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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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

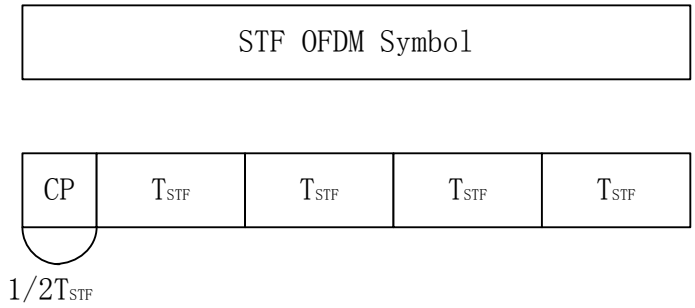
The time domain STF can be generated as follows:

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 hardward 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:

LTF_time = IDFT(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_{LTF} as shown in Figure 126.


LTF
LTF
CP
T_{LTF}
T_{LTF}
$1/2T_{LTF}$