

**IEEE P802.15**  
**Wireless Personal Area Networks**

Project	IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)	
Title	Some Comment Resolution for TG4m TVWS-NB-OFDM	
Date Submitted	March. 19, 2013	
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Re:	Submission for comment resolution in LB87 of IEEE 802.15.4m draft	
Abstract	Comment Resolution for the TVWS-NB-OFDM	
Purpose	Resolve TVWS-NB-OFDM related comments in LB87	
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Release	The contributor acknowledges and accepts that this contribution becomes the property of IEEE and may be made publicly available by P802.15.	

*CID 420: Time domain STF needs to be defined by using IDFT/IFFT.*

*CID 423: Figure 125 should be consistent with Fig. 116.*

*CID 425: Frequency domain representation of STF for TVWS-NB-OFDM needs to be defined more clearly.*

*CID 426: Frequency domain specific data value for STF shall be given for easy hardward implementation*

**Proposed Resolution:**

**20.3.1.1.1 Frequency domain STF**

The frequency domain STF is represented as specified in Table 142a

Table 142 a

##	Re	Im	##	Re	Im	##	Re	Im	##	Re	Im
-192	-1.4142	-1.4142	-96	-1.4142	-1.4142	0	-1.4142	-1.4142	96	-1.4142	-1.4142
-191	0	0	-95	0	0	1	0	0	97	0	0
-190	0	0	-94	0	0	2	0	0	98	0	0
-189	0	0	-93	0	0	3	0	0	99	0	0
-188	1.6257	1.165	-92	1.165	-1.6257	4	-1.6257	-1.165	100	-1.165	1.6257
-187	0	0	-91	0	0	5	0	0	101	0	0
-186	0	0	-90	0	0	6	0	0	102	0	0
-185	0	0	-89	0	0	7	0	0	103	0	0
-184	-1.9829	-0.2611	-88	1.9829	0.2611	8	-1.9829	-0.2611	104	1.9829	0.2611
-183	0	0	-87	0	0	9	0	0	105	0	0
-182	0	0	-86	0	0	10	0	0	106	0	0
-181	0	0	-85	0	0	11	0	0	107	0	0
-180	1.546	-1.2688	-84	1.2688	1.546	12	-1.546	1.2688	108	-1.2688	-1.546
-179	0	0	-83	0	0	13	0	0	109	0	0
-178	0	0	-82	0	0	14	0	0	110	0	0
-177	0	0	-81	0	0	15	0	0	111	0	0
-176	0.5176	1.9319	-80	0.5176	1.9319	16	0.5176	1.9319	112	0.5176	1.9319
-175	0	0	-79	0	0	17	0	0	113	0	0
-174	0	0	-78	0	0	18	0	0	114	0	0
-173	0	0	-77	0	0	19	0	0	115	0	0
-172	-1.9733	0.3258	-76	0.3258	1.9733	20	1.9733	-0.3258	116	-0.3258	-1.9733

-171	0	0	-75	0	0	21	0	0	117	0	0
-170	0	0	-74	0	0	22	0	0	118	0	0
-169	0	0	-73	0	0	23	0	0	119	0	0
-168	-0.7654	-1.8478	-72	0.7654	1.8478	24	-0.7654	-1.8478	120	0.7654	1.8478
-167	0	0	-71	0	0	25	0	0	121	0	0
-166	0	0	-70	0	0	26	0	0	122	0	0
-165	0	0	-69	0	0	27	0	0	123	0	0
-164	1.165	-1.6257	-68	1.6257	1.165	28	-1.165	1.6257	124	-1.6257	-1.165
-163	0	0	-67	0	0	29	0	0	125	0	0
-162	0	0	-66	0	0	30	0	0	126	0	0
-161	0	0	-65	0	0	31	0	0	127	0	0
-160	1.9319	-0.5176	-64	1.9319	-0.5176	32	1.9319	-0.5176	128	1.9319	-0.5176
-159	0	0	-63	0	0	33	0	0	129	0	0
-158	0	0	-62	0	0	34	0	0	130	0	0
-157	0	0	-61	0	0	35	0	0	131	0	0
-156	1.9904	0.196	-60	0.196	-1.9904	36	-1.9904	-0.196	132	-0.196	1.9904
-155	0	0	-59	0	0	37	0	0	133	0	0
-154	0	0	-58	0	0	38	0	0	134	0	0
-153	0	0	-57	0	0	39	0	0	135	0	0
-152	1.9829	0.2611	-56	-1.9829	-0.2611	40	1.9829	0.2611	136	-1.9829	-0.2611
-151	0	0	-55	0	0	41	0	0	137	0	0
-150	0	0	-54	0	0	42	0	0	138	0	0
-149	0	0	-53	0	0	43	0	0	139	0	0
-148	1.9733	-0.3258	-52	0.3258	1.9733	44	-1.9733	0.3258	140	-0.3258	-1.9733
-147	0	0	-51	0	0	45	0	0	141	0	0
-146	0	0	-50	0	0	46	0	0	142	0	0
-145	0	0	-49	0	0	47	0	0	143	0	0
-144	1.4142	-1.4142	-48	1.4142	-1.4142	48	1.4142	-1.4142	144	1.4142	-1.4142
-143	0	0	-47	0	0	49	0	0	145	0	0
-142	0	0	-46	0	0	50	0	0	146	0	0
-141	0	0	-45	0	0	51	0	0	147	0	0
-140	-0.3258	-1.9733	-44	-1.9733	0.3258	52	0.3258	1.9733	148	1.9733	-0.3258
-139	0	0	-43	0	0	53	0	0	149	0	0
-138	0	0	-42	0	0	54	0	0	150	0	0
-137	0	0	-41	0	0	55	0	0	151	0	0

-136	-1.9829	-0.2611	-40	1.9829	0.2611	56	-1.9829	-0.2611	152	1.9829	0.2611
-135	0	0	-39	0	0	57	0	0	153	0	0
-134	0	0	-38	0	0	58	0	0	154	0	0
-133	0	0	-37	0	0	59	0	0	155	0	0
-132	-0.196	1.9904	-36	-1.9904	-0.196	60	0.196	-1.9904	156	1.9904	0.196
-131	0	0	-35	0	0	61	0	0	157	0	0
-130	0	0	-34	0	0	62	0	0	158	0	0
-129	0	0	-33	0	0	63	0	0	159	0	0
-128	1.9319	-0.5176	-32	1.9319	-0.5176	64	1.9319	-0.5176	160	1.9319	-0.5176
-127	0	0	-31	0	0	65	0	0	161	0	0
-126	0	0	-30	0	0	66	0	0	162	0	0
-125	0	0	-29	0	0	67	0	0	163	0	0
-124	-1.6257	-1.165	-28	-1.165	1.6257	68	1.6257	1.165	164	1.165	-1.6257
-123	0	0	-27	0	0	69	0	0	165	0	0
-122	0	0	-26	0	0	70	0	0	166	0	0
-121	0	0	-25	0	0	71	0	0	167	0	0
-120	0.7654	1.8478	-24	-0.7654	-1.8478	72	0.7654	1.8478	168	-0.7654	-1.8478
-119	0	0	-23	0	0	73	0	0	169	0	0
-118	0	0	-22	0	0	74	0	0	170	0	0
-117	0	0	-21	0	0	75	0	0	171	0	0
-116	-0.3258	-1.9733	-20	1.9733	-0.3258	76	0.3258	1.9733	172	-1.9733	0.3258
-115	0	0	-19	0	0	77	0	0	173	0	0
-114	0	0	-18	0	0	78	0	0	174	0	0
-113	0	0	-17	0	0	79	0	0	175	0	0
-112	0.5176	1.9319	-16	0.5176	1.9319	80	0.5176	1.9319	176	0.5176	1.9319
-111	0	0	-15	0	0	81	0	0	177	0	0
-110	0	0	-14	0	0	82	0	0	178	0	0
-109	0	0	-13	0	0	83	0	0	179	0	0
-108	-1.2688	-1.546	-12	-1.546	1.2688	84	1.2688	1.546	180	1.546	-1.2688
-107	0	0	-11	0	0	85	0	0	181	0	0
-106	0	0	-10	0	0	86	0	0	182	0	0
-105	0	0	-9	0	0	87	0	0	183	0	0
-104	1.9829	0.2611	-8	-1.9829	-0.2611	88	1.9829	0.2611	184	-1.9829	-0.2611
-103	0	0	-7	0	0	89	0	0	185	0	0
-102	0	0	-6	0	0	90	0	0	186	0	0

-101	0	0	-5	0	0	91	0	0	187	0	0
-100	-1.165	1.6257	-4	-1.6257	-1.165	92	1.165	-1.6257	188	1.6257	1.165
-99	0	0	-3	0	0	93	0	0	189	0	0
-98	0	0	-2	0	0	94	0	0	190	0	0
-97	0	0	-1	0	0	95	0	0	191	0	0

**20.3.1.1.2 Time domain STF generation**

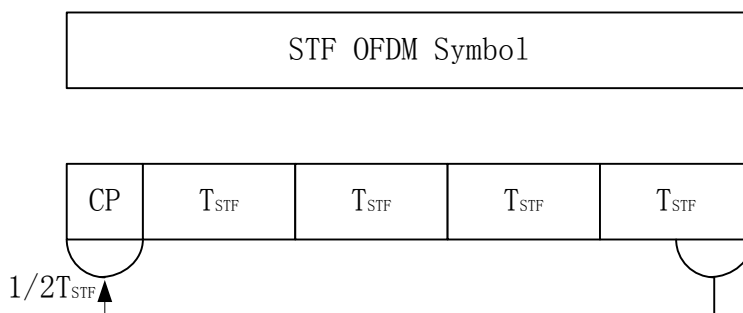
The time domain STF can be generated as follows:

$$STF\_time = IDFT(STF\_freq)$$

The CP with 1/2 STF duration is then prepended to the STF OFDM symbol.

**20.3.1.1.3 Time domain STF repetition**

There are 4 repetitions of STF in the time domain and CP is a 1/2  $T_{STF}$  duration as shown Figure 125.



**CID 434:** LTF for TVWS-NB-OFDM must have cyclic prefix and Fig 126 should be consistent with Fig. 117.

**CID 436:** Frequency domain representation of LTF for TVWS-NB-OFDM needs to be defined more clearly

**CID 437:** Frequency domain specific data value for LTF shall be given for easy hardware implementation

**20.3.1.2.1 Frequency domain LTF generation**

The frequency domain LTF is represented as specified in Table 142b

Table 142b

##	Re	Im	##	Re	Im	##	Re	Im	##	Re	Im
-192	0.051	-0.051	-96	0.051	-0.051	0	0.051	-0.051	96	0.051	-0.051
-191	0	0	-95	0	0	1	0	0	97	0	0
-190	0.0687	-0.0221	-94	0.0221	0.0687	2	-0.0687	0.0221	98	-0.0221	-0.0687

-189	0	0	-93	0	0	3	0	0	99	0	0
-188	0.0319	0.0647	-92	-0.0319	-0.0647	4	0.0319	0.0647	100	-0.0319	-0.0647
-187	0	0	-91	0	0	5	0	0	101	0	0
-186	-0.068	-0.0243	-90	-0.0243	0.068	6	0.068	0.0243	102	0.0243	-0.068
-185	0	0	-89	0	0	7	0	0	103	0	0
-184	0.0625	0.0361	-88	0.0625	0.0361	8	0.0625	0.0361	104	0.0625	0.0361
-183	0	0	-87	0	0	9	0	0	105	0	0
-182	0.0059	-0.0719	-86	0.0719	0.0059	10	-0.0059	0.0719	106	-0.0719	-0.0059
-181	0	0	-85	0	0	11	0	0	107	0	0
-180	-0.06	-0.0401	-84	0.06	0.0401	12	-0.06	-0.0401	108	0.06	0.0401
-179	0	0	-83	0	0	13	0	0	109	0	0
-178	-0.0642	-0.033	-82	-0.033	0.0642	14	0.0642	0.033	110	0.033	-0.0642
-177	0	0	-81	0	0	15	0	0	111	0	0
-176	-0.0187	-0.0697	-80	-0.0187	-0.0697	16	-0.0187	-0.0697	112	-0.0187	-0.0697
-175	0	0	-79	0	0	17	0	0	113	0	0
-174	0.0721	-0.0035	-78	0.0035	0.0721	18	-0.0721	0.0035	114	-0.0035	-0.0721
-173	0	0	-77	0	0	19	0	0	115	0	0
-172	-0.0647	0.0319	-76	0.0647	-0.0319	20	-0.0647	0.0319	116	0.0647	-0.0319
-171	0	0	-75	0	0	21	0	0	117	0	0
-170	0.0719	0.0059	-74	0.0059	-0.0719	22	-0.0719	-0.0059	118	-0.0059	0.0719
-169	0	0	-73	0	0	23	0	0	119	0	0
-168	0	-0.0722	-72	0	-0.0722	24	0	-0.0722	120	0	-0.0722
-167	0	0	-71	0	0	25	0	0	121	0	0
-166	-0.0467	-0.055	-70	0.055	-0.0467	26	0.0467	0.055	122	-0.055	0.0467
-165	0	0	-69	0	0	27	0	0	123	0	0
-164	-0.0319	-0.0647	-68	0.0319	0.0647	28	-0.0319	-0.0647	124	0.0319	0.0647
-163	0	0	-67	0	0	29	0	0	125	0	0
-162	0.0485	-0.0535	-66	-0.0535	-0.0485	30	-0.0485	0.0535	126	0.0535	0.0485
-161	0	0	-65	0	0	31	0	0	127	0	0
-160	0.0187	0.0697	-64	0.0187	0.0697	32	0.0187	0.0697	128	0.0187	0.0697
-159	0	0	-63	0	0	33	0	0	129	0	0
-158	-0.0221	-0.0687	-62	0.0687	-0.0221	34	0.0221	0.0687	130	-0.0687	0.0221
-157	0	0	-61	0	0	35	0	0	131	0	0
-156	-0.0401	0.06	-60	0.0401	-0.06	36	-0.0401	0.06	132	0.0401	-0.06
-155	0	0	-59	0	0	37	0	0	133	0	0

-154	0.0467	0.055	-58	0.055	-0.0467	38	-0.0467	-0.055	134	-0.055	0.0467
-153	0	0	-57	0	0	39	0	0	135	0	0
-152	0.0625	0.0361	-56	0.0625	0.0361	40	0.0625	0.0361	136	0.0625	0.0361
-151	0	0	-55	0	0	41	0	0	137	0	0
-150	0.0309	0.0652	-54	-0.0652	0.0309	42	-0.0309	-0.0652	138	0.0652	-0.0309
-149	0	0	-53	0	0	43	0	0	139	0	0
-148	-0.0647	0.0319	-52	0.0647	-0.0319	44	-0.0647	0.0319	140	0.0647	-0.0319
-147	0	0	-51	0	0	45	0	0	141	0	0
-146	0.033	-0.0642	-50	-0.0642	-0.033	46	-0.033	0.0642	142	0.0642	0.033
-145	0	0	-49	0	0	47	0	0	143	0	0
-144	-0.051	0.051	-48	-0.051	0.051	48	-0.051	0.051	144	-0.051	0.051
-143	0	0	-47	0	0	49	0	0	145	0	0
-142	0.0642	0.033	-46	-0.033	0.0642	50	-0.0642	-0.033	146	0.033	-0.0642
-141	0	0	-45	0	0	51	0	0	147	0	0
-140	0.0647	-0.0319	-44	-0.0647	0.0319	52	0.0647	-0.0319	148	-0.0647	0.0319
-139	0	0	-43	0	0	53	0	0	149	0	0
-138	0.0652	-0.0309	-42	-0.0309	-0.0652	54	-0.0652	0.0309	150	0.0309	0.0652
-137	0	0	-41	0	0	55	0	0	151	0	0
-136	0.0625	0.0361	-40	0.0625	0.0361	56	0.0625	0.0361	152	0.0625	0.0361
-135	0	0	-39	0	0	57	0	0	153	0	0
-134	-0.055	0.0467	-38	-0.0467	-0.055	58	0.055	-0.0467	154	0.0467	0.055
-133	0	0	-37	0	0	59	0	0	155	0	0
-132	0.0401	-0.06	-36	-0.0401	0.06	60	0.0401	-0.06	156	-0.0401	0.06
-131	0	0	-35	0	0	61	0	0	157	0	0
-130	-0.0687	0.0221	-34	0.0221	0.0687	62	0.0687	-0.0221	158	-0.0221	-0.0687
-129	0	0	-33	0	0	63	0	0	159	0	0
-128	0.0187	0.0697	-32	0.0187	0.0697	64	0.0187	0.0697	160	0.0187	0.0697
-127	0	0	-31	0	0	65	0	0	161	0	0
-126	0.0535	0.0485	-30	-0.0485	0.0535	66	-0.0535	-0.0485	162	0.0485	-0.0535
-125	0	0	-29	0	0	67	0	0	163	0	0
-124	0.0319	0.0647	-28	-0.0319	-0.0647	68	0.0319	0.0647	164	-0.0319	-0.0647
-123	0	0	-27	0	0	69	0	0	165	0	0
-122	-0.055	0.0467	-26	0.0467	0.055	70	0.055	-0.0467	166	-0.0467	-0.055
-121	0	0	-25	0	0	71	0	0	167	0	0
-120	0	-0.0722	-24	0	-0.0722	72	0	-0.0722	168	0	-0.0722

-119	0	0	-23	0	0	73	0	0	169	0	0
-118	-0.0059	0.0719	-22	-0.0719	-0.0059	74	0.0059	-0.0719	170	0.0719	0.0059
-117	0	0	-21	0	0	75	0	0	171	0	0
-116	0.0647	-0.0319	-20	-0.0647	0.0319	76	0.0647	-0.0319	172	-0.0647	0.0319
-115	0	0	-19	0	0	77	0	0	173	0	0
-114	-0.0035	-0.0721	-18	-0.0721	0.0035	78	0.0035	0.0721	174	0.0721	-0.0035
-113	0	0	-17	0	0	79	0	0	175	0	0
-112	-0.0187	-0.0697	-16	-0.0187	-0.0697	80	-0.0187	-0.0697	176	-0.0187	-0.0697
-111	0	0	-15	0	0	81	0	0	177	0	0
-110	0.033	-0.0642	-14	0.0642	0.033	82	-0.033	0.0642	178	-0.0642	-0.033
-109	0	0	-13	0	0	83	0	0	179	0	0
-108	0.06	0.0401	-12	-0.06	-0.0401	84	0.06	0.0401	180	-0.06	-0.0401
-107	0	0	-11	0	0	85	0	0	181	0	0
-106	-0.0719	-0.0059	-10	-0.0059	0.0719	86	0.0719	0.0059	182	0.0059	-0.0719
-105	0	0	-9	0	0	87	0	0	183	0	0
-104	0.0625	0.0361	-8	0.0625	0.0361	88	0.0625	0.0361	184	0.0625	0.0361
-103	0	0	-7	0	0	89	0	0	185	0	0
-102	0.0243	-0.068	-6	0.068	0.0243	90	-0.0243	0.068	186	-0.068	-0.0243
-101	0	0	-5	0	0	91	0	0	187	0	0
-100	-0.0319	-0.0647	-4	0.0319	0.0647	92	-0.0319	-0.0647	188	0.0319	0.0647
-99	0	0	-3	0	0	93	0	0	189	0	0
-98	-0.0221	-0.0687	-2	-0.0687	0.0221	94	0.0221	0.0687	190	0.0687	-0.0221
-97	0	0	-1	0	0	95	0	0	191	0	0

**20.3.1.2.2 Time domain LTF generation**

The time domain LTF can be generated as follows:

$$\text{LTF\_time} = \text{IDFT}(\text{LTF\_freq})$$

The CP with 1/2 LTF duration is then prepended to the LTF OFDM symbol.

**20.3.1.2.3 Time domain LTF repetition**

There are two repetitions of LTF in the time domain as shown in Figure 126. A 1/2 symbol CP is prepended to two consecutive copies of the base symbol with duration  $T_{\text{LTF}}$  as shown in Figure 126.



