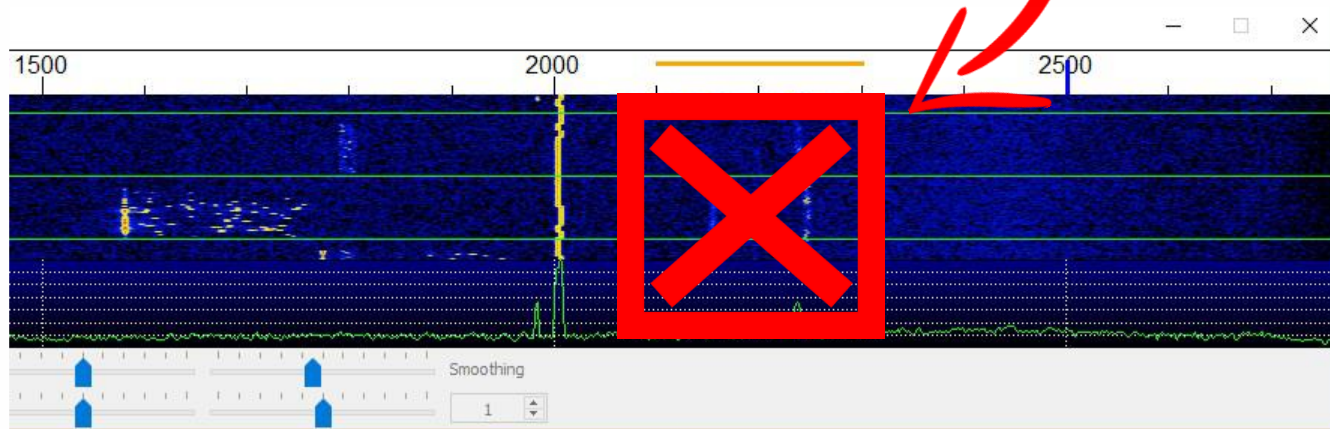
Quick word about the Waterfall

- You may not hear it but it's there! Stick around for 2 minutes...Always listen first as you would on CW or SSB to avoid QRM-ing
- Above 2500 Mark is JT9 / Below is JT65 – Stay in your area!
- Each Cycle is 1 Minute with close to 50 seconds of activity.
- Bars Indicate where you are (Green is RX / Red is TX)



Things to know about 30m

- **WARNING:** Brown Bar is WSPR “Whisper” – NEVER Transmit JT65/9 or anything other than WSPR here...ever!



JT Alert Plugin showing Activity

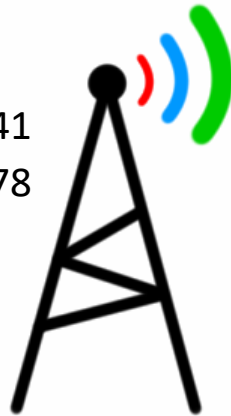
- Note the conditions and the active bands! These were supposedly “Bad Conditions” ...Not on Digital!
- This was in December 2016, since I have seen a growth in 80/160m
- Keep in mind, this does not mean you hear it all from your QTH but gives you a good general idea

Unique Callsigns TX/RX per Band (NA)									
Solar : SFI 78 : A 4 : K 1									
	tx	rx	tx	rx		tx	rx	tx	rx
160m	2	8			17m	11	6		
80m	24	40	1	6	15m	22	15		
60m	18	16			12m				
40m	56	127	22	63	10m				
30m	15	28	2	7	6m				
20m	44	116	6	22	ALL	187	337	29	95
JT65		(Last Update : 19-Nov, 00:11 utc)						JT9	



Frequencies and tips for JT65. JT9 add 2Khz. FT8 is generally a few Khz away, all are preset in WSJT-X

- 160m - 1836-1838
- 80m – 3576
- 40m – 7076
- 30m – 10138-10141
- 20m – 14076-14078
- 17m – 18102
- 15m – 21076
- 12m – 24917
- 10m – 28076
- 6m - 50276

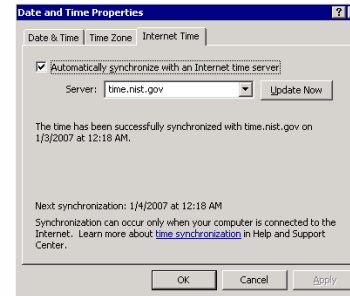


- WSJT-X software has there preprogrammed
- For 60m Use the CENTER CHANEL of the 5 **after** selecting 60m on your software.
- 6m openings you can work out of state and even DX with few watts!
- 40/60/80/160 come alive after dark as it does with other modes, local QSO only daytime
- 10/12/15 are mainly when sun spot counts are high but worth checking as they DO open.
- 30/20/17 are your money bands for this mode and activity round the clock at times.
- The JT65 mode used for moon bounce is a different version, NOT JT65(a)

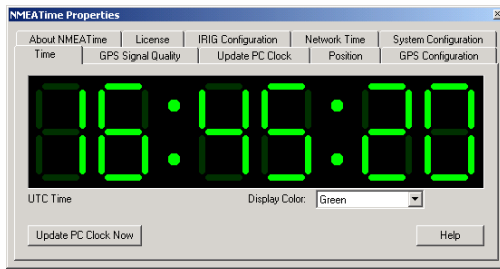


Quick word about TIME...

- JT 65/9 send on the top of the minute...**EXACTLY**. For successful QSO PC time needs to be spot on or no decodes.
- Aftermarket Software: Atomic Clock Sync, NetTime, Time-Sync and of course Dimension4 (I used this before)



Another option is to use GPS to set Time via NMEATime, I used to use this but is overkill for most. Requires a USB or Serial GPS.



There is now an NMEATime2, even better and I switched to this.

Another GREAT choice is BktTimeSync by IZ2BKT on version 1.9.1 as of end of 2017. Can use both time servers and GPS.

Check your NTP delay using “NTP-Tool” free download.



Decoding JT65/9 Signal Reports

- NOT using 59 (SSB), 599 (PSK, RTTY), 5NN (cw)
- **JT65** always **NEGATIVE** numbers like -18
- **JT9** & **FT8** can be **BOTH** (-23 or +02, etc.)
- If you are getting a +10, YOU ARE TOO LOUD!
- Lower number is always weaker
- Decoder Ring Optional (Joke)



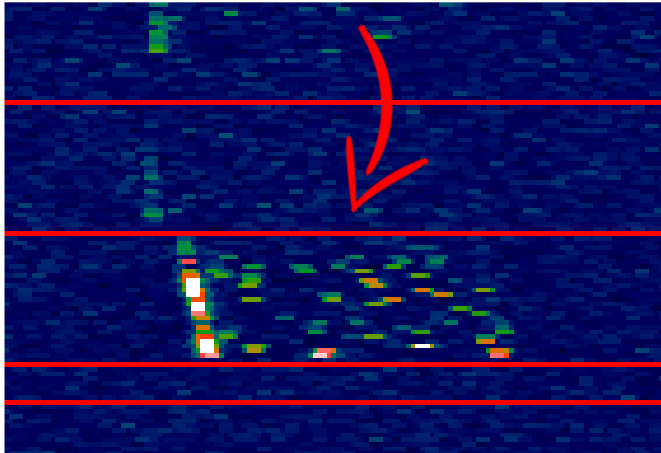
Before we move on...

QUIZ
TIME!



Can you Identify this JT65 Issue?

As Seen on Waterfall:



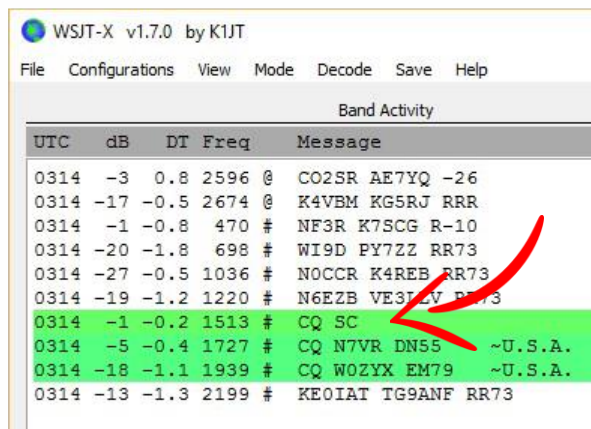
Answer:

- Frequency drift. Possible older radio warming up, or soundcard is drifting. I see this a lot with CO (Cuban) Stations lately.
- Very hard to decode, although I have seen it done & have done it.
- NOTE: If everything looks like this on your waterfall...Then it's YOU!



Can you Identify the problems here?

See first Green CQ Line:



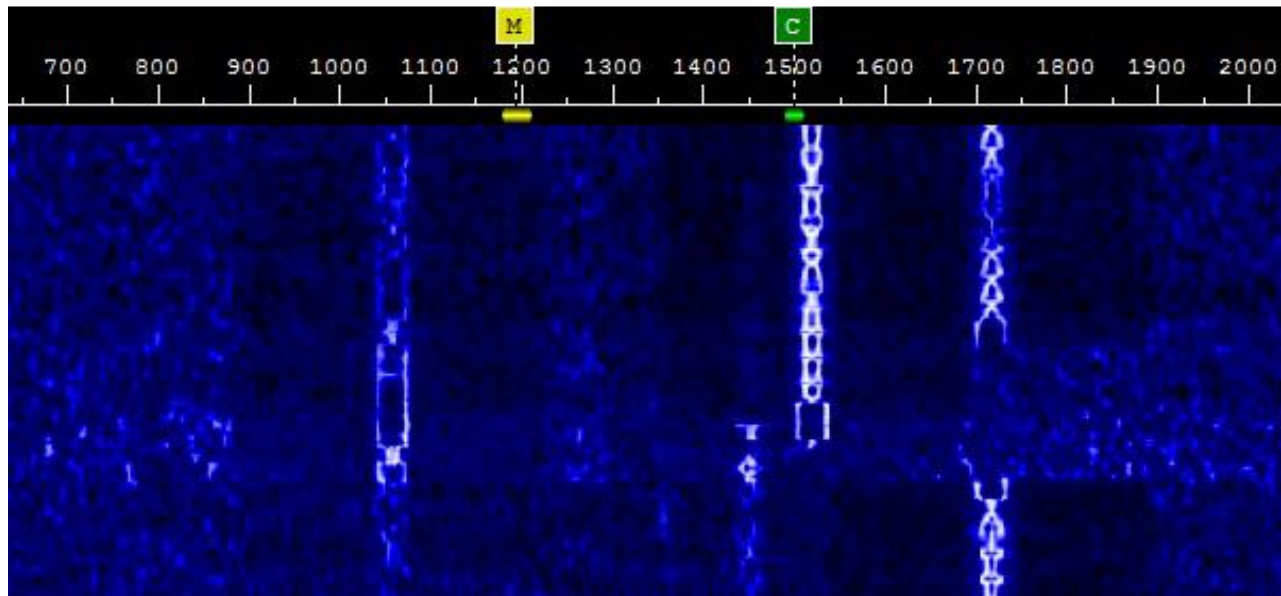
UTC	dB	DT	Freq	Message
0314	-3	0.8	2596 @	CO2SR AE7YQ -26
0314	-17	-0.5	2674 @	K4VBM KG5RJ RRR
0314	-1	-0.8	470 #	NF3R K7SCG R-10
0314	-20	-1.8	698 #	WI9D PY7ZZ RR73
0314	-27	-0.5	1036 #	NOCCR K4REB RR73
0314	-19	-1.2	1220 #	N6EZB VE3LV RR73
0314	-1	-0.2	1513 #	CQ SC
0314	-5	-0.4	1727 #	CQ N7VR DN65 ~U.S.A.
0314	-18	-1.1	1939 #	CQ W0ZYX EM79 ~U.S.A.
0314	-13	-1.3	2199 #	KE0IAT TG9ANF RR73

ANSWER:

- No call sign of ham looking for South Carolina
- We are required to ID
- Not possible to Respond due to JT65 QSO Structure.
- Likely STILL looking for SC!
- Proper form is **CQ W6AER SC** instead of **CQ W6AER CM87** if SC hunting...CQ DX (Call) or CQ (Call) DX is also ok.



PART 4: The world of PSK



Comparing the Phase-Shift Keying (PSK) Modes

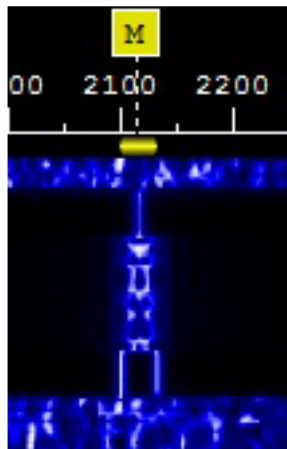
- Very Easy to use
- Low power – No AMP!
- As conditions improve, speed used tends to go up.
- QPSK - Quadrature phase shift, slower, more accurate but rarely used sadly! (Ex. QPSK31)
- Recommend Macros, especially with faster speeds! PSK 125 is faster then I can read.
- The “F” After mode is forward error correction (Ex. PSK31F)

Mode	Data Rate	Conditions for use	Bandwidth
PSK31	Typing Speed	Average	31hz
PSK63	Fast	Good	63hz
PSK125	Yikes!	Great	125hz

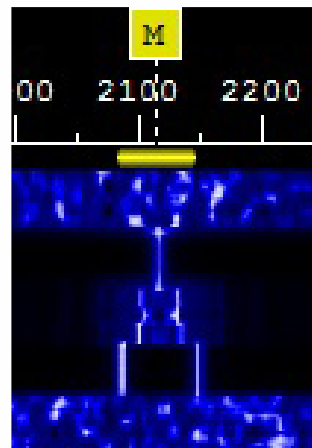


As Seen on the Waterfall:

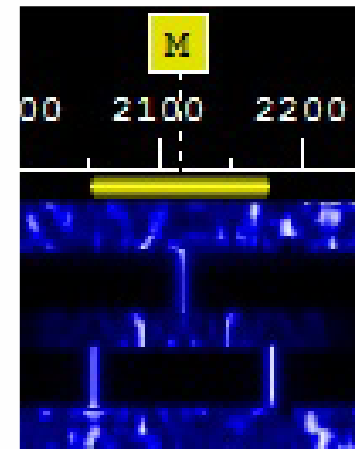
PSK 31



PSK 63



PSK 125

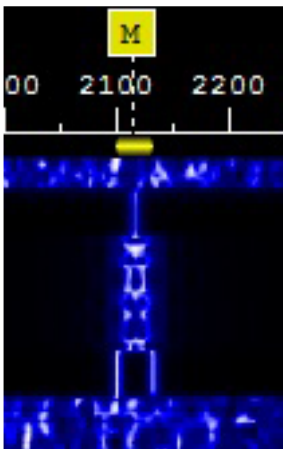


- As speed goes up, so does bandwidth, Only “mid portion” is data!
- When bandwidth goes up, can be harder to decoded. Errors tend to go up unless conditions are good.

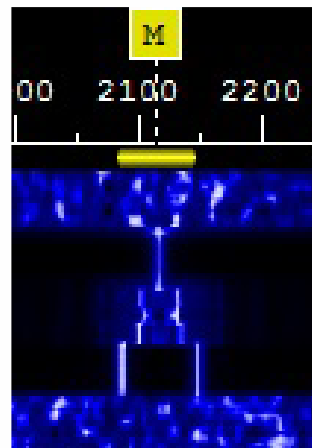


....And now, what they sound like:

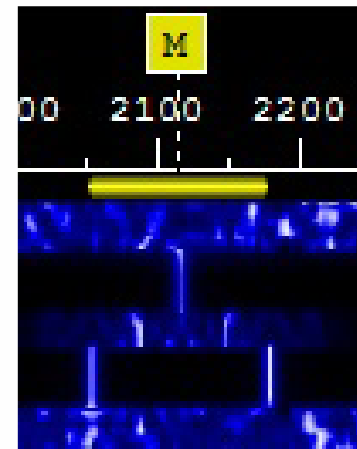
PSK 31



PSK 63



PSK 125





The screenshot shows the Digital Master 780 software interface. The main window is titled "BPSK-31" and displays a QSO log. The log shows a QSO between KE9CK and W6AER. The call log text is as follows:

```

17:20:44> Main
KE9CK KE9CK de W6AER W6AER pse kn
W6AER de KE9CK
Hi OM
Report : 599 599
Name : Bob Bob
QTH : Lafayette, Indiana. loc : EN60NI [73.2° 1,909.0mi] Tippecanoe County.
How copy? BTU OM, W6AER deE9CK kn
17:21:39> Main
KE9CK de W6AER

Hello Bob, name here is Lucas Lucas
RST is 599 599 into (QTH) Pacifica Pacifica
6mi (10km) South of San Francisco, (LOC) CM87sp CM87sp
Web: www.w6aer.com

BTU Bob, KE9CK de W6AER pse kn
  
```

Red annotations on the screenshot include:

- QSO Window**: A red arrow points to the main log window.
- CONTROLS**: A red arrow points to the control bar below the log, which includes buttons for Send (F4), Auto (F2), Pause (F3), Squelch (F5), Repeat, and Abort.
- Responses**: A red arrow points to the text in the log window.

The interface also shows a "General Macro" window on the left with fields for name, QTH, and frequency. The bottom of the screen shows a waterfall display and system status (CPU: 0%, Audio: 2%, Overload).



Typical PSK QSO Start: (I responded to CQ)

```

17:20:44> Main
KE9CK KE9CK de W6AER W6AER pse kn
K6AER de KE9CK <- Note the Errors, NO Error Correction!
Hi OM
Report : 599 599
Name : Bob Bob
QTH : Lafayette, Indiana loc : EN6ØNI [73.2° 1,909.0mi] Tippecanoe County.
How copy? BTU OM, W6AER deE9CK kn
17:21:39> Main
KE9CK de W6AER

Hello Bob, name here is Lucas Lucas
RST is 599 599 into (QTH) Pacifica Pacifica
6mi (1Økm) South of San Francisco, (LOC) CM87sp CM87sp
Web: www.w6aer.com
BTU Bob, KE9CK de W6AER pse kn

```

REPORT

GRID

GRID

REPORT

I REPEAT REPEAT to reduce errors



Typical PSK QSO End:

```

BPSK-31
My setup summary:
Yaesu FTDX-3000, 25 Watts, using Timewave Navigator & HRD v.6.2 + DM780
Antenna : Hexbeam & Butternut HF9V

QSL is OK via LOTW, eQSL (AG), ClubLog, HRDlog, Bureau or Direct Mail / Actual Card
NO SASE / NO STAMP needed, I always respond 100%

BTU KE9CK de W6AER kn
W6AER de KE9CK, 73 Lucas copy 100% and thanks for PSK31 QS11228 on 20m.
Good DX. Best wishes from Lafayette, Indiana. QSL ok via e-QSL.cc (AG).
QSO Logged 1/26/2017 UTC: 17:25:36 W6AER de KE9CK Bye Bye sk
17:25:49> Main
KE9CK de W6AER

73 Bob & thank you for this BPSK-31 QSO 1249 on 20m, good DX & Health to you!
KE9CK de W6AER sk sk

```

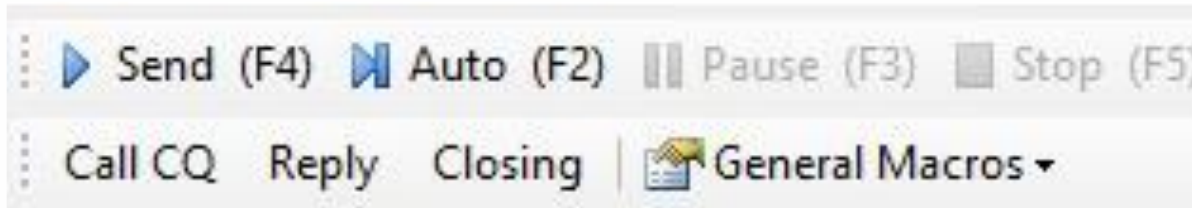
KN = Go ahead to specific station

SK = End of Contact (Silent Key)

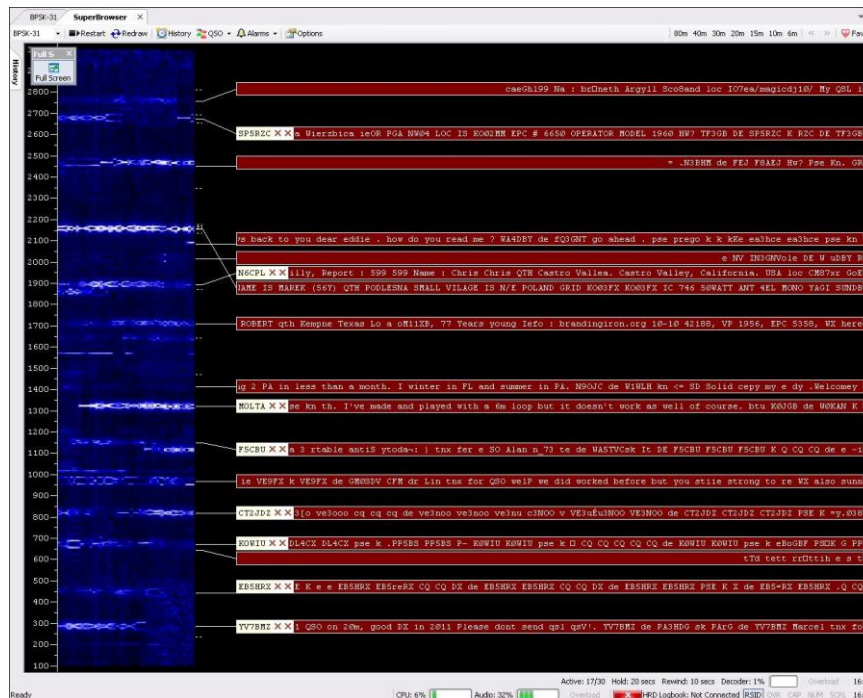


Controls to know:

- Exchange is much like JT65/9 but FASTER and you CAN ragchew. Drawback, does not decode as well but does decode better than RTTY and in some cases yes it even beats CW!
- Call CQ, Reply, Closing can all have multiple “Macros” (Pre Written text...I do not like to type too much)! Handy if running your system remote from a tablet, etc.



Use "SuperBrowser" to view all QSOs Live



The Lingo

- K = Over / KN = Turn Over to a specific station
- SK = End of QSO (Silent Key)
- BTU = Back to You
- TU = Thanks, sometimes TNX
- PSE = Please, can be used with PSE K or KN
- OM = Old Man / YL = Young Lady / XYL – Wife (Used instead of names at times)
- FB = Fine Business (in other words, good or all received)
- GM = Good Morning / GA = Good Afternoon / CUL = See You Later
- Arigato/Sayonara (Japanese), Gracias/Adios (Spanish) = Thank you/Good Bye
- 73 = Best Regards / 88 = Love and Kisses

The word 'Lingo' is written in a large, black, sans-serif font inside a green speech bubble with a white outline. The speech bubble has a tail pointing towards the bottom left.

Frequencies and tips for PSK Modes

- 160 m – 1.838 MHz
- 80 m – 3.580 MHz
- 40 m – 7.040 MHz
- 30 m – 10.142 MHz
- 20 m – 14.070 MHz
- 17 m – 18.100 MHz
- 15 m – 21.070 MHz
- 12 m – 24.920 MHz
- 10 m – 28.120 MHz
- 6 m – 50.290 MHz



ALWAYS use USB (Upper Side Band) even below 10MHz Unlike you would on Phone. Also True for JT65/9 and most HF digital modes.

You will find 20m to be the most active on average

10/12m are hopping when sun spots are good!

40m is good at night but traffic varies

Many Software packages have these preset

Do not type EVERYTHING IN CAPS, Slower on PSK!

Check out pskreporter.info to see where you are heard

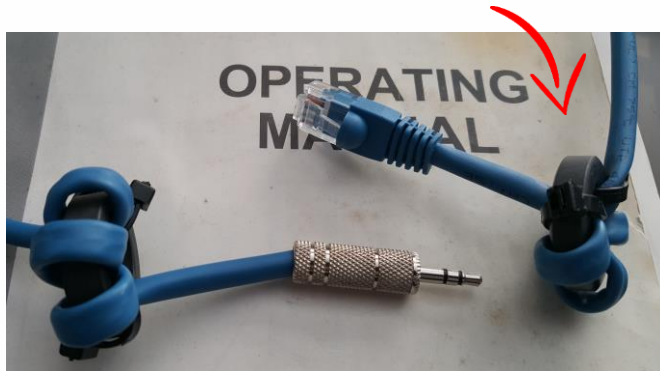


Part 5: Links, Tips & Additional Resources

Tips

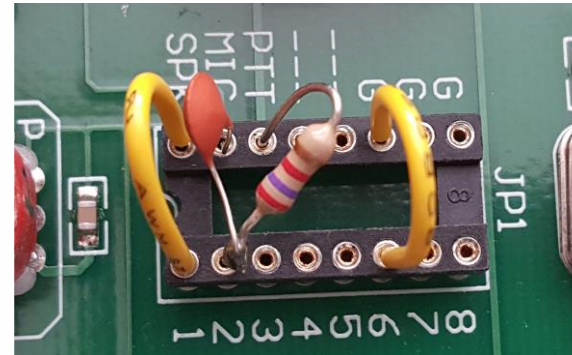
Use Ferrites to cut noise!

Type #31 is usually Recommended for hams



You can make your **OWN** cables using Cat5 Ethernet cables & plugs for the signalink and some other external soundcards. In this case a headphone jack did the trick.

Some radios need special “jumpers” or cables. This I had to do for the FT-847 on the signalink



Speaker and Ground and straight through, In needs a capacitor, resistor stops false trigger



Tips for DX and getting these modes to perform even better!

Tips

Hardware End:

- Use your roofing filters! If you have a 300hz, center the waterfall on it. I worked stations that I could not decode otherwise!
- Narrow the bandwidth to just what you want to work! No need to see 2.4-2.8Khz at the time IF something weak catches your eyes & strong station near.

Software end:

- On WSJT-X set decode to DEEP (There are 3 settings)
- Also you can have it do multi-pass. 2-3 is great but will use more CPU so don't go too crazy
- Call **SPLIT** if needed on PSK or JT/FT8 modes, yes like in Phone/CW... WORKS on DX!



Things I learned and for you to remember:

Turn off Radio DSP used for CW/Voice

Turn off ALL compression

Keep your eye on the ALC, Don't overdrive!
Stay below blue line.

AGC OFF or FAST
although more personal preference.



How to be a GREAT new Digital Operator

Listen 2 cycles before TX, so 2 minutes for JT65/9, at least 30 Seconds for FT8. 1-2 Minutes for PSK and RTTY is rule of thumb. Don't QRM a QSO in progress.

If station is calling someone else, be sure you are not calling the station again on their frequency or preferably at all. Don't QRM.

Setup a watchdog timer and don't leave station running unattended! I see many runaway QSOs and people not paying attention to what is going on.

Let QSOs finish, this means 73. RRR does not mean you can call now. Don't interrupt QSOs.

Don't overdrive you audio (Check ALC) so you stay within your slot.

Limit your RF power out (Check PO). More power is not the answer. Other than RRTY keep amp off!

Not following the above are great ways to make enemies and get hate mail!

Follow The DX code of conduct!



The Law and Digital Modes



According to the FCC:

- Modes must have technical characteristics which are documented publicly for the purpose of facilitating communications. (97.309 (a)(4))
- Below 28 Mhz can not exceed 1 kHz in width. (97.305 notes 3 and 4)
- Station ID may be done in the mode or with CW. (97.119 (b)(3))
- Can not be encrypted to hide meaning

Which is why:

- Has to be well documented. New modes are introduced regularly!
- SSTV is technically a voice mode and is close to 3khz, Hellschreiber similarly so.
- There is no FM below 28Mhz – Too wide!
- CW id can be set on WSJT-X and recommended, required at the end of QSO
- There are in fact ways to encrypt both data and voice.

Please never do this: It's ILLEGAL!

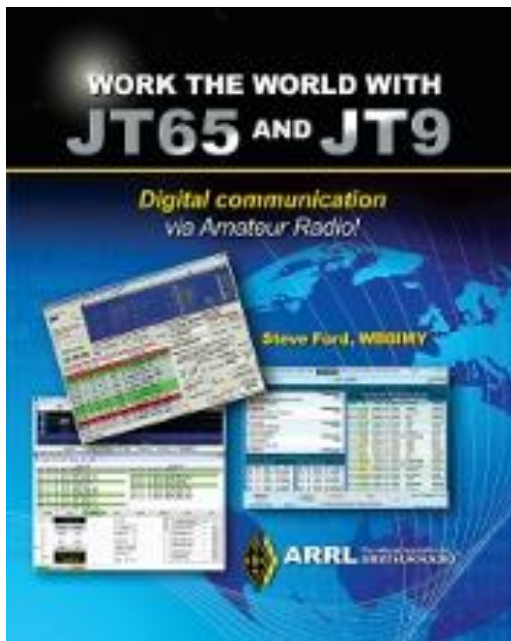


Where to Obtain the Software:

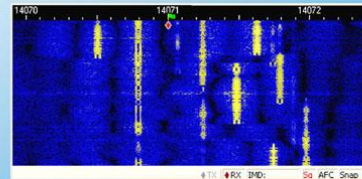
- WSJT-X: <http://physics.princeton.edu/pulsar/K1JT/wsjtx.html>
- JT-Alert: <http://hamapps.com>
- MMTTY: <http://hamsoft.ca/pages/mmtty.php>
- Gitty: <http://www.dxatlas.com/download.asp>
- Fldigi: <http://www.w1hkj.com>
- Ham Radio Deluxe: <http://www.hrdsoftwarellc.com>



Additional Recommend Reading on some of the digital modes covered



Nifty E-Z Guide to PSK31 Operation



PSK31 Digital Operating Modes
 PC to Transceiver Interfacing
 Practical Issues of Operation
 DigIPan Software Operation
 Sound Card Configuration
 Homebrew and Commercial Interfaces

Bernie Lafreniere, N6FN



Recommend Video Viewing:

Dave, KE0OG has a great Intro do Digital Setup as well as other resources on his website, Including PSK31 Demo

<http://dcasler.com>

Randy, K7AGE has great video tutorials on PSK31 and SSTV he also presents at Pacificon and SeaPac if you get a chance to catch him

<https://www.youtube.com/user/K7AGE/videos>

Alternatively another PSK31 Tutorial

<https://www.youtube.com/watch?v=wbmXFzmXF00>



Additional Recommend Video Viewing:

If you rather attempt fldigi check out these:

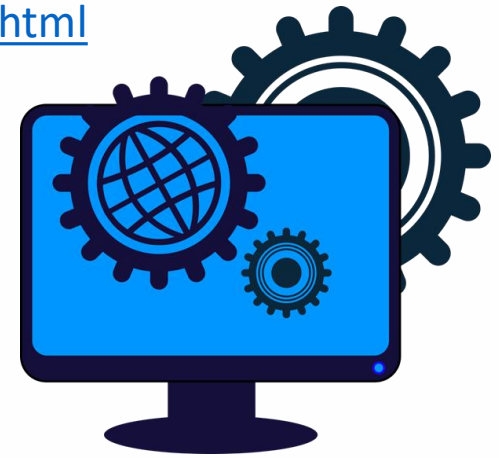
<https://coastalhamradio.wordpress.com/2017/02/26/wondering-how-fldigi-works/>

<https://www.youtube.com/user/K4REF/videos>



Additional Info on the Web:

- WB8NUT has a very detailed website: <http://wb8nut.com/digital>
- The ARRL Overview: <http://www.arrl.org/digital-data-modes>
- Sights & Sounds of Digital Modes: <http://www.w1hkj.com/modes/index.htm>
- Creating RTTY and PSK Marcos: <https://ng1i.com/creating-macros>
- NTP-Tool: <http://www.time-synchronization.co.uk>
- BktTimeSync: <http://www.maniaradio.it/en/bkttimesync.html>
- NMEATime: <http://www.visualgps.net/>



DX Code of Conduct



- I will listen, and listen, and then listen again before calling.
- I will only call if I can copy the DX station properly.
- I will not trust the DX cluster and will be sure of the DX station's call sign before calling.
- I will not interfere with the DX station nor anyone calling and will never tune up on the DX frequency or in the QSX slot.
- I will wait for the DX station to end a contact before I call.
- I will always send my full call sign.
- I will call and then listen for a reasonable interval. I will not call continuously.
- I will not transmit when the DX operator calls another call sign, not mine.
- I will not transmit when the DX operator queries a call sign not like mine.
- I will not transmit when the DX station requests geographic areas other than mine.
- When the DX operator calls me, I will not repeat my call sign unless I think he has copied it incorrectly.
- I will be thankful if and when I do make a contact.
- I will respect my fellow hams and conduct myself so as to earn their respect



Any Questions for me?

You can also email me:
W6AER@ARRL.NET

