Digital Modes

An Introduction

Aims of the Session

- **Look at the most popular modes**
- **The 3 main software packages**
- **Typical Computer – Rig systems**
- **In use examples**
- **Practical Demo’s**

Why

- Weak Signal
  - Band Conditions
  - Low Power
  - Poor Aerial
- Audio Problems
  - Local Noise Levels
  - Hard of hearing
- Picture
- Checking Band Conditions

The Software & Modes

WSJT-X

- FT8
- JT65
- MSK114
- WSPR

Pre Set
Messages

Fldigi

- PSK
- RTTY
- CW
- WEFAX

Pre Loaded
Messages
+ free text

MMSSTV/ QSSTV

- SSTV

Pre Loaded
Still Pictures

Computer Types

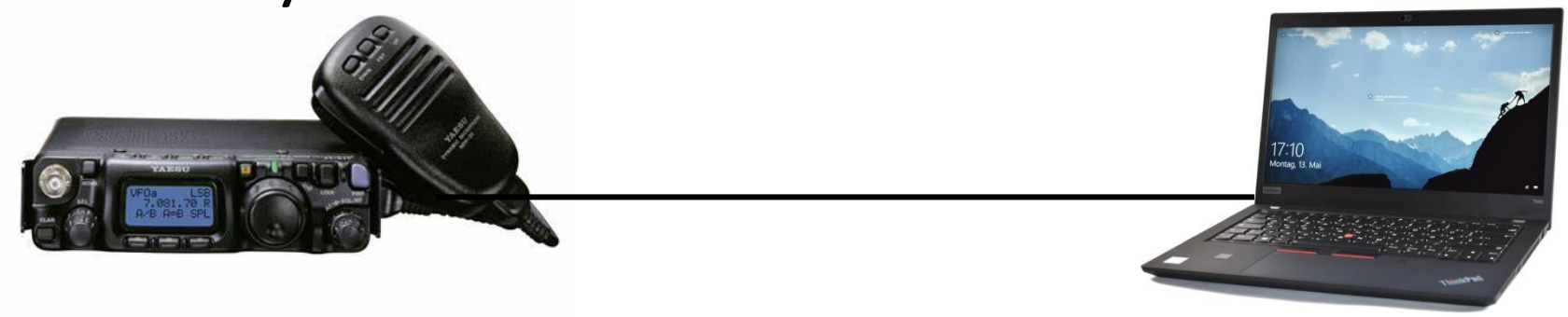
- Windows

- Raspberry Pi

- Apple ?

The Hardware

- RX only – Audio Cable



- RX Only – No wires

Possible Issues with Direct Connection

- Hum
- RF Feedback
- Instability
- DC path if power lead fails

Audio lines – Isolation transformer

PTT line Optical coupler or external VOX

- VOX often not operated from data input of rig

The Hardware

Interface gives

- Audio Path on TX & RX (external sound card)
- PTT Control (VOX in unit)

The Hardware

- TX & RX – Sound Card in RIG (ICOM +)
  - – USB Cable

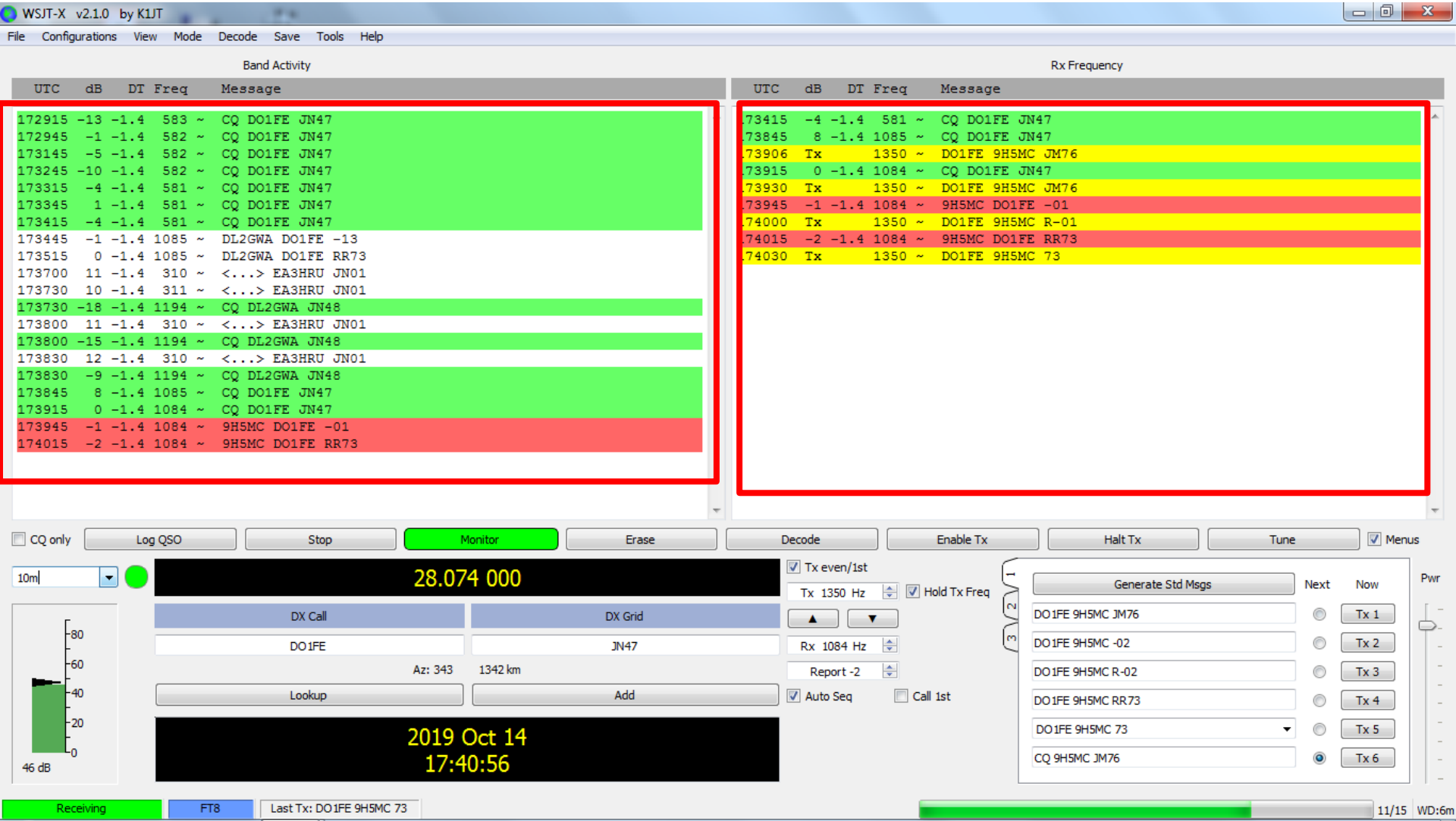
Settings

- Wide filter on most modes
- USB-D
    - SSTV Below 10MHz LSB-D
    - SSTV on VHF could be on FM
- Mod level
    - Keep down below ALC level
    - Max 80% transmit power controlled by audio level
- Time Within 1 sec on some modes

Common Frequencies used

- **FT8**
  - 3.573
  - 7.074
  - 14.074
  - 18.100
  - 21.074
  - 28.074
  - 50.313
- **PSK31**
  - 3.58
  - 7.04
  - 14.07
  - 21.08
  - 28.12
- **SSTV**
  - 3.73 (LSB)
  - 14.23 (USB)
  - 144.500
  - 145.800 (ISS)

FT8


WSJT-X v2.1.0 by K1JT
File Configurations View Mode Decode Save Tools Help
Band Activity
UTC dB DT Freq Message
172915 -13 -1.4 583 ~ CQ DO1FE JN47
172945 -1 -1.4 582 ~ CQ DO1FE JN47
173145 -5 -1.4 582 ~ CQ DO1FE JN47
173245 -10 -1.4 582 ~ CQ DO1FE JN47
173315 -4 -1.4 581 ~ CQ DO1FE JN47
173345 1 -1.4 581 ~ CQ DO1FE JN47
173415 -4 -1.4 581 ~ CQ DO1FE JN47
173445 -1 -1.4 1085 ~ DL2GWA DO1FE -13
173515 0 -1.4 1085 ~ DL2GWA DO1FE RR73
173700 11 -1.4 310 ~ <...> EA3HRU JN01
173730 10 -1.4 311 ~ <...> EA3HRU JN01
173730 -18 -1.4 1194 ~ CQ DL2GWA JN48
173800 11 -1.4 310 ~ <...> EA3HRU JN01
173800 -15 -1.4 1194 ~ CQ DL2GWA JN48
173830 12 -1.4 310 ~ <...> EA3HRU JN01
173830 -9 -1.4 1194 ~ CQ DL2GWA JN48
173845 8 -1.4 1085 ~ CQ DO1FE JN47
173915 0 -1.4 1084 ~ CQ DO1FE JN47
173945 -1 -1.4 1084 ~ 9H5MC DO1FE -01
174015 -2 -1.4 1084 ~ 9H5MC DO1FE RR73
Rx Frequency
UTC dB DT Freq Message
173415 -4 -1.4 581 ~ CQ DO1FE JN47
173845 8 -1.4 1085 ~ CQ DO1FE JN47
173906 Tx 1350 ~ DO1FE 9H5MC JM76
173915 0 -1.4 1084 ~ CQ DO1FE JN47
173930 Tx 1350 ~ DO1FE 9H5MC JM76
173945 -1 -1.4 1084 ~ 9H5MC DO1FE -01
174000 Tx 1350 ~ DO1FE 9H5MC R-01
174015 -2 -1.4 1084 ~ 9H5MC DO1FE RR73
174030 Tx 1350 ~ DO1FE 9H5MC 73
CQ only
Log QSO
Stop
Monitor
Erase
Decode
Enable Tx
Halt Tx
Tune
Menus
10m
28.074 000
Tx even/1st
Tx 1350 Hz
Hold Tx Freq
DX Call
DX Grid
DO1FE
JN47
Rx 1084 Hz
Report -2
Az: 343
1342 km
Lookup
Add
Auto Seq
Call 1st
2019 Oct 14
17:40:56
Generate Std Msgs
Next
Now
DO1FE 9H5MC JM76
DO1FE 9H5MC -02
DO1FE 9H5MC R-02
DO1FE 9H5MC RR73
DO1FE 9H5MC 73
CQ 9H5MC JM76
Tx 1
Tx 2
Tx 3
Tx 4
Tx 5
Tx 6
Pwr
80
60
40
20
0
46 dB
Receiving
FT8
Last Tx: DO1FE 9H5MC 73
11/15
WD:6m

FT8

Band Activity

UTC	dB	DT	Freq	Message
165330	14	-1.2	522	~ CQ EA8ACW IL28
165400	11	-1.1	521	~ CQ EA8ACW IL28
170500	-11	-1.1	1644	~ CQ ZP4KFX GG14
170530	-12	-1.1	1644	~ CQ ZP4KFX GG14
170600	-7	-1.1	1644	~ CQ ZP4KFX GG14
171000	-12	-1.1	1645	~ F4DJK ZP4KFX -14
171030	-10	-1.1	1644	~ F4DJK ZP4KFX RR73
171100	-7	-1.1	1645	~ F4HSU ZP4KFX -13
171130	-10	-1.1	1645	~ F4HSU ZP4KFX -13
171200	-10	-1.1	1645	~ F4HSU ZP4KFX RR73
171300	-8	-1.1	1645	~ EA2DVT ZP4KFX -17
171330	-11	-1.1	1645	~ EA2DVT ZP4KFX -17
171400	-10	-1.1	1646	~ EA2DVT ZP4KFX RR73
171800	1	-1.0	2080	~ CQ LU7DXQ GF05
171830	0	-1.0	2078	~ CQ LU7DXQ GF05
171900	5	-1.0	2076	~ CQ LU7DXQ GF05
171930	5	-1.0	2155	~ 9H5MC LU7DXQ -19
172000	-2	-1.0	2155	~ 9H5MC LU7DXQ RR73
172100	4	-1.0	2156	~ F8DBF LU7DXQ -05

Rx Frequency

UTC	dB	DT	Freq	Message
165330	14	-1.2	522	~ CQ EA8ACW IL28
165400	11	-1.1	521	~ CQ EA8ACW IL28
165415	Tx		1250	~ EA8ACW 9H5MC JM76
165445	Tx		1250	~ EA8ACW 9H5MC JM76
165615	Tx		1250	~ CQ 9H5MC JM76
165645	Tx		1250	~ CQ 9H5MC JM76
165715	Tx		1250	~ CQ 9H5MC JM76
171100	-7	-1.1	1645	~ F4HSU ZP4KFX -13
170600	-7	-1.1	1644	~ CQ ZP4KFX GG14
171300	-8	-1.1	1645	~ EA2DVT ZP4KFX -17
171330	-11	-1.1	1645	~ EA2DVT ZP4KFX -17
171345	Tx		1250	~ ZP4KFX 9H5MC JM76
171400	-10	-1.1	1646	~ EA2DVT ZP4KFX RR73
171415	Tx		1250	~ ZP4KFX 9H5MC JM76
171445	Tx		1250	~ ZP4KFX 9H5MC JM76
171515	Tx		1250	~ ZP4KFX 9H5MC JM76
171830	0	-1.0	2078	~ CQ LU7DXQ GF05
171900	5	-1.0	2076	~ CQ LU7DXQ GF05
171915	Tx		1250	~ LU7DXQ 9H5MC JM76
171930	5	-1.0	2155	~ 9H5MC LU7DXQ -19
171945	Tx		1250	~ LU7DXQ 9H5MC R+05
172000	-2	-1.0	2155	~ 9H5MC LU7DXQ RR73
172015	Tx		1250	~ LU7DXQ 9H5MC 73
172100	4	-1.0	2156	~ F8DBF LU7DXQ -05

Menus Tools Help

CQ only | Log QSO | Stop | Monitor | Erase | Decode | Enable Tx | Halt Tx | Tune | Menus

10m

28.074 000

Tx even/1st

Tx 1250 Hz | Hold Tx Freq

DX Call | DX Grid

LU7DXQ | GF05

Rx 2155 Hz

Report -2

Az: 233 10887 km

Lookup | Add

Auto Seq | Call 1st

2019 Oct 15
17:21:33

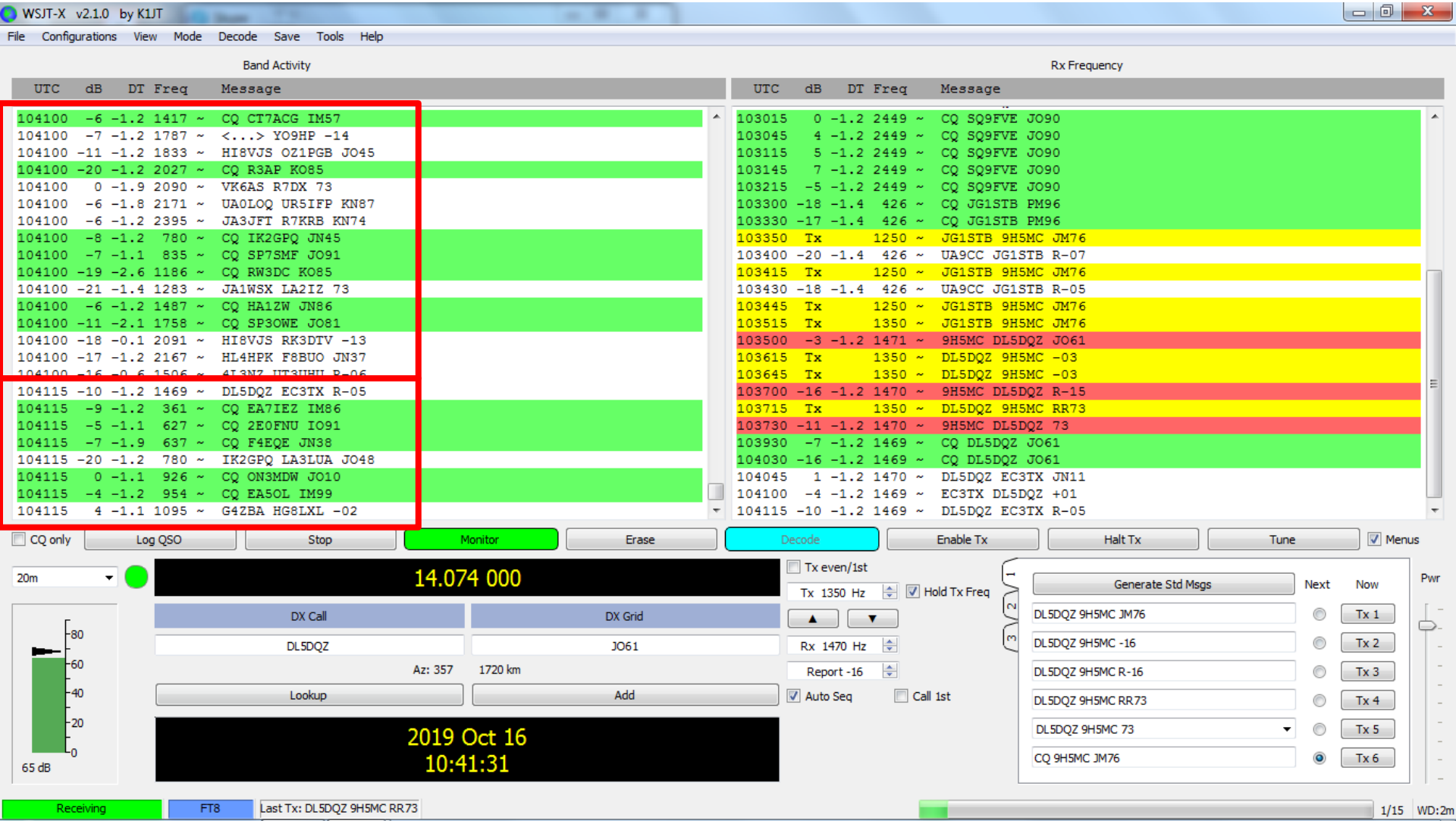
80 60 40 20 0
51 dB

Generate Std Msgs | Next | Now | Pwr

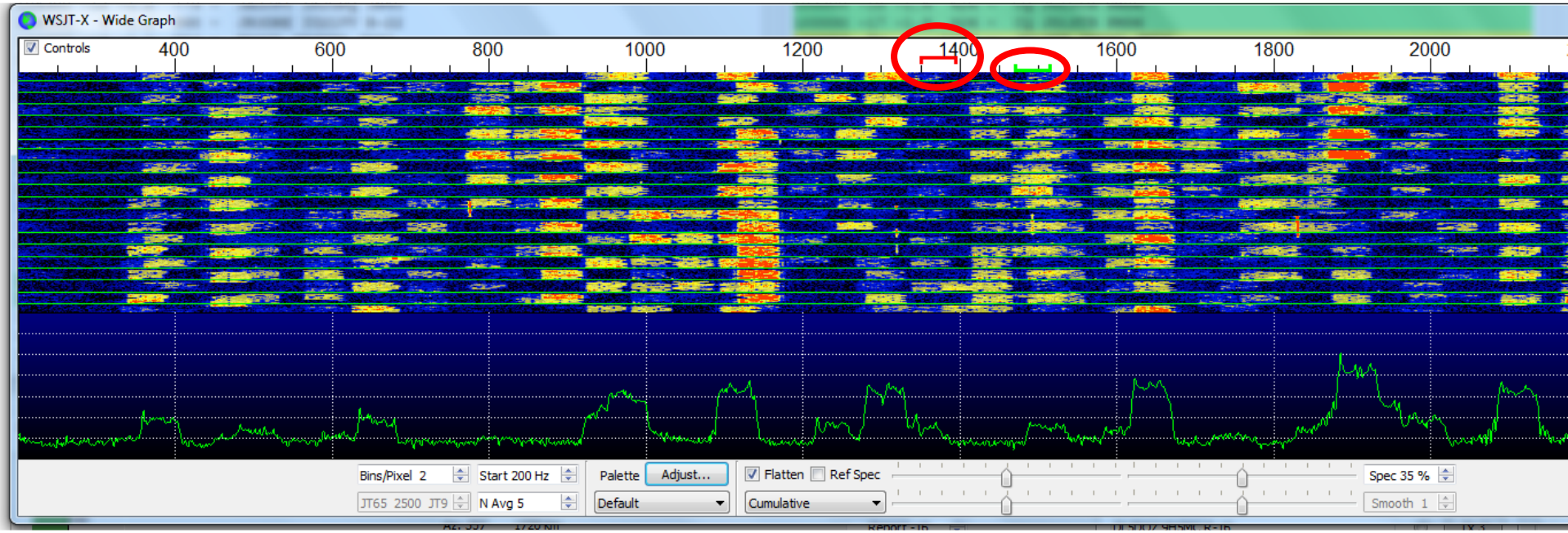
LU7DXQ 9H5MC JM76		Tx 1
LU7DXQ 9H5MC -02		Tx 2
LU7DXQ 9H5MC R-02		Tx 3
LU7DXQ 9H5MC RR73		Tx 4
LU7DXQ 9H5MC 73		Tx 5
CQ 9H5MC JM76		Tx 6

Receiving | FT8 | Last Tx: LU7DXQ 9H5MC 73 | 3/15 | WD:5m

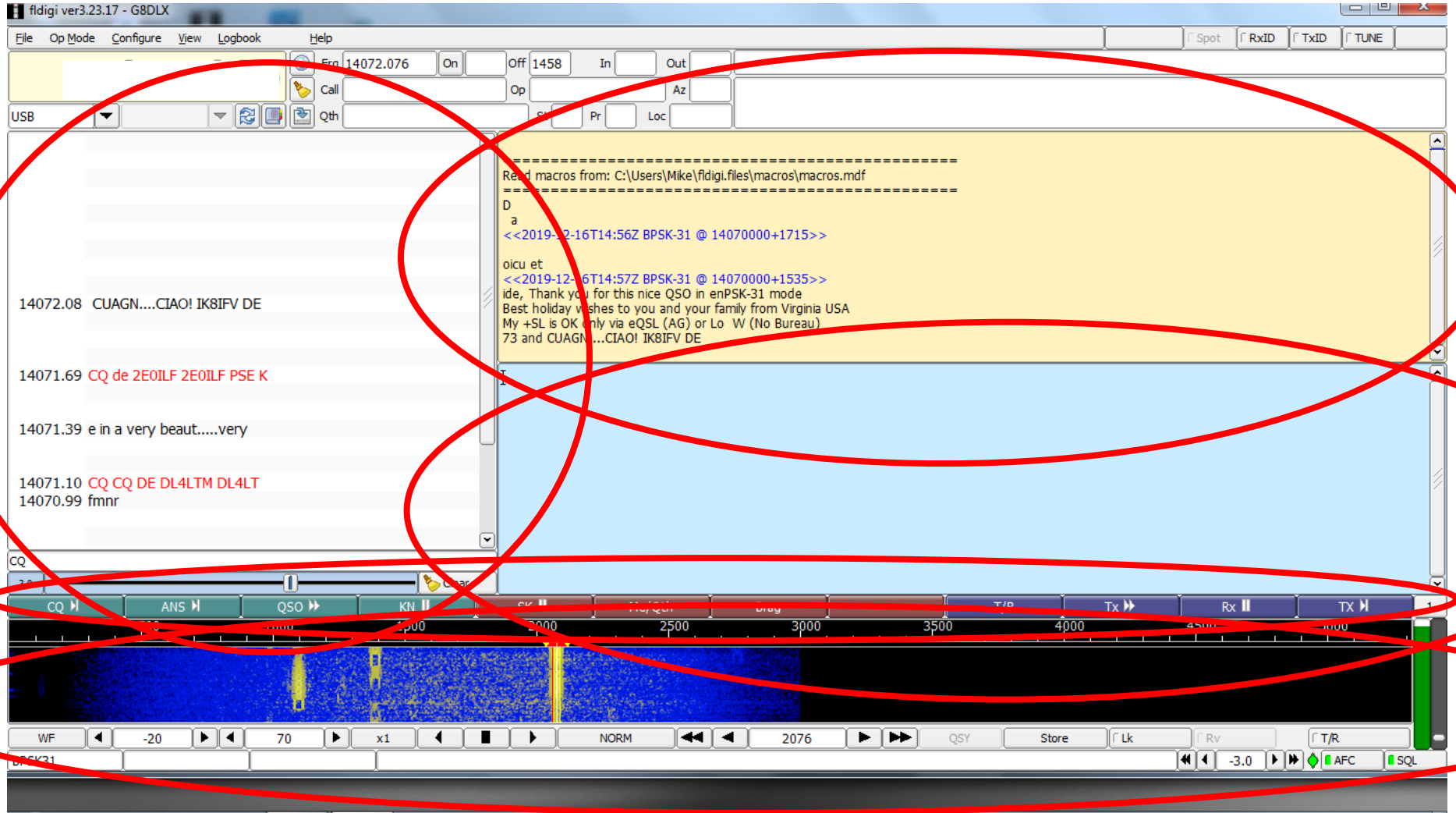
FT8


WSJT-X v2.1.0 by K1JT
File Configurations View Mode Decode Save Tools Help
Band Activity
UTC dB DT Freq Message
104100 -6 -1.2 1417 ~ CQ CT7ACG IM57
104100 -7 -1.2 1787 ~ <...> YO9HP -14
104100 -11 -1.2 1833 ~ HI8VJS OZ1PGB JO45
104100 -20 -1.2 2027 ~ CQ R3AP KO85
104100 0 -1.9 2090 ~ VK6AS R7DX 73
104100 -6 -1.8 2171 ~ UA0LOQ UR5IFP KN87
104100 -6 -1.2 2395 ~ JA3JFT R7KRB KN74
104100 -8 -1.2 780 ~ CQ IK2GPQ JN45
104100 -7 -1.1 835 ~ CQ SP7SMF JO91
104100 -19 -2.6 1186 ~ CQ RW3DC KO85
104100 -21 -1.4 1283 ~ JA1WSX LA2IZ 73
104100 -6 -1.2 1487 ~ CQ HA1ZW JN86
104100 -11 -2.1 1758 ~ CQ SP3OWE JO81
104100 -18 -0.1 2091 ~ HI8VJS RK3DTV -13
104100 -17 -1.2 2167 ~ HL4HPK F8BUO JN37
104115 -10 -1.2 1469 ~ DL5DQZ EC3TX R-05
104115 -9 -1.2 361 ~ CQ EA7IEZ IM86
104115 -5 -1.1 627 ~ CQ 2E0FNU IO91
104115 -7 -1.9 637 ~ CQ F4EQE JN38
104115 -20 -1.2 780 ~ IK2GPQ LA3LUA JO48
104115 0 -1.1 926 ~ CQ ON3MDW JO10
104115 -4 -1.2 954 ~ CQ EA5OL IM99
104115 4 -1.1 1095 ~ G4ZBA HG8LXL -02
Rx Frequency
UTC dB DT Freq Message
103015 0 -1.2 2449 ~ CQ SQ9FVE JO90
103045 4 -1.2 2449 ~ CQ SQ9FVE JO90
103115 5 -1.2 2449 ~ CQ SQ9FVE JO90
103145 7 -1.2 2449 ~ CQ SQ9FVE JO90
103215 -5 -1.2 2449 ~ CQ SQ9FVE JO90
103300 -18 -1.4 426 ~ CQ JG1STB PM96
103330 -17 -1.4 426 ~ CQ JG1STB PM96
103350 Tx 1250 ~ JG1STB 9H5MC JM76
103400 -20 -1.4 426 ~ UA9CC JG1STB R-07
103415 Tx 1250 ~ JG1STB 9H5MC JM76
103430 -18 -1.4 426 ~ UA9CC JG1STB R-05
103445 Tx 1250 ~ JG1STB 9H5MC JM76
103515 Tx 1350 ~ JG1STB 9H5MC JM76
103500 -3 -1.2 1471 ~ 9H5MC DL5DQZ JO61
103615 Tx 1350 ~ DL5DQZ 9H5MC -03
103645 Tx 1350 ~ DL5DQZ 9H5MC -03
103700 -16 -1.2 1470 ~ 9H5MC DL5DQZ R-15
103715 Tx 1350 ~ DL5DQZ 9H5MC RR73
103730 -11 -1.2 1470 ~ 9H5MC DL5DQZ 73
103930 -7 -1.2 1469 ~ CQ DL5DQZ JO61
104030 -16 -1.2 1469 ~ CQ DL5DQZ JO61
104045 1 -1.2 1470 ~ DL5DQZ EC3TX JN11
104100 -4 -1.2 1469 ~ EC3TX DL5DQZ +01
104115 -10 -1.2 1469 ~ DL5DQZ EC3TX R-05
CQ only
Log QSO
Stop
Monitor
Erase
Decode
Enable Tx
Halt Tx
Tune
Menus
20m
14.074 000
Tx even/1st
Tx 1350 Hz
Hold Tx Freq
DX Call
DX Grid
DL5DQZ
JO61
Az: 357
1720 km
Rx 1470 Hz
Report -16
Lookup
Add
Auto Seq
Call 1st
2019 Oct 16
10:41:31
Generate Std Msgs
Next
Now
DL5DQZ 9H5MC JM76
DL5DQZ 9H5MC -16
DL5DQZ 9H5MC R-16
DL5DQZ 9H5MC RR73
DL5DQZ 9H5MC 73
CQ 9H5MC JM76
Tx 1
Tx 2
Tx 3
Tx 4
Tx 5
Tx 6
Pwr
65 dB
Receiving
FT8
Last Tx: DL5DQZ 9H5MC RR73
1/15
WD:2m

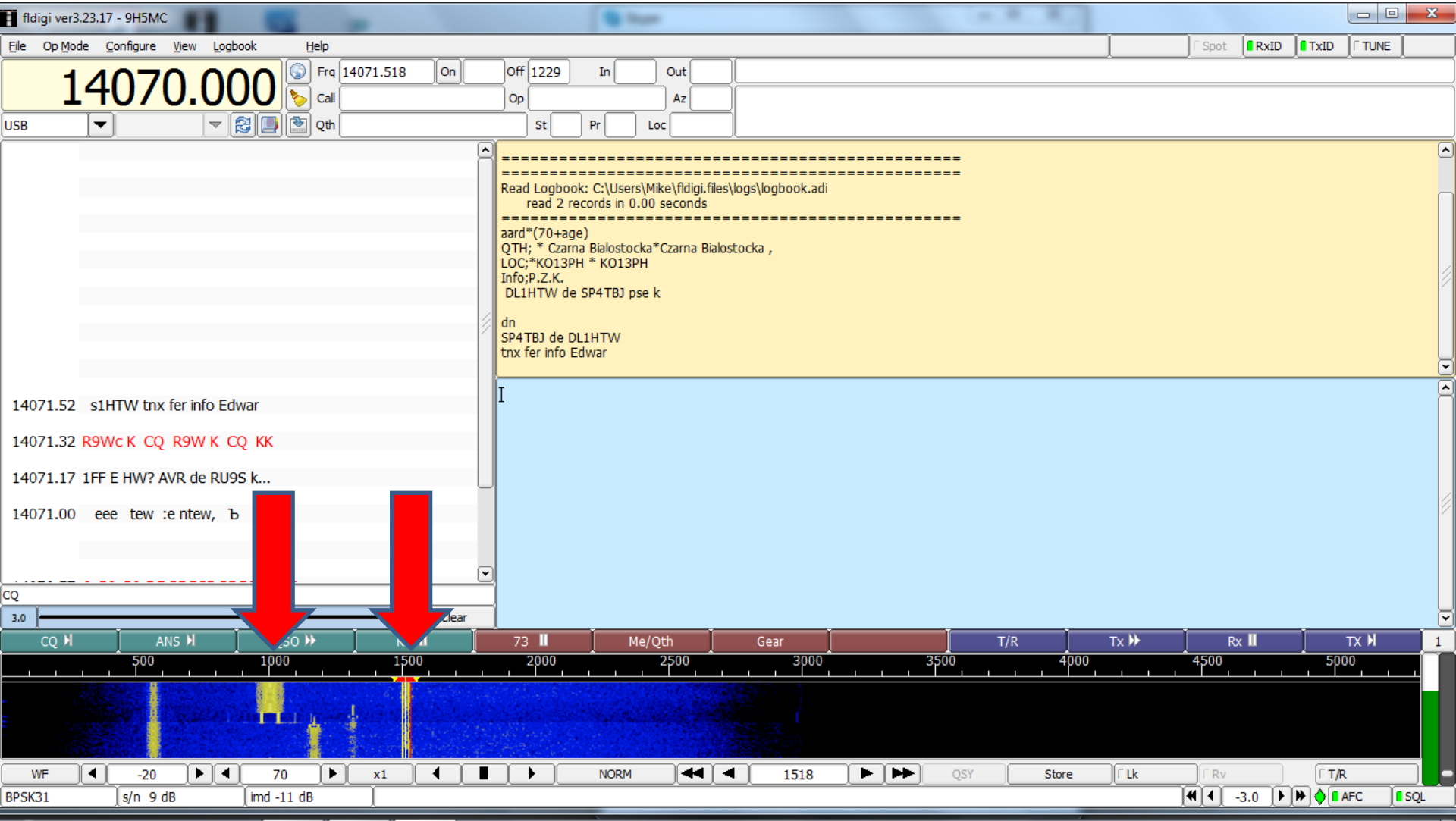
FT8


WSJT-X - Wide Graph
Controls
400
600
800
1000
1200
1400
1600
1800
2000
Bins/Pixel 2
Start 200 Hz
JT65 2500 JT9
N Avg 5
Palette
Adjust...
Default
Flatten
Ref Spec
Cumulative
Spec 35 %
Smooth 1

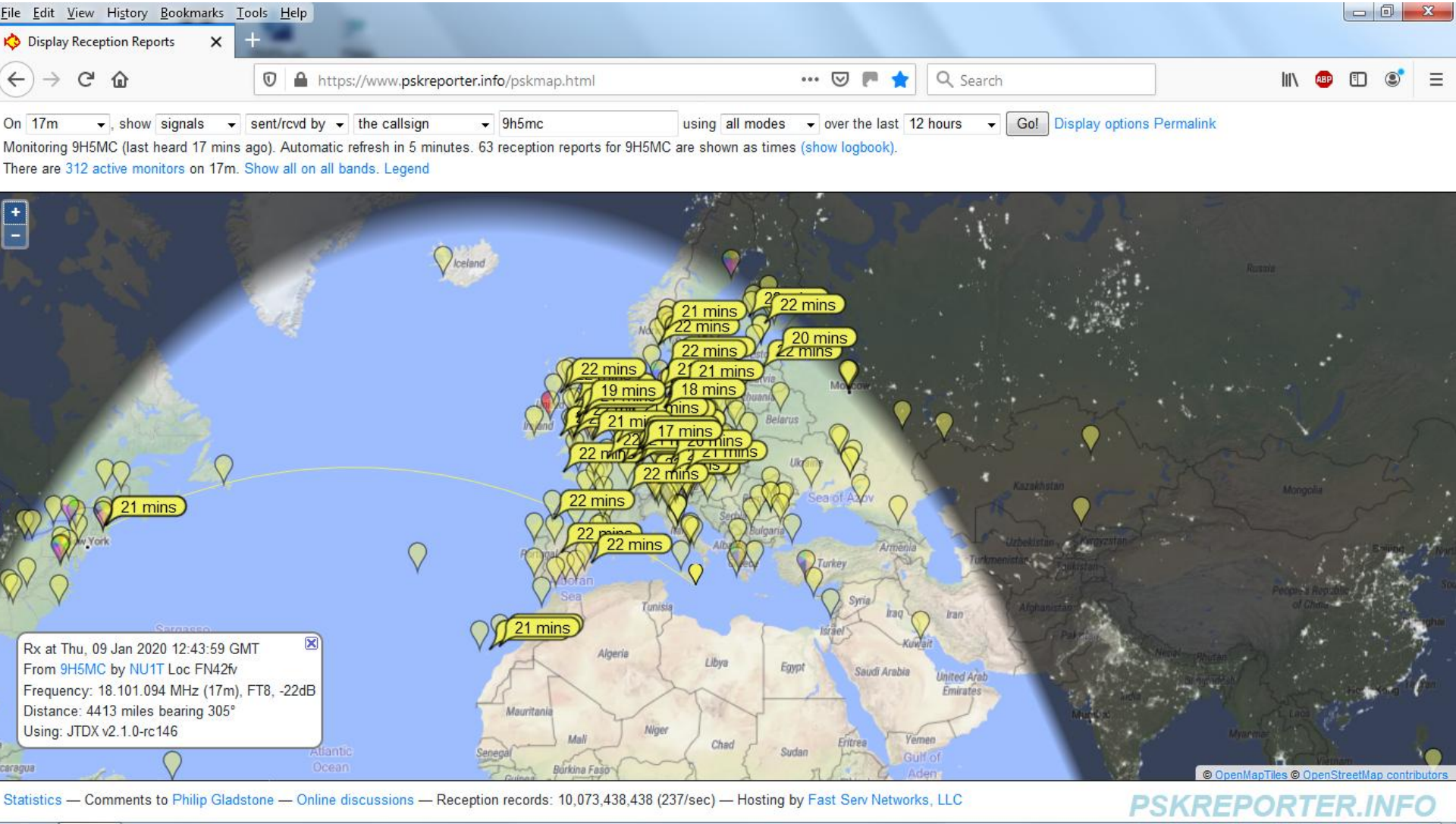
PSK31


fldigi ver3.23.17 - G8DLX
File Op Mode Configure View Logbook Help
Spot RxID TxID TUNE
Frq 14072.076 On Off 1458 In Out
Call Op Az
USB Qth Pr Loc
Read macros from: C:\Users\Mike\fldigi.files\macros\macros.mdf
D
a
<<2019-12-16T14:56Z BPSK-31 @ 14070000+1715>>
oicu et
<<2019-12-16T14:57Z BPSK-31 @ 14070000+1535>>
ide, Thank you for this nice QSO in enPSK-31 mode
Best holiday wishes to you and your family from Virginia USA
My +SL is OK only via eQSL (AG) or Lo W (No Bureau)
73 and CUAGN....CIAO! IK8IFV DE
14072.08 CUAGN....CIAO! IK8IFV DE
14071.69 CQ de 2E0ILF 2E0ILF PSE K
14071.39 e in a very beaut.....very
14071.10 CQ CQ DE DL4LTM DL4LT
14070.99 fmnr
CQ
CQ ANS QSO KN Tx Rx TX
2500 3000 3500 4000
WF -20 70 x1 NORM 2076 QSY Store Lk Rv T/R
BPSK31 -3.0 AFC SQL

PSK63 / 31


fldigi ver3.23.17 - 9H5MC
File Op Mode Configure View Logbook Help
14070.000
Frq 14071.518 On Off 1229 In Out
Call Op Az
USB Qth St Pr Loc
Spot RxID TxID TUNE
==========
==========
Read Logbook: C:\Users\Mike\fldigi.files\logs\logbook.adi
read 2 records in 0.00 seconds
==========
aard*(70+age)
QTH; * Czarna Bialostocka*Czarna Bialostocka ,
LOC;*KO13PH * KO13PH
Info;P.Z.K.
DL1HTW de SP4TBJ pse k
dn
SP4TBJ de DL1HTW
tnx fer info Edwar
14071.52 s1HTW tnx fer info Edwar
14071.32 R9Wc K CQ R9W K CQ KK
14071.17 1FF E HW? AVR de RU9S k...
14071.00 eee tew :e ntew, ъ
CQ
3.0
CQ ANS 73 Me/Qth Gear T/R Tx Rx TX
500 1000 1500 2000 2500 3000 3500 4000 4500 5000
WF -20 70 x1 NORM 1518 QSY Store Lk Rv T/R
BPSK31 s/n 9 dB imd -11 dB -3.0 AFC SQL

PSKreporter.info



SSTV Common Modes

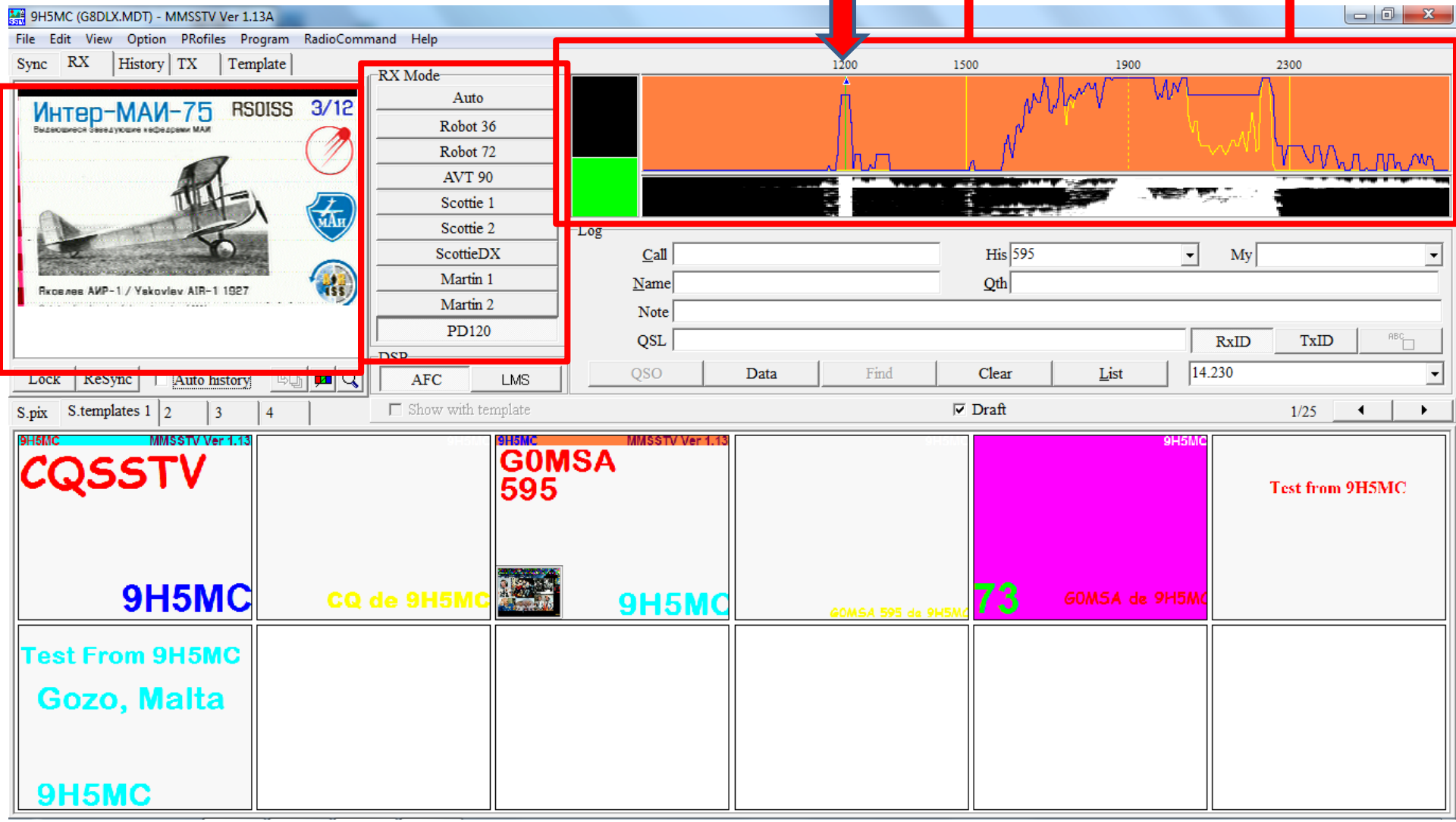
- Scotty 1
- Martin 1
- Both Colour 240 lines approx 110 secs per frame

- ISS PD120
- 480 lines takes 126 secs per frame then 2 min gap

- Robot 8 B&W 120 lines takes 8 secs per frame

- Sync 1200Hz
- Data 1500 to 2100Hz

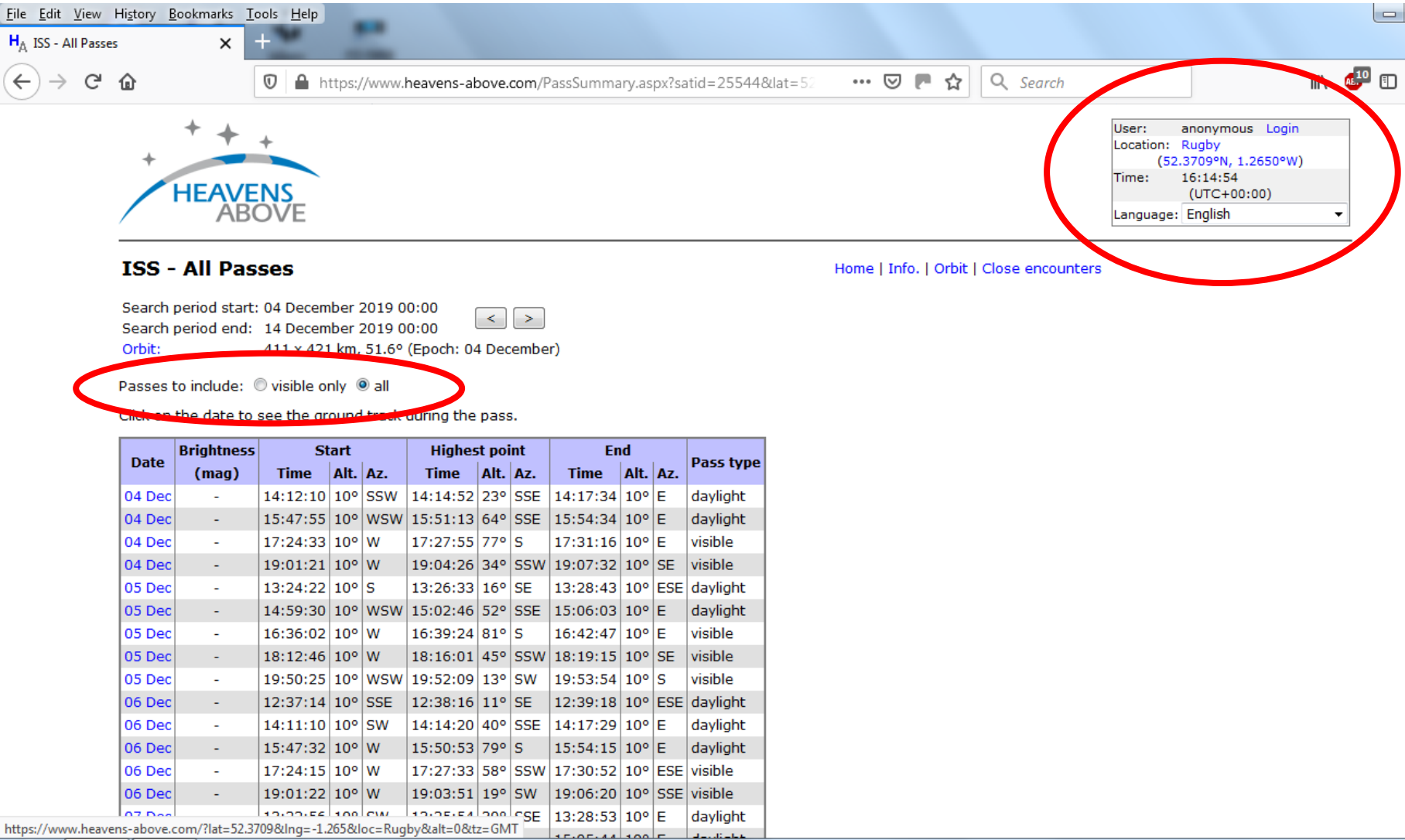
MMSSTV Screen



From 14.230 MHz

From 14.230 MHz

Web Site to find ISS Pass times



Date	Brightness (mag)	Start Time	Start Alt.	Start Az.	Highest point Time	Highest point Alt.	Highest point Az.	End Time	End Alt.	End Az.	Pass type
04 Dec	-	14:12:10	10°	SSW	14:14:52	23°	SSE	14:17:34	10°	E	daylight
04 Dec	-	15:47:55	10°	WSW	15:51:13	64°	SSE	15:54:34	10°	E	daylight
04 Dec	-	17:24:33	10°	W	17:27:55	77°	S	17:31:16	10°	E	visible
04 Dec	-	19:01:21	10°	W	19:04:26	34°	SSW	19:07:32	10°	SE	visible
05 Dec	-	13:24:22	10°	S	13:26:33	16°	SE	13:28:43	10°	ESE	daylight
05 Dec	-	14:59:30	10°	WSW	15:02:46	52°	SSE	15:06:03	10°	E	daylight
05 Dec	-	16:36:02	10°	W	16:39:24	81°	S	16:42:47	10°	E	visible
05 Dec	-	18:12:46	10°	W	18:16:01	45°	SSW	18:19:15	10°	SE	visible
05 Dec	-	19:50:25	10°	WSW	19:52:09	13°	SW	19:53:54	10°	S	visible
06 Dec	-	12:37:14	10°	SSE	12:38:16	11°	SE	12:39:18	10°	ESE	daylight
06 Dec	-	14:11:10	10°	SW	14:14:20	40°	SSE	14:17:29	10°	E	daylight
06 Dec	-	15:47:32	10°	W	15:50:53	79°	S	15:54:15	10°	E	daylight
06 Dec	-	17:24:15	10°	W	17:27:33	58°	SSW	17:30:52	10°	ESE	visible
06 Dec	-	19:01:22	10°	W	19:03:51	19°	SW	19:06:20	10°	SSE	visible
							SSE	13:28:53	10°	E	daylight

ISS over Spain

ISS Over Southern England

ISS over North Italy at start

Now some
Practical Demo's
of PSK & SSTV

FT8 & PSK Reporter on 29 Feb

https://amsat-uk.org/beginners/iss-sstv/

- All you need to do to receive SSTV pictures direct from the space station is to connect the audio output of a scanner or amateur radio transceiver via a simple interface to the soundcard on a Windows PC or an Apple iOS device, and tune in to 145.800 MHz FM. You can even receive pictures by holding an iPhone next to the radio loudspeaker.
- On Windows PC's the free application MMSSTV can be used to decode the signal, on Apple iOS devices you can use the SSTV app for compatible modes. For Linux systems try QSSTV.
- The ISS puts out a strong signal on 145.800 MHz FM and a 2m handheld with a 1/4 wave antenna will be enough to receive it. The FM transmission uses 5 kHz deviation which is standard in much of the world. In IARU Region 1 (British Isles, Europe, Africa) FM equipment is usually set by default to the narrower 2.5 kHz deviation.