

A photograph of a radio station. In the foreground, there's a grassy hill with a chain-link fence. Behind the fence, several tall metal antennas are visible against a blue sky with scattered white clouds. To the right, there's a two-story building with a light-colored, weathered facade and several windows. The text "2BSIQ" is overlaid in white on the lower part of the image.

2BSIQ

Two Bands Synchronized Interleaved QSOs



CT1BOH – José Nunes

CT1BOH

Active in CQWW since 1989

54 CQWW's

More than 250.000 QSOs



Operations in CQ WW Contest

Year	Mode	0	1	2	3	4	5	6	7	8	9
1980's	SSB										
	CW										CR2A
1990's	SSB		KP2A	KP2A	KP2A	P40E	P40E	P40E	P40E	SU2MT	P40E
	CW	CT3T	HC5M	4M2BYT	PY0F	PY0FF	PY0FF	9Y4H	P40E	P40E	P40E
2000's	SSB	KH7R	K5ZD	PT0F	PT0F	CQ9K	CT3YA	CT3YA	CQ9K	CQ9K	CR3A
	CW	P40E	PT5T	P40E	P40E	EA8ZS	CT3EN	CT3NT	CT3NT	CT3NT	CR3E
2010's	SSB	CR3A	CR3A	CR3A	CR3A	CT1BOH	CR3A	CR3A			
	CW	CR3E	CR3E	CR3E	CR3E	CR3A	CR3OO	CR3OO			

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- Definition of 2BSIQ
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- “Secrets” of 2BSIQ
- Origins of 2BSIQ
- CT1BOH road to 2BSIQ
- Is 2BSIQ better than SO2R?
- Can the SOAB world record be broken with 2BSIQ?
- Is zone 33 still the best QTH for record breaking?



Definition of 2BSIQ

- Definition
- Two bands
- Synchronized
- Interleaved
- Operating protocol

Definition

2BSIQ (Two Bands Synchronized Interleaved QSOs) is a complex contest operating mode that in a protoled synchronized way enables interleaved two radio running on two bands to dramatically increase QSO rates

- SO2R set-up
- Alternate moment running
- No inter-station interference
- Only one signal on the air

- Management of QSO moments
- Time estimation of TX/RX pairs
- Management audio/QSO field focus

Two Bands

Synchronized

2BSIQ

Interleaved

Protocol

- Grouping RX/TX moments of QSOs
- Fitting almost 2 QSO in 1 QSO time frame

- Protocol to manage delays
- Protocol to manage synchronization disruption
- Protocol to re-synchronize

Two Bands

2BSIQ requires the capability to RUN with no interstation interference, in an alternate way, on two bands, interleaving transmitting signals one at a time



SO2R set-up

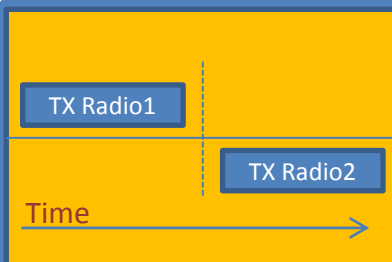
- Two radios; No inter-station interference
- No interference to be able to RUN on any two bands

	RADIO 1	RADIO 2
TX	■	■
RX	■	■

	RADIO 1	RADIO 2
TX	■	■
RX	■	■

Alternate running on two bands

- If radio1 on band 1 is TX, radio2 on band 2 must be RX
- If radio1 on band 1 is RX, radio 2 can be TX

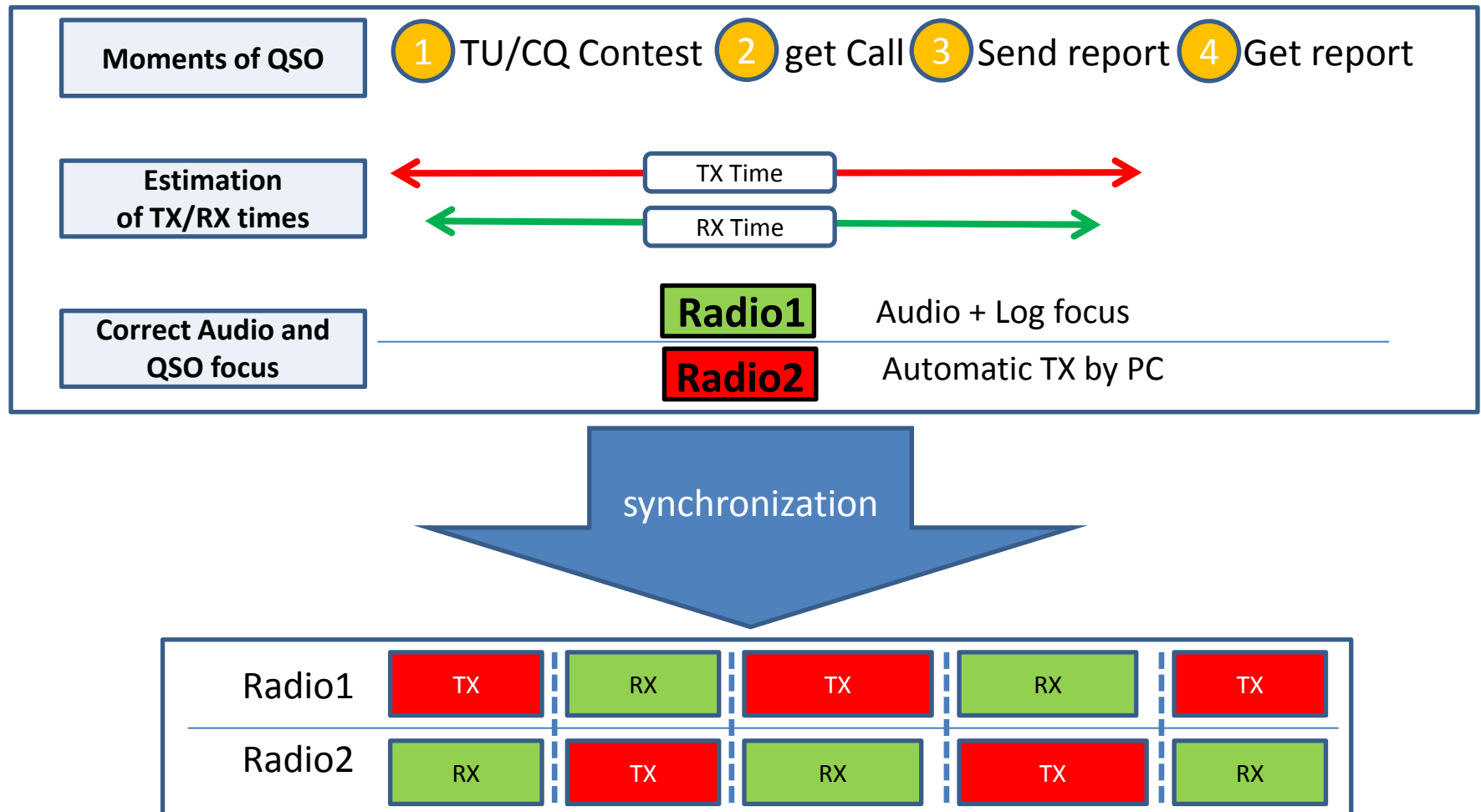


Only one signal on the air

- To comply with SOAB only one signal on the air
- To comply with SOAB each TX signal to different band

Synchronized

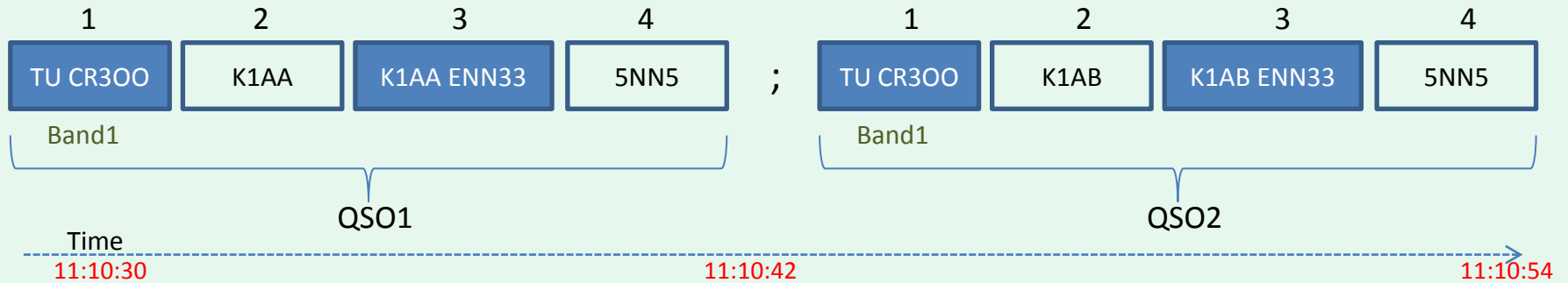
Synchronization on two bands is the key to a dramatic increase in QSO rates, obtained with management of key QSO moments, estimation of exact length of TX and RX pairs and correct focus of audio and QSO focus



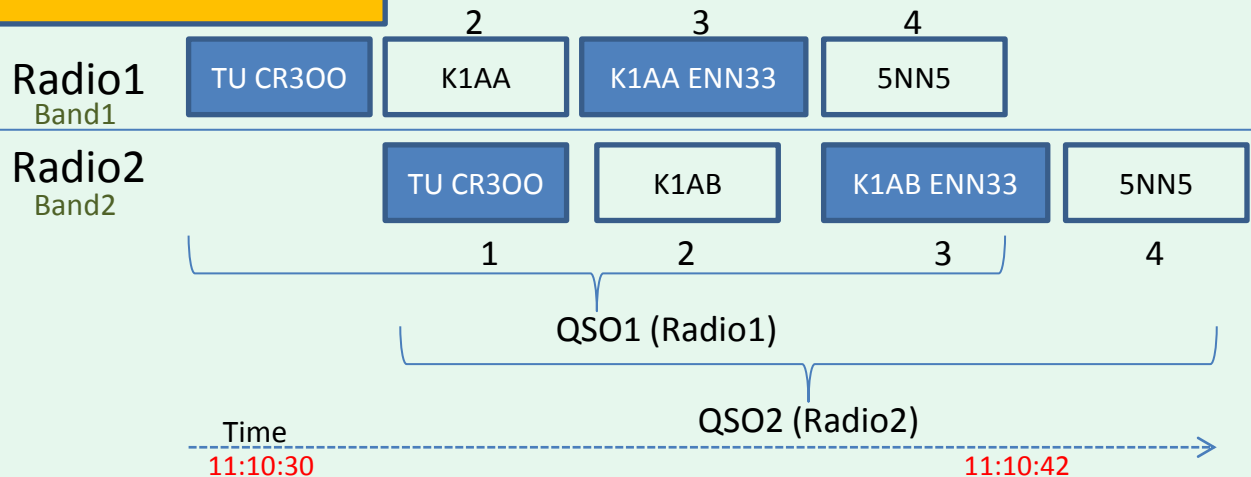
Interleaved QSOs

2BSIQ changes the paradigm from consecutive (one radio, one band) to interleaved (two radios, two bands). “Two QSOs” fit in the approximate time frame needed for one QSO

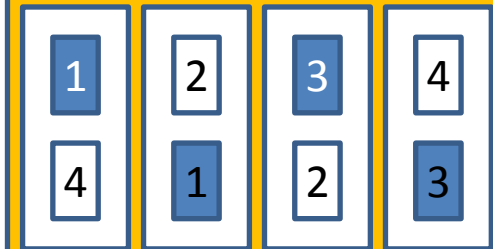
Consecutive QSOs



Interleaved QSOs

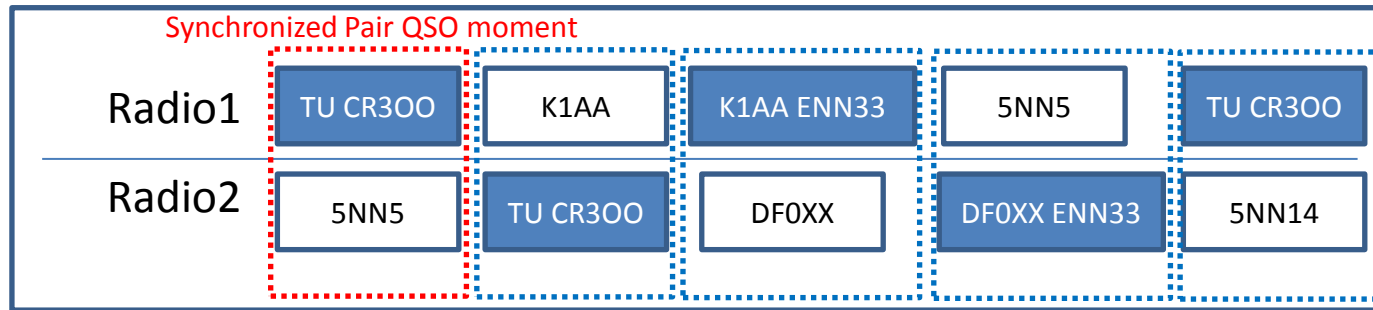


Interleave of Pair QSO moments

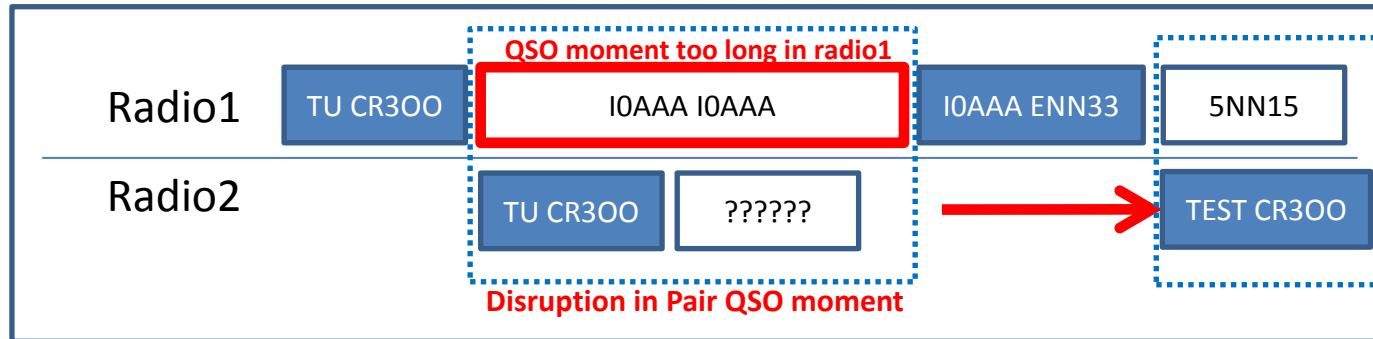


Operating Protocol

Perfect synchronization of “pair QSO moments” in two bands is not always possible, therefore an operating protocol must be followed to handle efficiently those situations



Perfect “pair QSO moment” synchronization



Disruption in “pair QSO moment” synchronization

Operating protocol
“What to do when”:

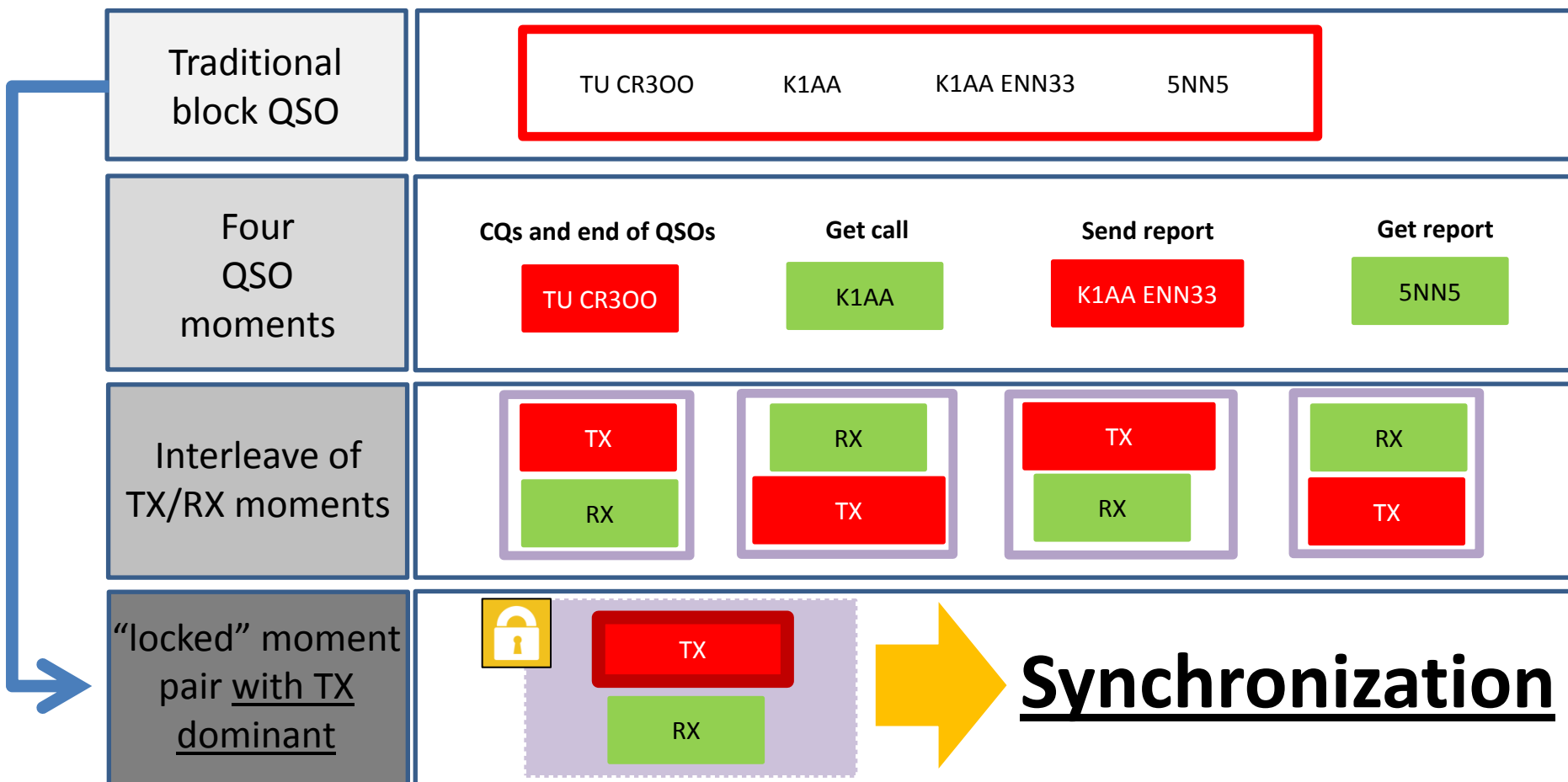
1. There are situations that push forward next pair QSO moment
2. There is disruption of synchronization
3. Re-synchronization of moments of QSO is needed

Dynamics of 2BSIQ

- **From QSO to locked moment pair**
- **TX the dominant element of the pair**
- **CW Length of TX element, calls and exchanges**
- **Delay and reaction times**
- **Four operator actions in a pair**

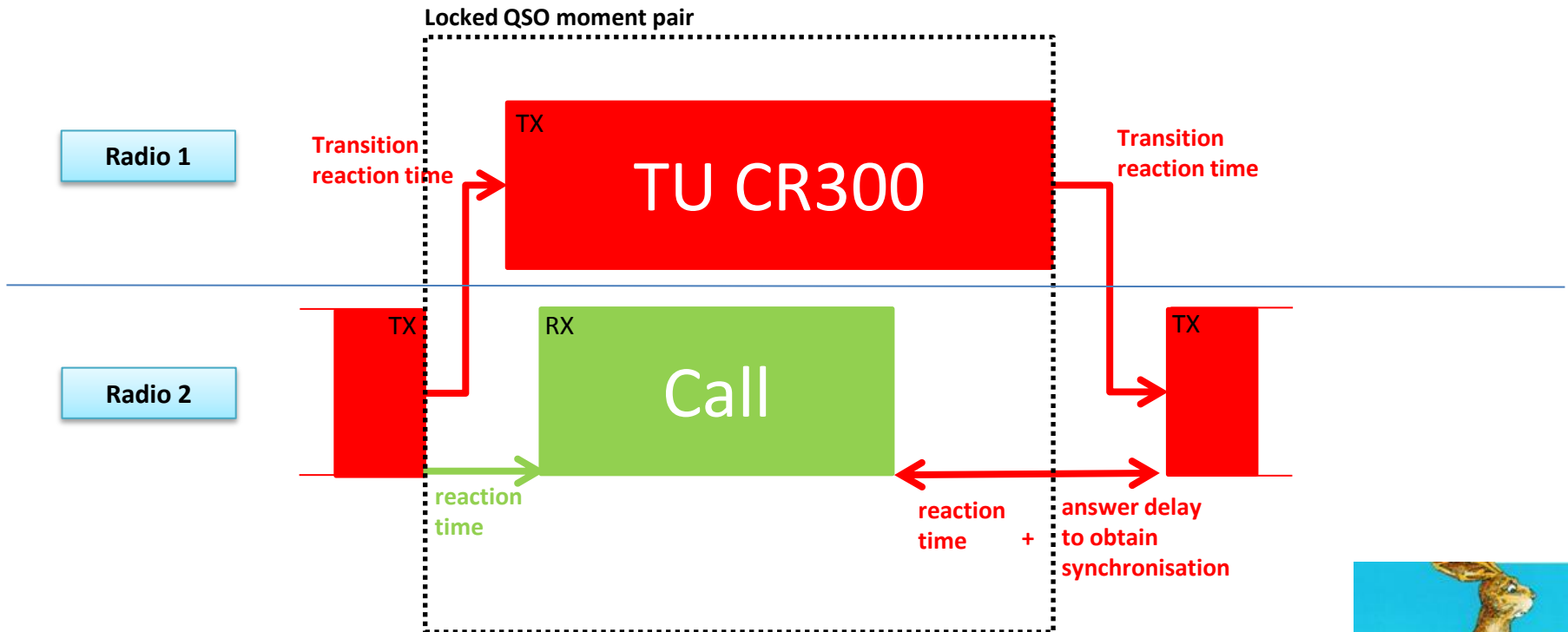
From QSO to Locked Moment Pair

To understand the dynamics of 2BSIQ, one has to go from the concept of a traditional block QSO to a “locked” QSO moment pair, otherwise synchronization will not occur



The TX element of a pair must be dominant

If the TX element is not the dominant one in the pair, perfect synchronization will not occur



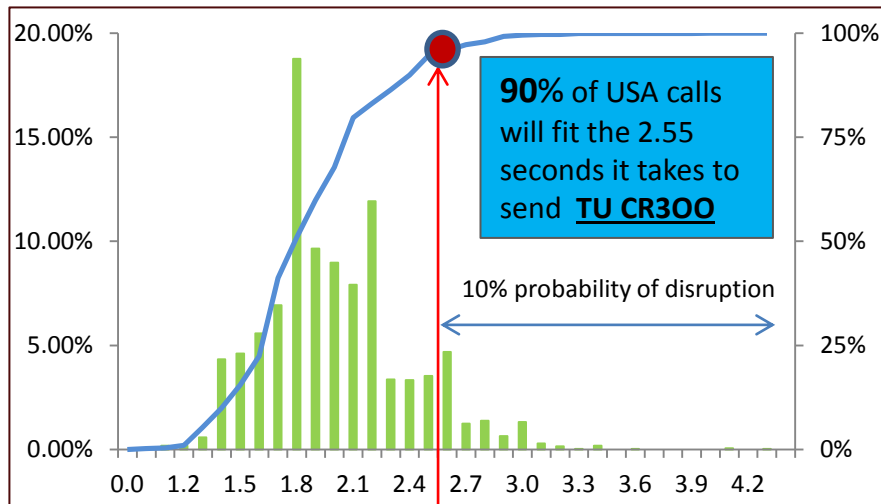
The rabbit, the fastest (shorter) element of the pair, rides on the turtle, the slowest (longer) element of the pair, hopefully in good timing – this is the essence of 2BSIQ



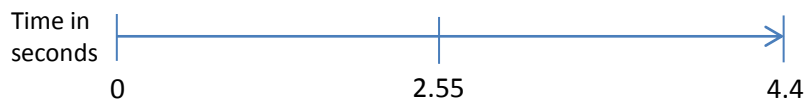
CW Length of TX/RX elements, calls and exchanges

The CW time length of the elements plays a very important part in the quest for perfect synchronization, and is dependent on many variables. Pile-up geographical area, because of the different structure of calls, also plays a very important part

CW length distribution of USA calls @ 30 WPM



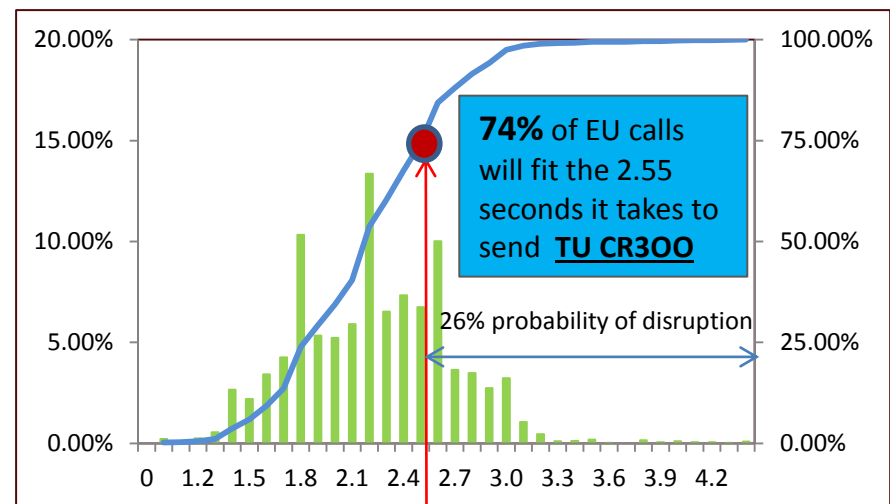
TU CR300



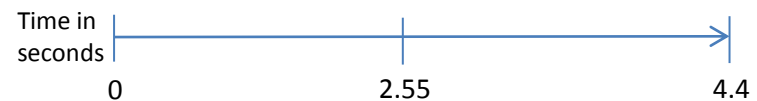
Average US call

2.044

CW length distribution of EU calls @ 30 WPM



TU CR300



Average Non US call

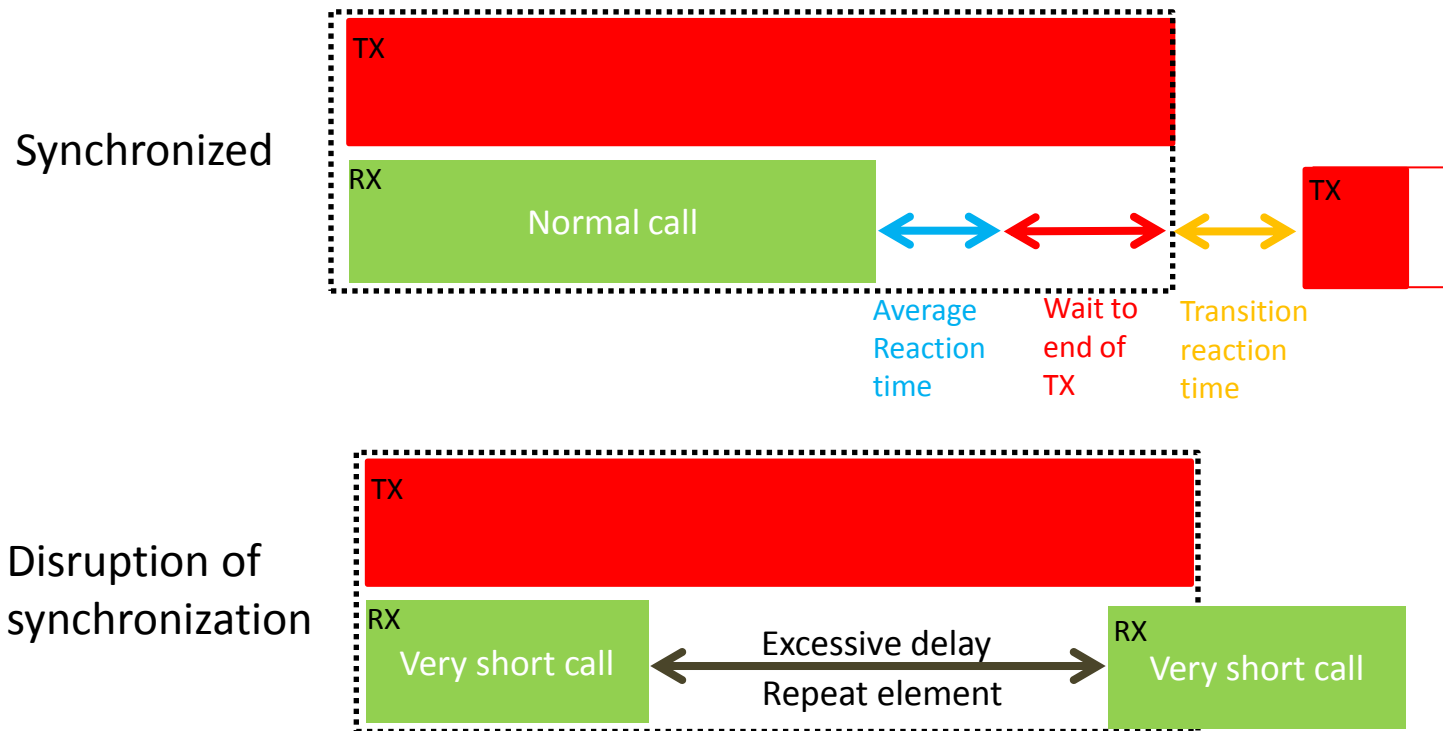
2.286

Note 1: Data from CR300 CQWW 2016 log: 3118 USA calls; 5444 Non USA calls assuming all transmission @ 30 WPM

Note 2: TU CR300 sent @ 40 WPM

Delays and reaction times

Delays and reaction times are critical to achieve perfect synchronization and a smooth operation, so that the stations calling/working do not notice answer delay



If there is an excessive delay, probably there will be a repeat, disrupting synchronization. When there is disruption of synchronization the protocol must be applied. The tools for this protocol are – skip, shift, delay and anticipating

Four operator actions in a pair

Doing 2BSIQ requires four actions from the operator in a pair



Key press

- 1 CR300 press F1 on keyboard for radio1 (TEST CR300)
Headphones are set to radio 2 both ears (R2R2)

Copy and type

- 2 Headphones are on radio2 (R2R2) while radio1 is TX
Copy a call (K1AA,IOZY,N7TT) and type it (in radio2 log field)

Wait

- 3 Headphones still on radio2 (R2R2) while radio1 is TX
N7TT typed in log field but waiting for end F1 on Radio1

Transition

- 4 Transition time, end of TX, moving to next pair
Headphones are set to both radios (R1R2) while no TX



Key press

- 1 CR300 press INSERT on keyboard for radio2 (N7TT ENN33)
Headphones are set to radio 1 both ears (R1R1)

Copy and type

- 2 Headphones are on radio1 (R1R1) while radio2 is TX
Copy a call (G3AB,N2AA,N8YY) and type it (in radio1 log field)

Wait

- 3 Headphones still radio1 (R1R1) while radio2 is TX
N8YY typed in log field but waiting for end INSERT on Radio2

Transition

- 4 Transition time, end of TX, moving to next pair
Headphones are set to both radios (R1R2) while no TX

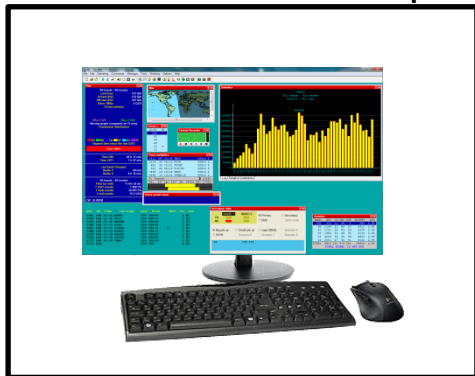
2BSIQ set-up

- **Possible 2BSIQ set-ups**
- **CR300 set-up during 2016 CQWW CW**
- **CR300 QTH**
- **CR300 Antennas**

Possible 2BSIQ set-ups

There are different possibilities regarding Computer, Audio-box, CW-messages, Keyboards and Logger

CR300 2015 set-up



Computer	One
Audio-box	Micro Ham u2r
CW messages	2BSIQ personalized scripts
Keyboards	One
Logger	Win-Test

CR300 2016 set-up



Computer	One
Audio-box	Home Made
CW messages	Standard CW messages
Keyboards	Two
Logger	Dxlog.net

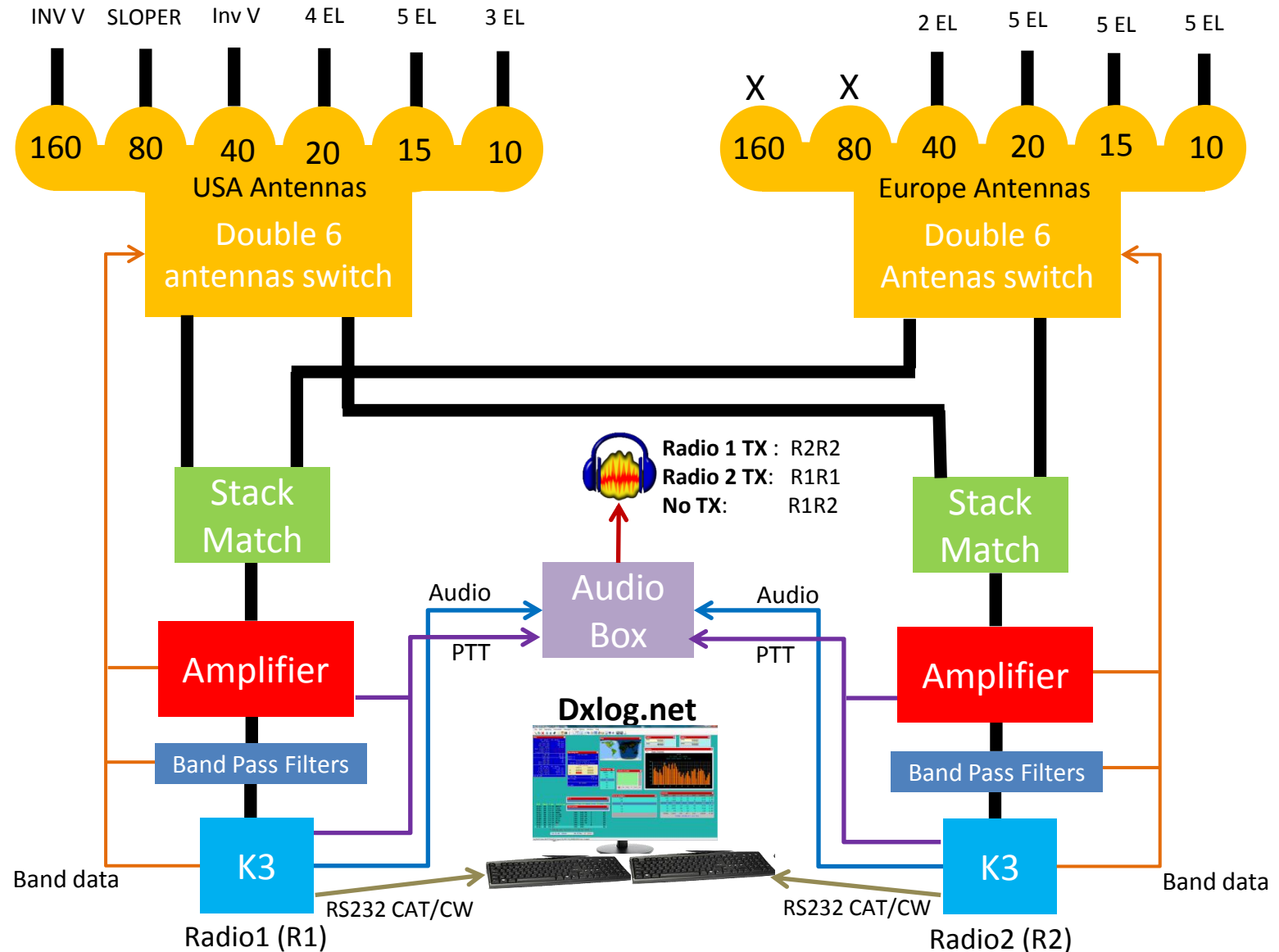
Two computers in a network may be considered as a third choice, but it should be discarded, because it requires an additional lock-out hardware to prevent two signals on the air

Although one or two keyboards may be a matter of personal preference, **two keyboards offers more flexibility**

CR300 2016 audio box is a simple audio splitter with PTT logic to control left R1 and right R2 headphones:

TX1 -- then R2R2
TX2 -- then R1R1
No TX -- then R1R2

CR300 set-up during 2016 CQWW CW



CR300 QTH

USA direction



Europe direction



CR300 antennas



“Secrets” of 2BSIQ

“Secrets” of 2BSIQ

2BSIQ secrets have to do with different aspects that enable synchronization and maintain synchronization throughout the 48 hours of the contest. Having these 10 points in mind will enable all interested to pursue their journey into 2BSIQ

1. Understanding all four components of QSO moment
2. Understanding “QSO pair moment” in order to obtain synchronization
3. Managing “delay” situations
4. Transition from QSO pair to QSO pair
5. Phones focus, keyboards focus and QSO log field focus management
6. Optimum TX time and distribution
7. Time length distribution of calling calls and exchanges
8. Fine tuning with CW speed
9. The four basic aspects of the protocol (**“Skip”, “Shift”, “Delay” and “Anticipating”**)
10. Training with a 2BSIQ simulator (Dxlog.net has a built in 2BSIQ simulator)

Origins of 2BSIQ

- SO2R, Inband, T07A Interleave
- Why isn't T07A making more QSOs?

SO2R, Inband, Interleave

2BSIQ has its origins in SO2R mode, in Inband technique of Multi Single operations and in “interleave QSO” operation by UT5UGR from TO7A

SO2R

- Alternate CQs on two bands
- Working a multiplier on another band in-between Run QSO

Inband

- RW1AC and RU1AA developed modern inband technique operations from RU1A
- P33W team excels in Inband operation from Cyprus skyrocketing QSOs from 7000 to 11000

TO7A Interleave

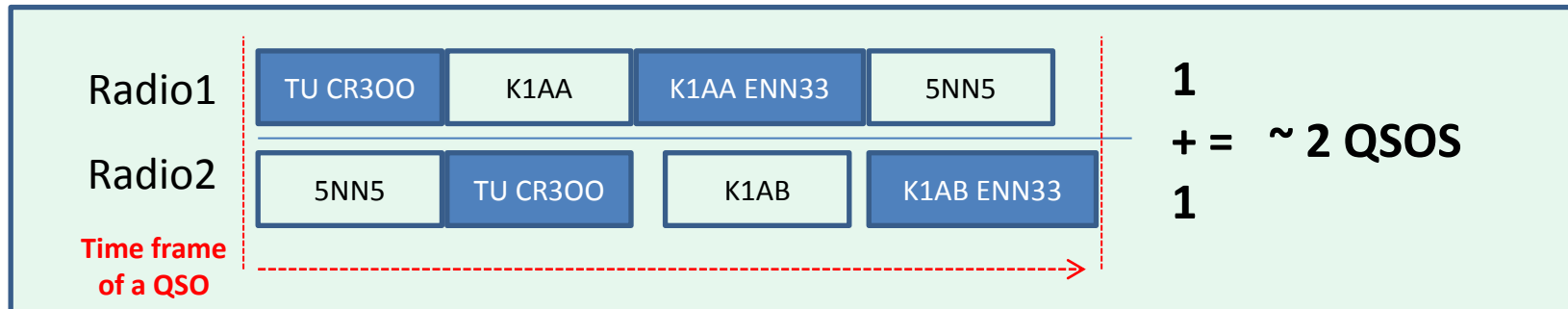
- UT5UGR from TO7A interleave QSOs for 48 hours during CQWW CW 2013 and 2014

Why isn't TO7A making more QSOs?

2BSIQ is much more than just “interleave of QSOs” and the “trigger” that led CT1BOH from “interleave of QSOs” into 2BSIQ originated from a simple question

Question?

If theoretically in the time frame of a “normal QSO”, two can be interleaved...
... why isn't UT5UGR/TO7A making a lot more QSOs than N2NT/V47T ?



	TO7A (UT5UGR)	V47T (N2NT)	Delta QSOs
CQWW CW2014	7892	7772	+1.5%
CQWW CW2013	7916	7181	+10.2%

Note: In 2013/4 N2NT/V47T operated from similar location of TO7A, and in a classic SO2R set-up

CT1BOH “road” to 2BSIQ

- Alternating run from KH7R in 2000
- Dual CQ with advanced SO2R
- Understanding Multi-Single Inband operation
- Inband technique
- Increasing QSO totals with Inband
- CR300, P33W, 4O3A teams
- TO7A/UT5UGR interleave QSO mode
- TO7A/UT5UGR YouTube videos
- 357.8 QSOs/hour rate is not good enough?!
- TO7A 20% QSO increase far from 40%
- TO7A graphical waterfall reveals the problem
- Perfect interleave synchronization graphic waterfall
- 2BSIQ “is born”
- Training 2BSIQ with Simulator for CQWW CW 2015

Alternating RUN from KH7R in 2000

In 2000 CT1BOH as KH7R used alternate RUN with great success and good rates (up to 5 QSOs per minute). **This of course was not 2BSIQ nor interleaved QSOs**, just alternating from one band to the other, with two keyboards, two microphones and two footswitches

1774	40m	PH	28-Oct-2000 06:29	6	XE2MX	NA	XE	Mexico
1775	80m	PH	28-Oct-2000 06:30	4	W7VJ	NA	K	United States
1776	40m	PH	28-Oct-2000 06:30	4	K7BTW	NA	K	United States
1777	80m	PH	28-Oct-2000 06:30	4	K8PO	NA	K	United States
1778	40m	PH	28-Oct-2000 06:30	6	W6EEN	NA	K	United States
1779	80m	PH	28-Oct-2000 06:30	6	XE2MX	NA	XE	Mexico
1780	40m	PH	28-Oct-2000 06:31	2	K7DHD	NA	K	United States
1781	80m	PH	28-Oct-2000 06:31	4	W6KNB	NA	K	United States
1782	80m	PH	28-Oct-2000 06:31	1	NY7T	NA	K	United States
1783	80m	PH	28-Oct-2000 06:31	4	K6AA	NA	K	United States
1784	40m	PH	28-Oct-2000 06:31	3	W6GWE	NA	K	United States
1785	40m	PH	28-Oct-2000 06:32	4	N7DV	NA	K	United States
1786	80m	PH	28-Oct-2000 06:32	5	K7HBN	NA	K	United States
1787	40m	PH	28-Oct-2000 06:32	1	NA5S	NA	K	United States
1788	40m	PH	28-Oct-2000 06:32	4	K9BGL	NA	K	United States
1789	40m	PH	28-Oct-2000 06:32	2	XE2EED	NA	XE	Mexico
1790	40m	PH	28-Oct-2000 06:33	2	KB7XL	NA	K	United States
1791	80m	PH	28-Oct-2000 06:33	6	VE6SV	NA	VE	Canada
1792	80m	PH	28-Oct-2000 06:33	6	K5MR	NA	K	United States
1793	80m	PH	28-Oct-2000 06:33	5	KL7Y	NA	KL	Alaska
1794	40m	PH	28-Oct-2000 06:33	4	VE5RI	NA	VE	Canada
1795	80m	PH	28-Oct-2000 06:34	5	K5NA	NA	K	United States
1796	40m	PH	28-Oct-2000 06:34	5	W6HYK	NA	K	United States
1797	40m	PH	28-Oct-2000 06:34	5	W6HYK	NA	K	United States
1798	40m	PH	28-Oct-2000 06:34	1	K8WKM	NA	K	United States
1799	40m	PH	28-Oct-2000 06:35	5	W6HYK	NA	K	United States
1800	40m	PH	28-Oct-2000 06:35	5	KI6CG	NA	K	United States
1801	80m	PH	28-Oct-2000 06:35	1	ZL4NR	OC	ZL	New Zealand
1802	40m	PH	28-Oct-2000 06:35	4	W6AX	NA	K	United States
1803	80m	PH	28-Oct-2000 06:36	6	WA5VGI	NA	K	United States
1804	40m	PH	28-Oct-2000 06:36	2	W7FCB	NA	K	United States
1805	40m	PH	28-Oct-2000 06:36	3	K6AUC	NA	K	United States
1806	80m	PH	28-Oct-2000 06:37	1	KQ6JI	NA	K	United States
1807	40m	PH	28-Oct-2000 06:37	4	K7JJ	NA	K	United States
1808	80m	PH	28-Oct-2000 06:37	1	WB6YAW	NA	K	United States
1809	40m	PH	28-Oct-2000 06:38	2	VE5UA/6	NA	VE	Canada

- KH7R was a big multi-multi station
- The strategy was to try to increase rate in low bands when rate was slow
- There was never an attempt to interleave QSOs
- 2BSIQ concept was very far away

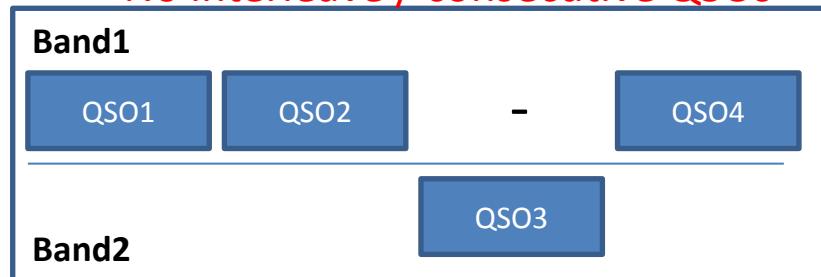
Dual-CQ with advanced SO2R

In 2005 when CT1BOH and F5MZN developed Win-Test Advanced SO2R scenario modes, the “Alternate CQ” mode was standard from the beginning and has been used from CR3E throughout the years

10m	CW	23-Nov-2013 10:07	1	RA6CU	EU	UA	European Russia
15m	CW	23-Nov-2013 10:07	8	ES9C	EU	ES	Estonia
10m	CW	23-Nov-2013 10:07	2	IK1RQQ	EU	I	Italy
15m	CW	23-Nov-2013 10:08	1	DL8ULO	EU	DL	Fed. Rep. of Germany
10m	CW	23-Nov-2013 10:08	3	S53RA	EU	S5	Slovenia
15m	CW	23-Nov-2013 10:08	2	DL5QS	EU	DL	Fed. Rep. of Germany
15m	CW	23-Nov-2013 10:09	2	DL7ARJ	EU	DL	Fed. Rep. of Germany
10m	CW	23-Nov-2013 10:09	1	DL1ARD	EU	DL	Fed. Rep. of Germany
10m	CW	23-Nov-2013 10:09	1	SV1EML	EU	SV	Greece
10m	CW	23-Nov-2013 10:10	2	RX3Z	EU	UA	European Russia
15m	CW	23-Nov-2013 10:10	4	PA0O	EU	PA	Netherlands
15m	CW	23-Nov-2013 10:10	2	DL1YCF	EU	DL	Fed. Rep. of Germany
15m	CW	23-Nov-2013 10:11	2	OK1DVA	EU	OK	Czech Republic
15m	CW	23-Nov-2013 10:11	1	SP4JFR	EU	SP	Poland
10m	CW	23-Nov-2013 10:11	1	RV4LC	EU	UA	European Russia
10m	CW	23-Nov-2013 10:12	1	OE2UKL	EU	OE	Austria
10m	CW	23-Nov-2013 10:12	2	OZ1AAR	EU	OZ	Denmark
10m	CW	23-Nov-2013 10:12	2	DK6OR	EU	DL	Fed. Rep. of Germany
15m	CW	23-Nov-2013 10:12	3	DM1TT	EU	DL	Fed. Rep. of Germany
10m	CW	23-Nov-2013 10:13	1	IK1QFP	EU	I	Italy
10m	CW	23-Nov-2013 10:13	3	UA9AX	AS	UA9	Asiatic Russia
10m	CW	23-Nov-2013 10:13	1	IV3ARJ	EU	I	Italy
10m	CW	23-Nov-2013 10:14	1	G0TPH	EU	G	England
10m	CW	23-Nov-2013 10:14	2	IK2RLS	EU	I	Italy
15m	CW	23-Nov-2013 10:14	3	YU7KW	EU	YU	Serbia
15m	CW	23-Nov-2013 10:14	2	OG5G	EU	OH	Finland
10m	CW	23-Nov-2013 10:15	4	DM5Z	EU	DL	Fed. Rep. of Germany
15m	CW	23-Nov-2013 10:15	5	RT5G	EU	UA	European Russia
15m	CW	23-Nov-2013 10:15	1	G3TVW	EU	G	England
10m	CW	23-Nov-2013 10:16	1	DL1GZW	EU	DL	Fed. Rep. of Germany
15m	CW	23-Nov-2013 10:16	1	LB1GB	EU	LA	Norway
15m	CW	23-Nov-2013 10:16	1	P33P	AS	5B	Cyprus
15m	CW	23-Nov-2013 10:16	1	DK6XZ	EU	DL	Fed. Rep. of Germany
10m	CW	23-Nov-2013 10:17	4	S55OO	EU	S5	Slovenia
15m	CW	23-Nov-2013 10:17	1	RA3EA	EU	UA	European Russia
15m	CW	23-Nov-2013 10:17	2	DK9CG	EU	DL	Fed. Rep. of Germany
10m	CW	23-Nov-2013 10:17	4	SP2LNW	EU	SP	Poland
10m	CW	23-Nov-2013 10:18	2	DQ7A	EU	DL	Fed. Rep. of Germany
15m	CW	23-Nov-2013 10:18	1	DL1EFW	EU	DL	Fed. Rep. of Germany
10m	CW	23-Nov-2013 10:18	1	RN3FA	EU	UA	European Russia
10m	CW	23-Nov-2013 10:19	6	OM7ZM	EU	OM	Slovak Republic

But “Alternate CQ” mode, does not increase the possible number of QSOs in a time frame of a QSO, it just replaces an empty space (no QSO on a band) with a QSO on another band

No interleave / consecutive QSOs



Understanding Multi-Single Inband operation

“Interleave QSOs” originated in inband Multi Single operations. In order to fully understand and experience the concept I co-organized the successful 2014 CQWW CW CR3A Multi Single operation with OM8A team

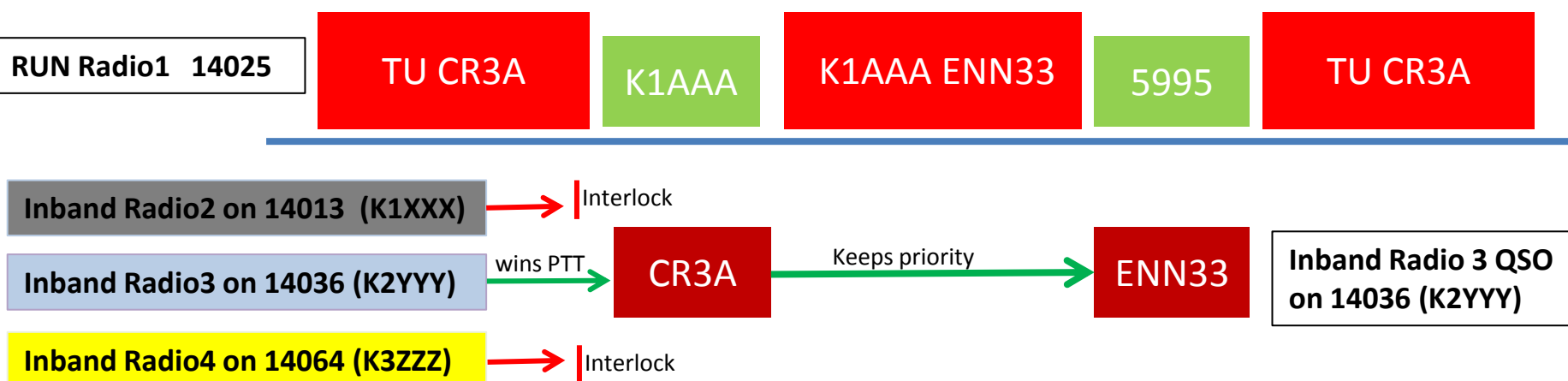
You can check details of the operation following the link

https://twitter.com/2014_cw_cr3a



Inband technique

Inband Multi Single operation, have sky-rocket QSOs and scores. The “RUN” station is now comprised of a “classic” RUN, and several Inband Stations that call stations on the same band but on a different frequency of “Run”, interleaving the QSOs when the RUN is not transmitting



- RUN Radio1 is running on 14025 (working K1AAA) – Traditional MS run station
- Three Inband stations “fight” to win PTT by calling respective stations on 14013 (K1XXX), on 14036 (K2YYY) and on 14064 (K3ZZZ), while CR3A RUN is QRX listening to K1AAA on 14025
- First Inband Station to TX wins PTT; The other two Inband Stations are “locked-out” by interlock
- Inband Radio3 who won PTT, *squeezes* the QSO with K2YYY and goes looking for other new stations to work while Inband Radio2 and 4 continue trying to work their stations on 14013 and 14064

Increasing QSO total with Inband

Advanced inband in Multi Single have left “Classic Multi Single” way behind. Managing correct timing, synchronization and delays in inband operation was fundamental to understand “interleave QSOs” and move closer to 2BSIQ definition

P33W	10	15	20	40	80	160	Total
Run	1939	1468	1424	1416	845	291	7383
Inband	807	794	535	667	427	71	3301
Mult	110	129	113	41	114	73	580
QSOs	2856	2391	2072	2124	1386	435	11264

P33W added 3301 QSO to his “RUN station” from S&P inband (+45%)

CR3A	10	15	20	40	80	160	Total
Run	2024	1605	2070	1405	501	46	7646
Inband	651	548	603	554	193	-	2549
Mult	98	153	46	127	121	82	627
QSOs	2773	2306	2719	2086	815	128	10822

CR3A added 2549 QSO to his “RUN station” from S&P inband (+33%)

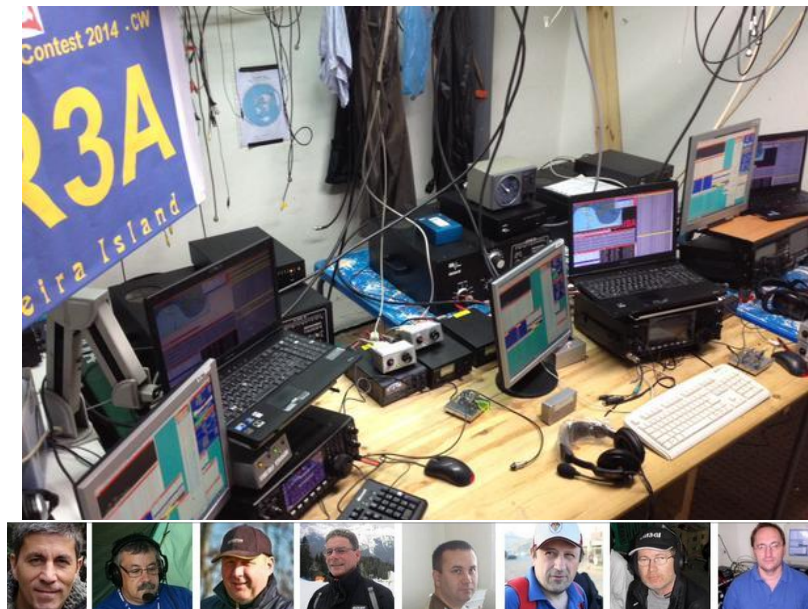
4O3A	10	15	20	40	80	160	Total
Run	1441	1292	1258	1827	853	211	6882
Inband	464	440	450	567	264	-	2185
Mult	138	90	119	31	126	95	599
QSOs	2043	1822	1827	2425	1243	306	9666

4O3A added 2185 QSO to his “RUN station” from S&P inband (+32%)

P33W greater experience with Inband operation was the key to their #1 in CQ WW CW 2014

CR3A, P33W, 4O3A teams during 2014 CQWW CW

CR3A RUN and Inband Stations



P33W Multi Single team at work



4O3A Multi Single Team at work



TO7A/UT5UGR interleave QSO mode

UT5UGR started interleaving QSOs from TO7A in 2011. Looking at CQWW public logs I could check that 2011 and 2012 were years he was testing this way of operation, just during some hours of the contest. Only in 2013 and then in 2014, he was “interleaving QSOs” for the 48 hours of the contest

	TO7A(UT5UGR)	V47T(N2NT)	8P5A(W2SC)
2014	7892	7772	7214
2013	7916	7181	7294
2012	7165	-	7230
2011	6757	-	7285
2010	-	7293	7097

Interleaving QSOs made TO7A operation jump from 7000 QSOs to 7900 QSOs, approximately 12% more QSOs, but, very far from 40% more, Inband MS stations get with S&P Inband

1. Comparing the 2014 operations we only see a small difference in favor of “interleave QSOs mode” of TO7A versus “classic SO2R mode” of V47T (+1.5%)
2. If theoretically, in the time frame of a “normal QSO”, one can interleave two QSOs
3. What is wrong with UT5UGR/TO7A “interleave QSO mode” ?

TO7A/UT5UGR YouTube videos

UT5UGR posted on YouTube, a video of his set-up for 2013 contest, and videos with audio of four hours of 2014. The 2014 Videos were instrumental to analyze in depth TO7A “interleave QSO” operation



The main video player shows a man wearing headphones and a light-colored shirt, sitting at a desk with various electronic equipment, including a computer monitor and a radio setup. The video title is "20131124 165348 03". The YouTube logo and "PT" are visible in the top left corner. The video progress bar shows 4:43 / 7:47.

On the right side, there are four smaller video thumbnails, each with a title, upload date, uploader, and view count:

- 29 Nov 14 19 03z by UT5UGR 873 views (39:26)
- 29 Nov 14 00 04z by UT5UGR 1,145 views (1:00:01)
- 29 Nov 14 02 06z by UT5UGR 227 views (58:13)
- 29 Nov 14 11 06z by UT5UGR 253 views (32:33)

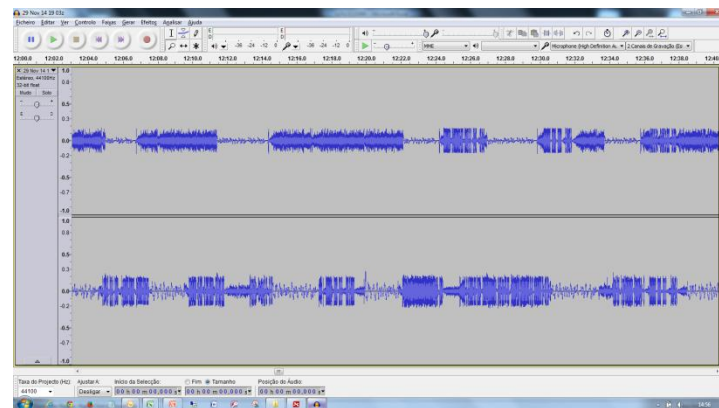
Links:

<https://www.youtube.com/watch?v=2rDkZokun-8> (2013)
<https://www.youtube.com/watch?v=xD1qr51cV-s> (2014)
<https://www.youtube.com/watch?v=EOKcbgk-OZ8> (2014)
<https://www.youtube.com/watch?v=QmQIz2eVFYQ> (2014)
<https://www.youtube.com/watch?v=zvdsbep9koE> (2014)

357.8 QSO/hour is not good enough?!

With TO7A Videos, the corresponding audio and log in hand, I selected the best rate and the best period of consecutive interleave QSOs.

QSO #	date	H	M	band	mode	freq	call	zone	dx	dx zone
3896	29-11-2014	19	15	10	CW	28.094	TO7A	8	PY4RGS	11
3897	29-11-2014	19	15	15	CW	21.076	TO7A	8	EI5JC	14
3898	29-11-2014	19	15	10	CW	28.094	TO7A	8	KS4X	4
3899	29-11-2014	19	15	15	CW	21.076	TO7A	8	K2LS	5
3900	29-11-2014	19	15	10	CW	28.094	TO7A	8	K1ZE	5
3901	29-11-2014	19	16	15	CW	21.076	TO7A	8	S54A	15
3902	29-11-2014	19	16	15	CW	21.076	TO7A	8	K1LD	5
3903	29-11-2014	19	16	10	CW	28.094	TO7A	8	N3RJ	5
3904	29-11-2014	19	16	15	CW	21.076	TO7A	8	W9LHG	4
3905	29-11-2014	19	16	10	CW	28.094	TO7A	8	NU7P	3
3906	29-11-2014	19	16	15	CW	21.076	TO7A	8	N0AT	4
3907	29-11-2014	19	17	10	CW	28.094	TO7A	8	K2TQC	5
3908	29-11-2014	19	17	15	CW	21.076	TO7A	8	KG7H	3
3909	29-11-2014	19	17	10	CW	28.094	TO7A	8	W1GQ	5
3910	29-11-2014	19	17	15	CW	21.076	TO7A	8	N6XI	3
3911	29-11-2014	19	17	10	CW	28.094	TO7A	8	K2TW	5
3912	29-11-2014	19	17	15	CW	21.076	TO7A	8	W8HAP	5
3913	29-11-2014	19	18	10	CW	28.094	TO7A	8	W2NO	5
3914	29-11-2014	19	18	15	CW	21.076	TO7A	8	N2MM	5
3915	29-11-2014	19	18	10	CW	28.094	TO7A	8	W7VV	3
3916	29-11-2014	19	18	15	CW	21.076	TO7A	8	KF2O	5
3917	29-11-2014	19	18	10	CW	28.094	TO7A	8	W7FI	3
3918	29-11-2014	19	18	15	CW	21.076	TO7A	8	W1CU	5
3919	29-11-2014	19	19	10	CW	28.094	TO7A	8	K6KQV	3



With the help of Audacity wave-audio program above I dissected the log section left (down to the millisecond):

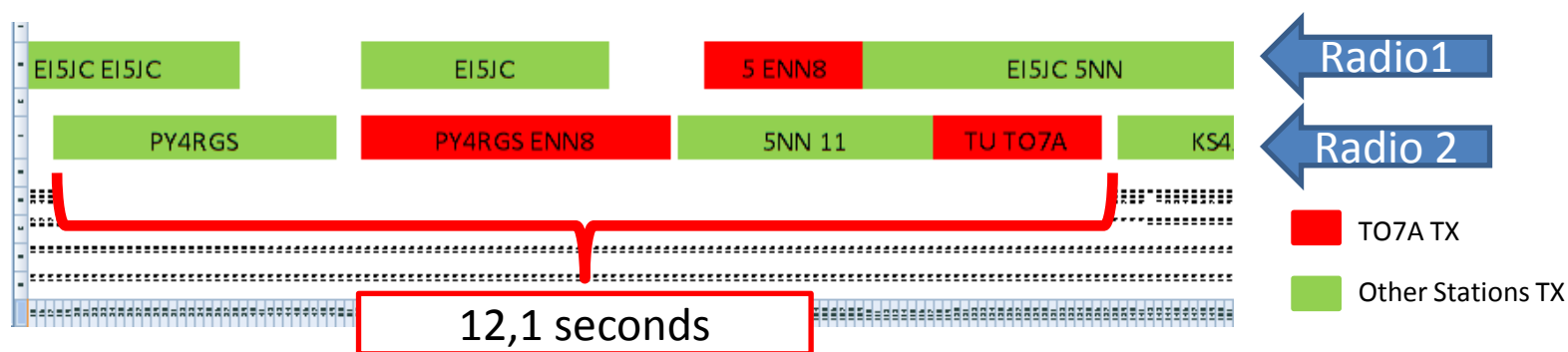
Audio length:	241.5 seconds
QSOs 10M: 12	178.9 Q/Hour
QSOs 15M:12	189.0 Q/Hour
Total QSO: 24	357.8 Q/Hour

357.8 QSOs/rate seems fantastic, **but**, listening to the audio there was something not right ...
I remember thinking - ***I must be crazy to dispute a 357.8 /rate is not good enough.*** In order to solve this paradox I had to investigate deeper

TO7A 20% QSO increase far way from 40%

Why doesn't "Interleave QSO" mode by UT5UGR sound right even though there is an apparent high rate result? Why can't the very high rate be sustained throughout the contest?

- With graphic horizontal waterfall below I determined the length of a "normal" QSO



PY4RGS QSO seems like a good candidate. No delays, 12,1 seconds to complete the 4 moments of the QSO

- If one QSO takes 12.1 seconds to complete, then with just one radio, in 241.5 seconds (the section under scrutiny) we should expect 20 QSOs.
- Using two radios, with "interleave mode", TO7A log shows 24 QSOs. An increase of 20%
- Better than the overall 1.5% increase he managed against V47T in the entire 2014 contest, but still very far away from 40% of MS stations

TO7A graphical waterfall reveals the problem

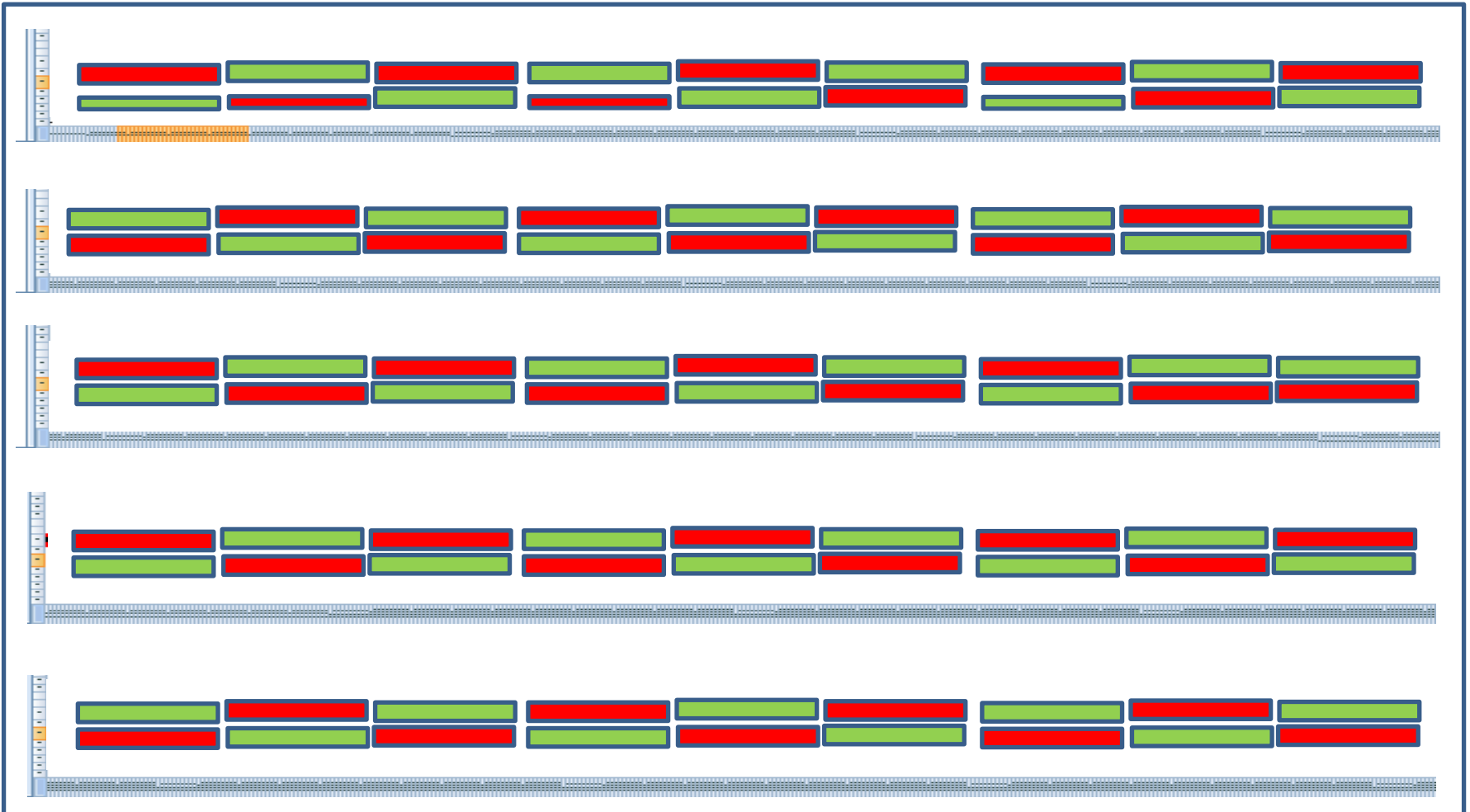
Plotting the 4 minute "graphic waterfall" below, from TO7A best consecutive interleave period reveals the problem - **TO7A is not able to maintain synchronization**

TO7A graphical waterfall log (from PY4RGS to N2MM – 19 QSOs)



Perfect interleave synchronization graphic waterfall

The same 4 minute "graphic waterfall" below, with perfect interleave synchronization would be like this



2BSIQ concept is born

Conceptually 2BSIQ is born in this very moment, when CT1BOH realizes synchronization is the key, and then proceeds to establish key success factors for this operating mode

UT5UGR “Interleave QSO” mode

1. Interleave of QSOs
2. Constant disruption of “QSO pair moments” synchronization
3. Lack of information of end of transmitting of other radio in each moment
4. Unawareness of optimum length for each QSO moment
5. Improper protocol to re-synchronize QSOs , control delays and “spill-over's”



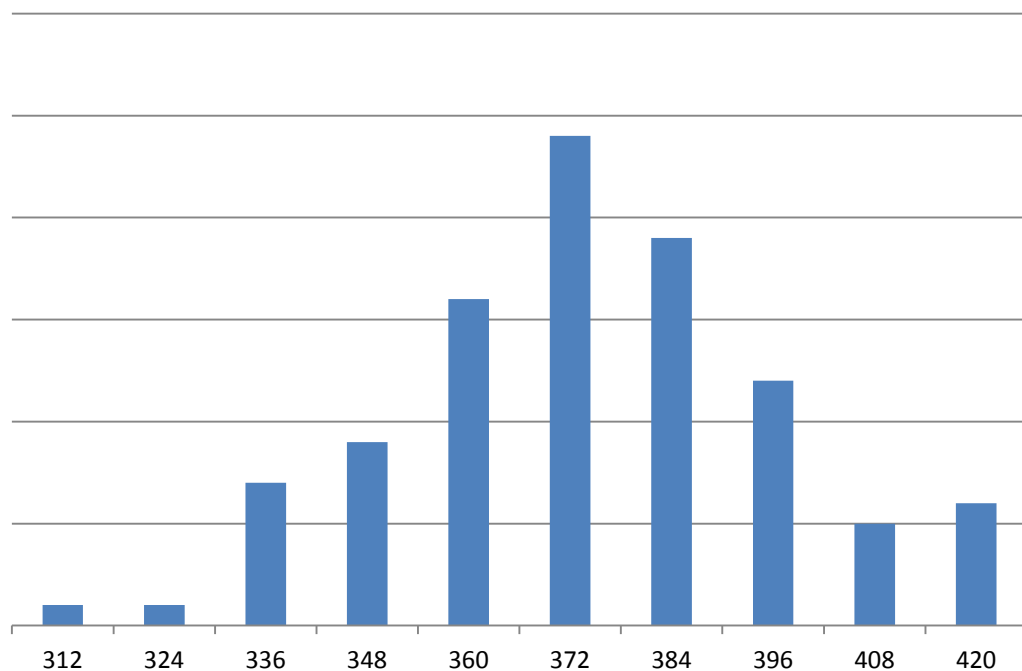
CT1BOH 2BSIQ

1. Synchronized interleave of QSOs
2. “Locking” “QSO pair moments” to obtain synchronization
3. Information of end of transmitting of other radio in each moment
4. Exact and optimum calculation of each QSO moment
5. Protocol rules to re-synchronize QSOs, control delays and “spill-over's”

Training 2BSIQ with CW simulator for CQWW CW 2015

Because CT1BOH home QTH is in a city building, chances to test 2BSIQ on air were very limited. As a result two Morse Runner were used instead of live contests for validation and training. The simulator was fundamental to calibrate synchronization and the protocol

QSO/hour rate distribution of 240 2BSIQ simulator sessions



Worst case
synchronization



Perfect
synchronization

Prior to CQWW CW 2015 Tests with two Morse Runner in two PCs validated 2BSIQ concept to obtain very high rates:

- 20 hours spent with simulator
- 240 session of 5 minutes each
- 7500 2BSIQ QSOs
- Average rate of 375 QSOs/Hour

Note: Since 2016, Dxlog.net has a built in 2BSIQ simulator

With a constant flow of calls, rates distribution ranged from 312 QSO/hour (minimum) to 420 QSOs/Hour (maximum)

CT1BOH jumped from simulator into live action during CQWW CW 2015

Is 2BSIQ better than SO2R?

- 2BSIQ increases QSO but...
- Is that enough to overcome decrease of multipliers?
- Comparing S&P, RUN, SO2R, 2BSIQ from a baseline score
- Comparing CR3E (SO2R) with CR3OO (2BSIQ)

2BSIQ will increase QSO total, but...

In theory almost two QSOs can fit in the time frame of one. But there are moments with less or no additional callers or disruption of synchronization

Radio1
Band1

TU CR300

K1AA

K1AA ENN33

5NN5

Radio2
Band2

5NN5

TU CR300

K1AB

K1AB ENN33

1

+ = ~ 2 QSOS

1

Radio1
Band1

TU CR300

K1AA

K1AA ENN33

5NN5

Radio2
Band2

5NN5

TU CR300

TEST CR300

1

+ = ~ 1.75 QSOS

0.75

Radio1
Band1

TU CR300

K1AA

K1AA ENN33

5NN5

Radio2
Band2

5NN5

TU CR300

1

+ = ~ 1.5 QSOS

0.5

Radio1
Band1

TU CR300

K1AA

K1AA ENN33

5NN5

Radio2
Band2

TEST CR300

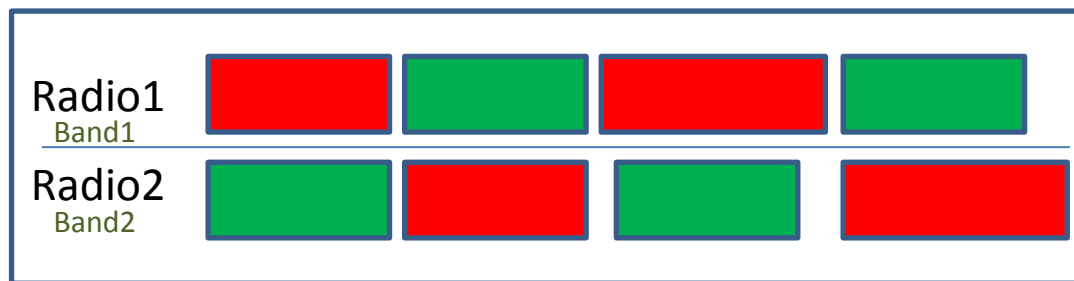
1

+ = ~ 1.25 QSOS

0.25

...is that enough to overcome the decrease of Multipliers?

Having two stations continuously running will have a negative impact in the multipliers



Is the increase in number of QSOs enough to consider 2BSIQ (with two running stations) a clear winning contest mode versus SO2R (with one running station and a S&P station)?

Comparing S&P, RUN, SO2R, 2BSIQ from a baseline score

Determining a base line score (CR3E as SO2R) and making rate and multiplier assumption for a next hour performance is the starting point to compare 2BSIQ with S&P only, RUN only and SO2R (Run and S&P)

1

Determining Baseline Score (CR3E last four SO2R contests from Madeira)

Year	Category	Score	QSOs	Zn	Cty	Hours	Operator(s)	mult
2012	SO HP ALL	15,221,316	7,275	170	556	48	CR3E/CT1BOH	726
2011	SO HP ALL	15,151,668	7,212	168	564	48	CR3E/CT1BOH	732
2010	SO HP ALL	14,208,754	7,243	157	522	48	CR3E/CT1BOH	679
2013	SO HP ALL	13,667,670	6,962	165	516	48	CR3E/CT1BOH	681

CR3E SO2R base line score = 7,200 QSOs * 700 Mults * 2.97 points = 14,968,800 points

2

Rate and Multiplier Assumptions for each “mode” for a next hour performance

Contest Mode	QSOs per hour	Multipliers per hour interval	
		Minimum	Maximum
S&P Only	40	0	15
RUN Only	165	0	5
SO2R	150	4	9
2BSIQ + 10% over SO2R	165	0	5
2BSIQ + 20% over SO2R	180	0	5
2BSIQ + 63% over SO2R	245	0	5

Adding 20% QSOs makes 2BSIQ equal to SO2R

Using CR3E baseline score we can check the interval score of the different contest modes one hour later varying worked multipliers

Base line score	7200	700	2.97	14,968,800
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↓ 1 hour later using each mode

SO1R - S&P Only	7240	700	2.97	15,051,960
		715	2.97	15,374,502

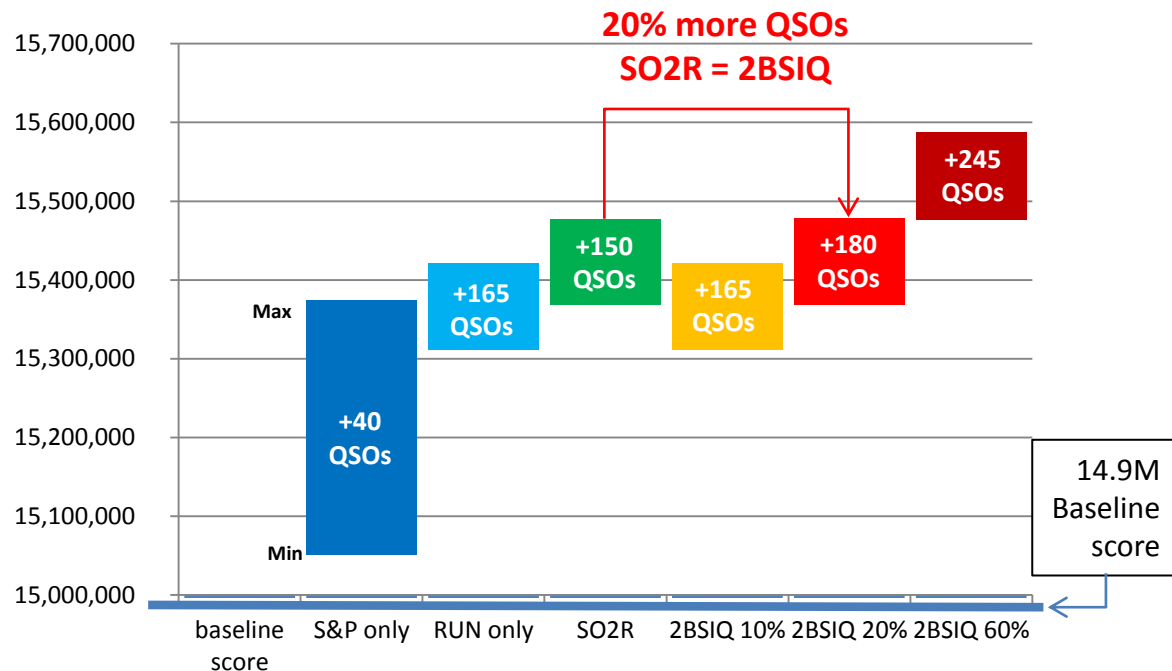
SO1R - RUN only	7365	700	2.97	15,311,835
		705	2.97	15,421,205

SO2R - RUN & S&P	7350	704	2.97	15,367,968
		709	2.97	15,477,116

2BSIQ + 10%	7365	700	2.97	15,311,835
		705	2.97	15,421,205

2BSIQ + 20%	7392	700	2.97	15,367,968
		705	2.97	15,477,739

2BSIQ + 63%	7445	700	2.97	15,477,116
		705	2.97	15,587,666



Adding 10% rate is not enough to make 2BSIQ better than SO2R *

Adding 20% rate makes 2BSIQ equal to SO2R

Adding 63% rate makes 2BSIQ better than the best SO2R/mult interval

* If you followed UT5UGR/TO7A disqualification due to multiplier log padding during CQWW CW 2014, this is probably the reason for it...

Comparing CR3E (SO2R) with CR3OO (2BSIQ)

To compare SO2R and 2BSIQ we would need two twins in two twin stations. CR3L operations in 2011 and 2015, will be used to estimate what would be CR3E (SO2R) operation in 2015 and compare it with CR3OO 2BSIQ real operation in 2015

CR3E SO2R from Madeira

Year	QSOs	Multipliers	Score
2011	7301	738	16.0 M

Estimate of CR3E SO2R in 2015

Year	QSOs	Multipliers	Score
2015	6623	688	13.6 M
	-9%	-7%	-15%

CR3L Operations from Madeira

Year	QSOs	Multipliers	Score
2011	13.260	965	38.0 M
2015	12.628	899	32.2 M
	-9%	-7%	-15%

Estimating CR3E SO2R score using CR3L score

CR3OO 2BSIQ from Madeira

Year	QSOs	Multipliers	Score
2015	8910	625	16.6 M
	+35%	-9%	+23%

2BSIQ versus SO2R

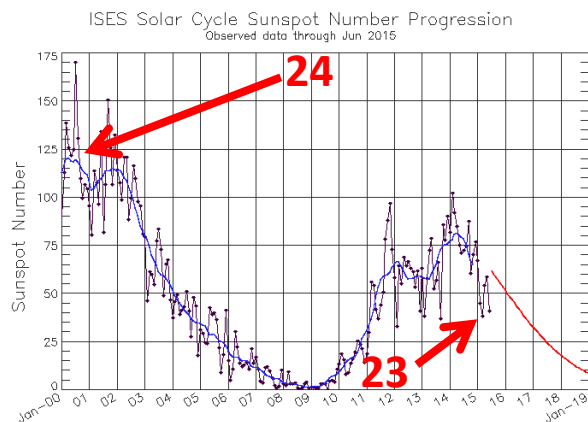
+ 35% QSOs
- 9% Multipliers
+ 23% Score

Can the SOAB World Record be broken with 2BSIQ ?

- Targeting EA8BH record**
- 2BSIQ opens a new possibility**
- CR300, TI5W and ZF2MJ operations**
- Is the record still possible this cycle?**

Targeting EA8BH World Record

Breaking EA8BH 2000 World Record presents an extremely difficult challenge



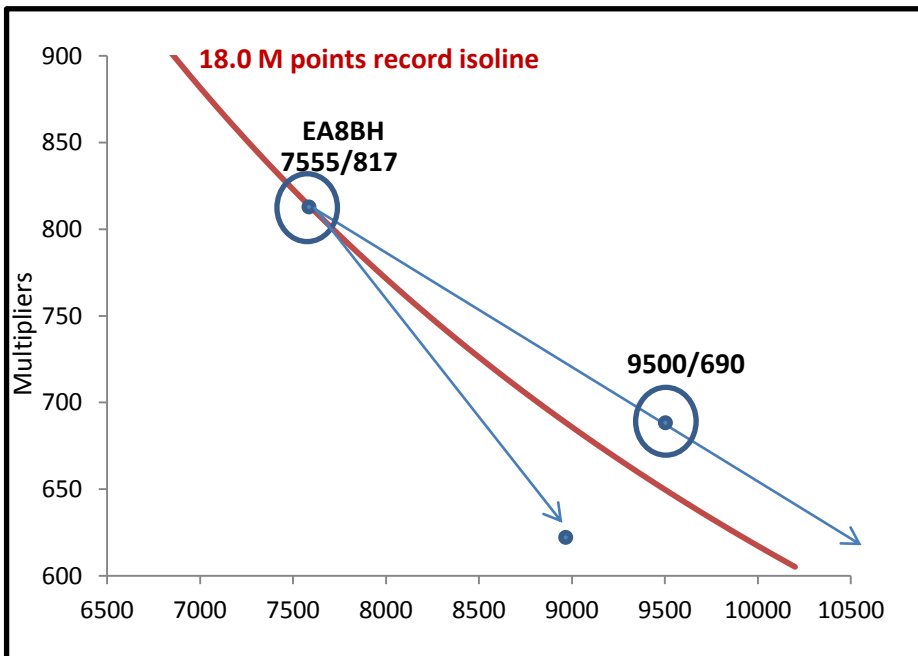
World Record and best 10 SO2R scores

Rank	Call	Year	Score	QSOs	Mults	Zn	Cty	Operator(s)
1	EA8BH	2000	18,010,765	7,555	817	183	634	N5TJ
2	P40E	2003	15,943,070	7,828	715	169	546	CT1BOH
3	EF8M	2011	15,846,012	7,873	691	160	531	RD3A
4	PZ5T	2011	15,673,940	7,592	718	173	545	VE3DZ
5	CR3E	2012	15,221,316	7,275	726	170	556	CT1BOH
6	CR3E	2011	15,151,668	7,212	732	168	564	CT1BOH
7	EF8M	2010	15,117,795	7,598	693	158	535	RD3A
8	HC8N	1999	14,626,579	7,001	731	185	546	N5KO
9	P40E	1998	14,372,964	6,853	729	176	553	CT1BOH
10	P40E	2002	14,251,216	7,026	724	161	563	CT1BOH

- Great operator
- Top of the sun spot cycle 23 (Higher MUF), much better than current cycle 24
- 24 hour around the clock propagation on 20/15/10 meters (not seen this cycle on CW)
- Great location - "Faro del Sardina" (Lighthouse del Sardina)
- No other serious multi band operation from Canary Islands ("Unique" multiplier)

2BSIQ opens a new possibility

2BSIQ seems to open a new possibility to break the record with a “*more QSOs*” strategy, that was not available until now



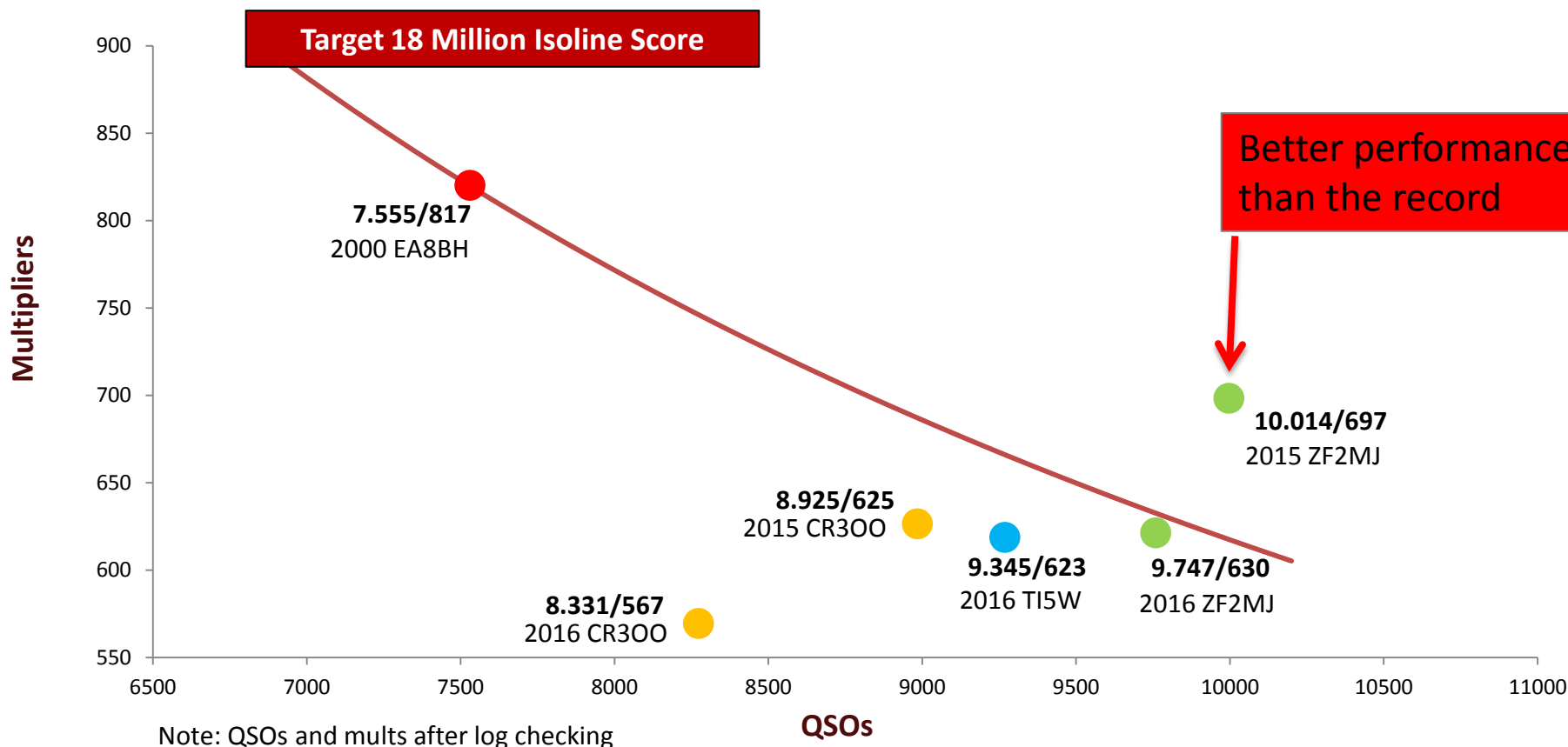
Targeting EA8BH record is possible, if and only if, two conditions are met:

- 2BSIQ provides a dramatic increase of QSO numbers
- Sufficient multipliers will call the 2BSIQ RUN stations to break the record isoline

- (9.500 QSOs and 690 Mults) for example will break the record with 19.4 Million
- In 2015 CR300 only made (8.910 QSOS and 625 Mults)
- In 2016 CR300 only made (8.300 QSOs and 567 Mults) but only 44 QSOs on 10 meters

CR300, TI5W and ZF2MJ operations

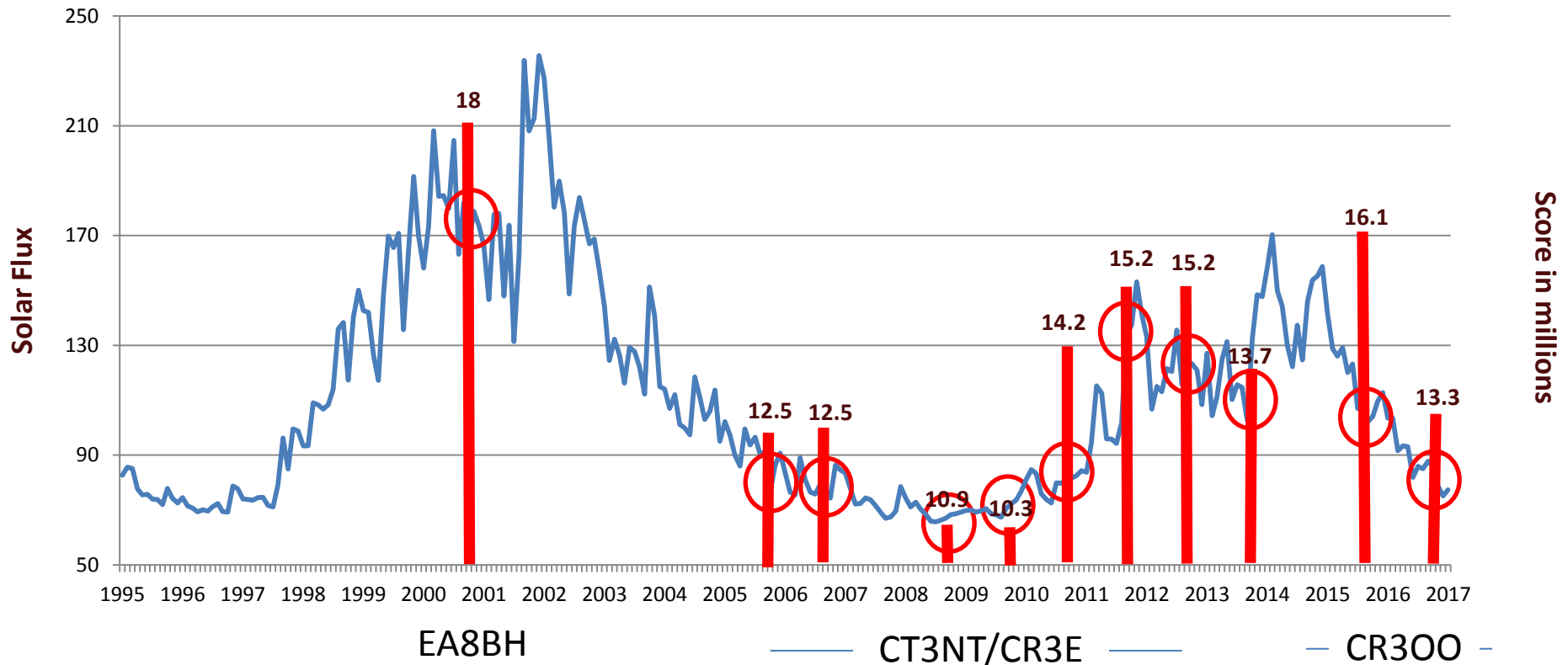
Already several serious 2BSIQ operations have occurred by CR300, TI5W and ZF2MJ



- The “record” has been beaten (in “performance”) by ZF2MJ in 2015, but because it is in zone 8, the world record was not broken. If in zone 9, score would be around 20M
- In 2016, with marginal 10 meter conditions, all scores were below the world record performance

Is the record still possible this cycle?

With 10 meters already marginal, it seem reasonable to say that breaking the record from zone 33, this late in the cycle is becoming a mirage, even with 2BSIQ, unless there is a glimpse of life on 10 meters



But what about other geographies?

Is Zone 33 still the best place in the world for SOAB or has 2BSIQ changed that?

Is zone 33 still the best QTH for record breaking?

- **Super High QSO rates with 2BSIQ**
- **TI5W and ZF2MJ minutes with 10 QSOs**
- **% of USA in normal and super rate minutes**
- **Impact of high % of USA, simultaneously on the two radios**
- **QSOs per hour according to % of USA**
- **The importance of having many hours with USA**
- **Why hours with higher % of USA are better for 2BSIQ**
- **Time to fly to zone 9 or 10**
- **Listen to 2BSIQ from CR300 in CQWW CW**

Super High QSO rates with 2BSIQ

With 2BSIQ, super high rate (6 or more QSOs per minute) becomes possible, pushing QSO total to new heights

	SO2R	2BSIQ		
QSOs per minute - Rate	CR3E	CR3OO	TI5W	ZF2MJ
1 QSOs – 60 rate	467	401	318	253
2 QSOs – 120 rate	669	582	500	464
3 QSOs – 180 rate	751	631	616	601
4 QSOs – 240 rate	550	506	492	557
5 QSOs – 300 rate	202	322	362	401
6 QSOs – 360 rate	31	157	232	249
7 QSOs – 420 rate	-	58	123	135
8 QSOs – 480 rate	-	13	51	53
9 QSOs – 540 rate	-	2	11	10
10 QSOs – 600 rate	-	-	7	1
Super High Rate QSOs	186	1470	2830	2963

Both TI5W and ZF2MJ achieved minutes with 10 QSOs

Note1: CR3E in 2012 was CT1BOH's most QSO operation from Madeira

Note2: QSO totals with dupes

SO2R operation by CR3E only had 31 super high rate minutes for a total of 186 QSOs

2BSIQ operation by CR3OO had 230 super high rate minutes for a total of 1470 QSOs

TI5W and ZF2MJ minutes with 10 QSOs

Looking at TI5W and ZF2MJ best super high rate minutes (10 QSOs per minute) there seems to be a pattern – high percentage of QSOs with USA during those minutes. Is USA a critical element in 2BSIQ?

TI5W

K3WWP	K3QF	W1RM	JA2HYD	W9DCA	OG6N	AB9YC
N4FY	N5FO	K5KJ	NN2NN	W1ZT	CN2R	K4AB
DL6IAK	N6JV	NW0M	W2RD	WN6K	RW1C	KE2D
N3ED	N6MU	PA6NB	W1TO	NE6I	UT4U	W3UA
WA1ZAM	K1RV	KT8K	WB5HJV	K2LS	VE3IAE	KM5G
K8ZT	N2BEG	N2CU	N9JR	K6TA	DL4CF	K9MA
DO4DXA	WK2H	AA1V	N4TB	N4TL	K3FMQ	N2AN
N4RA	NC6B	N2WK	VE3GFN	N0RB	DL0XM	W6YA
N2LBR	XE1H	HG1S	JA0UMV	K3DQB	G4KFT	N4WO
AA4V	K2RET	VE3KZ	AB4Z	N5IR	W1HIS	NE2V
80% USA	90% USA	80% USA	80% USA	100% USA	30% USA	100% USA

ZF2MJ

W7IDG
WN6K
AC0W
N6GQ
NQ7R
KD5R
VE3XT
K6YK
W6HD
N2YB
100% USA

Note: Check that TI5W minute with 30% USA, four Non USA calls are all short 2X1 (OG6N, CN2R, RW1C and UT4U)

Note: For simplicity all stations from zones 3,4,5 are considered USA

% of USA in normal and super high rate minutes

Clearly USA provides a big boost for Super High rate QSOs. Super high rate can be obtained with lower percentages of USA, but not in the same magnitude

	2BSIQ		
QSOs per minute - Rate	CR3OO	TI5W	ZF2MJ
1 QSOs – 60 rate	401	318	253
2 QSOs – 120 rate	582	500	464
3 QSOs – 180 rate	631	616	601
4 QSOs – 260 rate	506	492	557
5 QSOs – 300 rate	322	362	401
Normal rate QSOs	7092	6944	7216
% USA	36%	56%	57%

6 QSOs – 360 rate	157	232	249
7 QSOs – 420 rate	58	123	135
8 QSOs – 480 rate	13	51	53
9 QSOs – 540 rate	2	11	10
10 QSOs – 600 rate	-	7	1
Super High Rate QSOs	1470	2830	2963
% USA	38%	73%	68%

% of USA in Minutes

With QSOs per minute	CR3OO	TI5W	ZF2MJ
1	31%	41%	42%
2	32%	46%	49%
3	35%	51%	54%
4	37%	61%	60%
5	41%	66%	61%
6	39%	70%	65%
7	33%	73%	70%
8	42%	79%	74%
9	56%	75%	69%
10	-	80%	100%

Note: For simplicity all stations from zones 3,4,5 are considered USA

Impact of high % of USA, simultaneously on the two radios

Because 2BSIQ synchronizes QSOs in two bands, having a high % of USA on each of the two radios, maximizes super high rate. The probability of disruption is much smaller

QSOs per minute - Rate	CR300	ZF2MJ
6 QSOs – 360 rate	157	249
7 QSOs – 420 rate	58	135
8 QSOs – 480 rate	13	53
9 QSOs – 540 rate	2	10
10 QSOs – 600 rate	-	1
Super High Rate QSOs	1470	2963
% USA	38%	68%

% of USA in Radio 2	% of USA in Radio 1			
	ZF2MJ 2963 QSOs	>=0% and <40%	>=40% and < 60%	>= 60%
	>=0% and <40%	290	77	249
	>=40% and < 60%	119	58	160
	>= 60%	328	249	1433 ^{48%}

% of USA in Radio 2

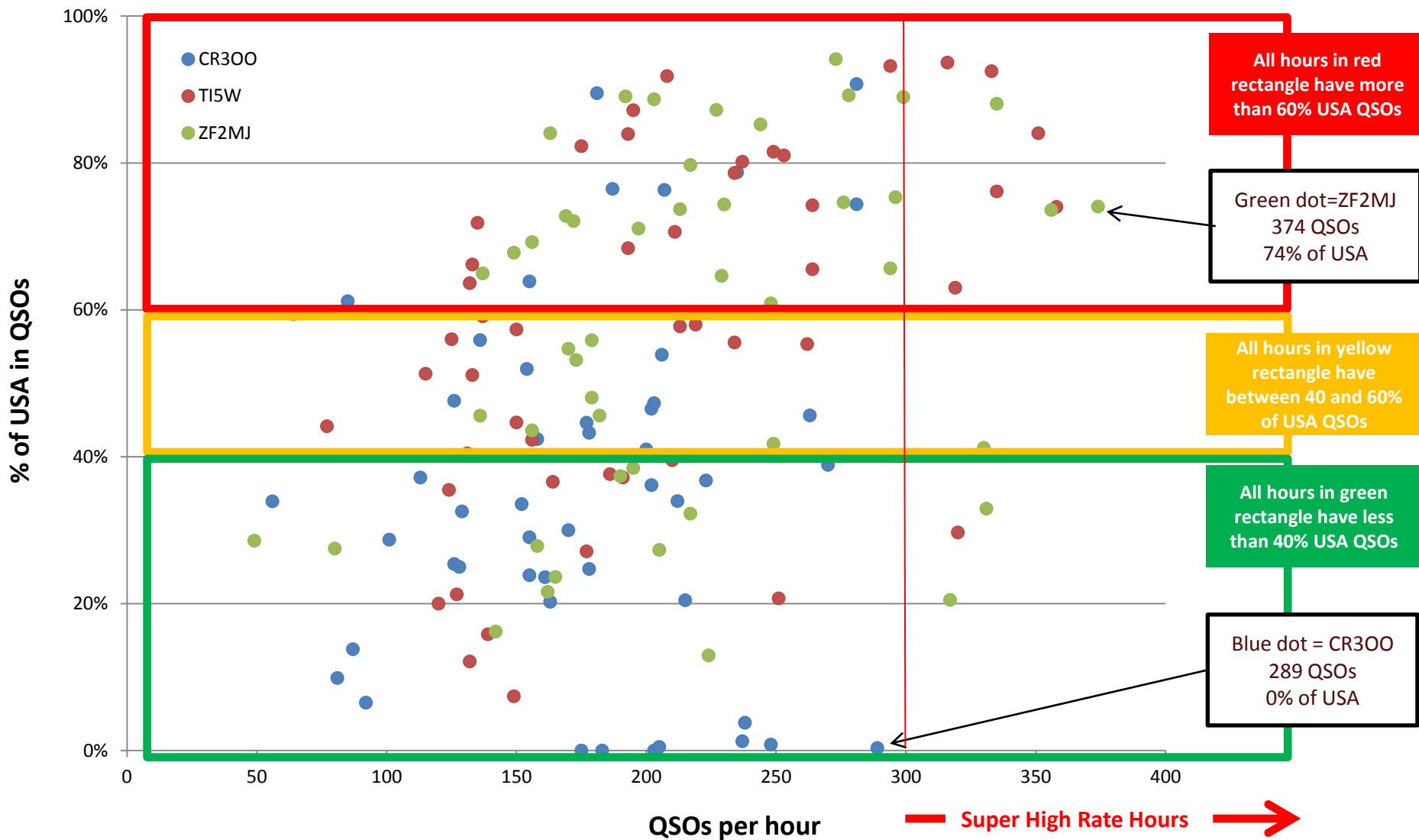
% of USA in Radio 1			
CR300 1470 QSOs	>=0% and <40%	>=40% and < 60%	>= 60%
>=0% and <40%	632	76	235
>=40% and < 60%	52	18	65
>= 60%	86	0	306 ^{21%}

Almost 50% of ZF2MJ super high rate QSO happen in minutes, where there is a percentage of USA, at the same time in Radio1 and in Radio2, >=60%

A QTH that can sustain high percentage of USA on two bands simultaneously will have a great advantage in 2BSIQ

QSOs per hour according to % of USA

The graph below plots for CR300, TI5W and ZF2MJ all 48 hours of the contest



The importance of having many hours with USA

More hours of high % of USA available, more chances of Super High Rate

% USA	CR300	TI5W	ZF2MJ
>=60%	8 HOURS 1612 _{QSOs} 202 RATE	22 HOURS 5382 _{QSOs} 245 RATE	25 HOURS 5927 _{QSOs} 237 RATE
>=40% and <60%	11 HOURS 2003 _{QSOs} 182 RATE	14 HOURS 2312 _{QSOs} 165 RATE	10 HOURS 1818 _{QSOs} 182 RATE
<40%	29 HOURS 4947 _{QSOs} 171 RATE	12 HOURS 2080 _{QSOs} 173 RATE	13 HOURS 2435 _{QSOs} 187 RATE

Rates are about the same when working hours with less than 60% USA

QSO Total
With dupes

8.562

9.774

10.180

Why hours with high % of USA are better for 2BSIQ?

2BSIQ related reasons:

- USA calls are shorter than Non USA calls (on average 242 ms)
- A TX leading pair, when there is a variable call element from USA is shorter
- A fixed RX element where there is a zone report from (zone 3,4,5) is shorter
- Sending enn7, enn8, enn9 is shorter than enn33
- With shorter calls and exchanges the probability of a disruption in synchronization is smaller
- USA pile-up is better behaved

Propagation and geographical related reasons

- With the decline of sunspot cycle, a location south of USA will enjoy great North/South propagation
- A location near USA will have simultaneously more USA on two bands

Time to fly to zone 9 or 10

With the importance of having high percentage of USA QSO on the two radios for maximizing 2BSIQ, it seems it is time to fly to zone 9 or 10



Listen to 2BSIQ from CR300 in CQWW CW



<https://www.youtube.com/watch?v=42TCOtmJuEI>

You can listen to CT1BOH operating CR300 in 2BSIQ.

Make sure to put your headphones in order to understand from which radio (Radio1 or Radio2) stations are coming from.

Also Understand that CT1BOH never listens to his Transmission. He is always listening on the radio in RX, alternating from one band to the other.

This 2 minute section nets 17 QSOs at an instant rate of 510 QSOs per hour.

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