

Appendix A

Volume Control Test Data and Plots

For Report No.: SUCR250100003901

The DUT shall have at least one volume control setting that will produce a conversational gain of ≥ 6 .

Verdict: Pass.

1.1 For codecs with bit rate, check the bit rate with the worst conversational gain

Codec	Codec Bitrate (kbps)	Conv. Gain(dB)					
		WCDMA B4		LTE B4		802.11 b	
		2N	8N	2N	8N	2N	8N
AMR-NB	4.75	9.61	14.34	9.48	14.18	9.36	14.16
	5.15	9.67	14.42	9.62	14.51	9.74	14.47
	5.90	9.77	14.43	9.63	14.37	9.69	14.43
	6.70	9.92	14.57	9.63	14.44	9.69	14.48
	7.40	9.97	14.58	10.13	14.55	9.73	14.45
	7.95	10.11	14.73	10.18	14.55	9.92	14.76
	10.20	10.05	14.73	10.17	14.54	9.94	14.74
	12.20	10.32	14.93	10.18	14.81	9.92	14.73
AMR-WB	6.60	8.90	13.64	8.93	13.48	8.53	13.19
	8.85	9.22	13.77	9.27	13.83	8.92	13.64
	12.65	9.34	13.75	9.26	13.78	8.90	13.63
	14.25	9.29	13.87	9.33	13.75	8.88	13.68
	15.85	9.28	13.83	9.28	13.75	8.82	13.25
	18.25	9.34	13.93	9.31	13.77	8.93	13.69
	19.85	9.18	13.99	9.35	13.79	8.96	13.74
	23.05	9.32	13.97	9.28	13.86	8.93	13.76
	23.85	9.01	13.97	9.35	13.85	9.18	13.73
EVS-NB	5.90	N/A		9.63	14.01	9.56	14.09
	7.20			10.13	14.29	9.67	14.60
	8.0			9.83	14.28	9.64	14.60
	9.6			9.79	14.27	9.61	14.51
	13.20			9.82	14.57	9.67	14.66
	16.40			10.09	14.63	9.64	14.59
	24.4			10.38	14.62	10.12	14.39
EVS-WB	5.90			8.48	13.01	8.30	12.93
	7.20			8.51	13.18	8.40	13.07
	8.0			8.61	13.21	8.46	13.17
	9.6			8.75	13.14	8.37	13.05
	13.20			8.78	13.22	8.63	13.47
	16.40			9.11	13.55	8.76	13.47
	24.4			8.85	13.68	8.94	13.58

1.2 For codecs with bit rate, tested only bit rate with the worst conversational gain

Air Interface	Band	Limit (dB)	Conv. Gain(dB)					
			FR V1		FR V2		HR V1	
			2N	8N	2N	8N	2N	8N
GSM	850	6	10.03	14.75	10.00	14.72	10.47	15.16
	1900	6	10.12	14.81	9.99	14.73	10.48	15.23

Air Interface	Band	Limit (dB)	Conv. Gain(dB)							
			AMR NB (4.7kbps)		AMR WB (6.6kbps)		EVS NB (5.9kbps)		EVS WB (5.9kbps)	
			2N	8N	2N	8N	2N	8N	2N	8N
WCDMA	B2	6	9.49	14.32	8.75	13.56	N/A			
	B4	6	9.61	14.34	8.90	13.64				
	B5	6	9.43	14.44	8.67	13.55				
LTE	B 2	6	9.38	14.13	8.68	13.41	9.27	14.07	8.32	12.88
	B 4	6	9.48	14.18	8.93	13.48	9.63	14.01	8.48	13.01
	B 5	6	9.52	14.03	8.67	13.42	9.29	13.96	8.25	13.11
	B 7	6	9.48	14.02	8.73	13.36	9.32	14.02	8.28	13.12
	B 12	6	9.39	14.16	8.74	13.41	9.38	14.02	8.34	13.17
	B 13	6	9.32	13.96	8.73	13.36	9.09	14.15	8.31	13.14
	B 17	6	9.53	14.14	8.78	13.37	9.36	14.04	8.33	13.10
	B 26	6	9.51	14.25	8.73	13.42	9.14	13.91	8.22	13.00
	B 38	6	9.48	14.10	8.69	13.41	9.42	13.97	8.37	13.04
	B 41	6	9.42	14.09	8.72	13.36	9.18	14.05	8.25	13.03
	B 66	6	9.40	14.16	8.71	13.42	9.25	14.03	8.35	12.97
WLAN-2.4G	802.11b	6	9.36	14.16	8.53	13.19	9.56	14.09	8.30	12.93
	802.11g	6	9.43	14.02	8.76	13.36	9.24	14.03	8.28	13.04
	802.11n	6	9.44	14.13	8.65	13.37	9.21	13.98	8.24	13.13

The noise power shall ≥ 20 when tested over the range of 1/3 octave band center frequencies.

Verdict: Pass

2.1 Distortion Test Result for EVS-NB 24.4 kbps and LTE

Center Freq	Limit	PN-SDNR(dB)									
		LTE Band 2		LTE Band 4		LTE Band 5		LTE Band 7		LTE Band 12	
		2N	8N	2N	8N	2N	8N	2N	8N	2N	8N
400	20	31.04	33.09	33.11	32.99	33.08	33.25	31.64	32.34	32.48	31.45
500		30.72	29.74	31.22	35.34	33.20	29.62	34.80	35.68	31.67	35.80
630		38.65	38.74	37.20	36.40	33.95	29.22	37.59	39.33	37.43	27.24
800		41.29	41.14	32.95	38.57	39.98	32.59	39.36	40.62	40.19	28.32
1000		41.87	32.41	30.92	33.70	40.48	42.21	42.26	40.19	33.88	29.79
1250		26.92	33.11	25.41	26.71	32.88	26.15	33.74	33.84	27.46	33.18
1600		42.73	43.26	43.39	44.02	42.47	40.42	35.06	42.84	43.69	42.52
2000		43.31	44.56	43.93	33.99	42.57	33.61	37.17	35.73	44.41	35.90
2500		37.72	31.98	34.30	32.87	37.64	34.40	37.58	32.11	42.23	35.02
3150		40.19	27.36	40.61	27.94	41.13	28.74	42.06	28.76	40.71	29.12

Center Freq	Limit	PN-SDNR(dB)									
		LTE Band 13		LTE Band 17		LTE Band 26		LTE Band 38		LTE Band 41	
		2N	8N	2N	8N	2N	8N	2N	8N	2N	8N
400	20	32.64	31.87	33.56	33.23	33.54	32.74	33.07	30.66	33.29	32.86
500		33.85	28.69	35.87	28.69	36.15	35.85	29.83	29.25	29.37	35.68
630		37.58	37.90	37.53	29.30	37.46	34.74	34.58	38.20	39.07	38.19
800		31.30	40.53	39.94	40.57	39.77	40.48	39.68	31.63	39.32	33.50
1000		33.64	42.08	35.68	31.96	40.42	39.69	40.42	32.25	40.41	28.78
1250		28.51	26.89	26.61	28.53	30.57	34.07	31.34	30.28	32.57	33.27
1600		38.97	42.85	43.47	30.03	42.25	41.66	41.41	29.76	40.93	30.81
2000		43.80	44.01	32.80	44.54	34.38	44.13	44.62	30.26	43.44	44.68
2500		36.09	33.90	42.94	33.90	38.17	33.59	42.82	32.09	42.44	31.75
3150		42.07	28.03	41.98	29.49	37.28	28.40	41.32	27.40	38.53	27.95

Center Freq	Limit	PN-SDNR(dB)	
		LTE Band 66	
		2N	8N
400	20	33.75	32.65
500		35.89	35.83
630		32.74	39.29
800		39.71	39.33
1000		42.48	42.40
1250		29.97	29.31
1600		29.44	42.09
2000		31.49	44.09
2500		42.83	33.43
3150		42.10	28.51

2.2 Distortion Test Result for EVS-NB 24.4 kbps and WLAN

Center Freq	Limit	PN-SDNR(dB)					
		2.4G - 802.11b		2.4G - 802.11g		2.4G - 802.11n	
		2N	8N	2N	8N	2N	8N
400	20	32.49	32.72	32.89	33.14	32.98	32.12
500		35.79	35.27	35.54	35.20	35.67	35.10
630		37.98	35.70	35.18	35.71	37.73	34.38
800		38.94	30.75	38.94	38.22	39.01	25.84
1000		41.73	36.38	40.17	31.68	40.84	33.31
1250		33.94	29.29	34.13	29.94	33.98	27.53
1600		41.48	42.29	42.38	27.50	43.46	40.44
2000		41.26	38.35	35.75	42.84	43.24	43.84
2500		42.44	31.41	39.01	30.15	37.28	29.75
3150		38.34	27.13	33.45	26.23	34.06	26.11

2.4 Distortion Test Result for EVB-WB 24.4 kbps and LTE

Center Freq	Limit	PN-SDNR(dB)									
		LTE Band 2		LTE Band 4		LTE Band 5		LTE Band 7		LTE Band 12	
		2N	8N	2N	8N	2N	8N	2N	8N	2N	8N
250	20	28.65	24.74	28.87	27.93	27.85	28.77	27.77	28.82	27.98	28.79
315		32.39	26.23	32.15	31.74	31.90	31.33	31.89	31.44	31.96	31.23
400		33.00	27.14	33.05	32.82	33.41	32.67	33.08	32.79	32.86	32.84
500		34.22	28.78	34.99	34.97	34.19	32.79	33.53	35.08	35.58	33.13
630		35.63	31.90	35.24	35.58	35.25	35.23	33.16	35.30	33.48	34.19
800		38.98	32.76	39.31	39.17	36.33	40.34	40.53	40.60	40.43	35.98
1000		43.73	34.03	43.74	44.01	42.75	42.52	33.47	41.96	34.10	40.83
1250		34.74	34.62	33.50	33.67	33.82	34.65	34.34	27.69	22.81	33.98
1600		38.98	33.90	41.32	42.64	22.27	26.83	26.27	27.36	42.52	25.10
2000		28.04	44.70	39.97	41.20	23.03	44.35	43.89	29.46	24.34	45.00
2500		41.78	25.18	41.17	26.50	34.35	26.30	37.43	26.61	41.98	26.85
3150		40.53	25.22	40.96	27.99	41.12	27.61	36.52	27.62	36.16	27.72
4000		29.67	43.89	40.39	25.31	31.24	28.26	31.04	28.44	39.96	29.04
5000		34.72	27.29	35.54	36.23	30.69	36.91	36.57	37.38	31.91	34.01

Center Freq	Limit	PN-SDNR(dB)									
		LTE Band 13		LTE Band 17		LTE Band 26		LTE Band 38		LTE Band 41	
		2N	8N	2N	8N	2N	8N	2N	8N	2N	8N
250	20	27.98	27.59	29.05	28.84	29.02	28.59	28.77	29.12	29.71	28.41
315		31.77	31.11	31.78	31.42	31.06	31.49	32.07	31.34	31.02	31.47
400		32.85	32.67	32.99	33.04	33.08	32.87	33.05	32.98	33.05	32.84
500		34.26	35.32	35.65	33.35	34.45	33.89	35.08	33.31	34.12	34.96
630		35.29	32.94	35.40	35.57	34.65	35.63	35.64	35.00	35.20	34.26
800		36.34	39.46	37.97	35.39	39.65	35.17	34.51	39.93	39.53	36.12
1000		42.57	41.09	42.70	41.10	42.00	35.66	42.12	30.99	41.36	42.11
1250		33.96	32.17	33.95	28.29	34.59	24.02	22.75	23.09	23.30	23.70
1600		21.67	41.04	22.03	40.86	24.03	42.09	41.41	41.61	40.53	25.64
2000		44.14	27.26	43.41	45.10	25.81	27.29	23.42	43.41	42.16	21.79
2500		41.52	26.52	33.13	26.50	35.77	28.92	31.80	26.27	41.68	26.96
3150		37.35	27.55	40.89	27.60	35.14	28.62	40.30	28.30	32.30	26.31
4000		39.80	28.89	31.81	28.53	39.77	29.07	38.08	26.07	29.01	25.01
5000		32.21	30.91	34.99	37.45	36.71	36.44	34.43	36.78	29.97	28.66

Center Freq	Limit	PN-SDNR(dB)	
		LTE Band 66	
		2N	8N
250	20	29.03	28.60
315		31.77	31.15
400		33.25	32.69
500		34.97	34.80
630		33.87	35.53
800		37.81	33.92
1000		41.94	31.50
1250		24.23	33.13
1600		25.60	27.46
2000		22.29	42.76
2500		41.55	26.37
3150		30.84	27.82
4000		28.35	29.05
5000		27.87	36.57

2.5 Distortion Test Result for EVB-WB 24.4 kbps and WLAN

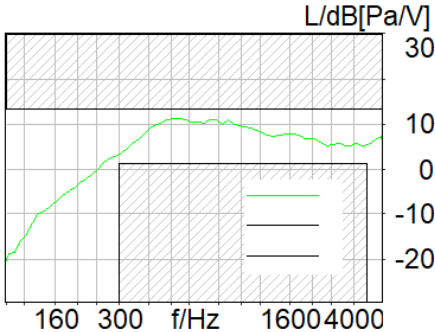
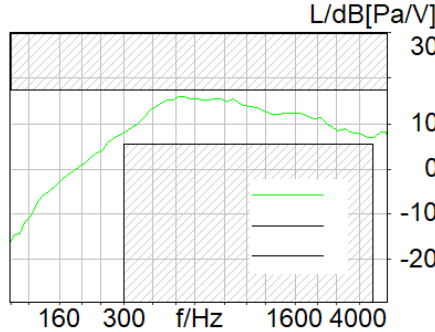
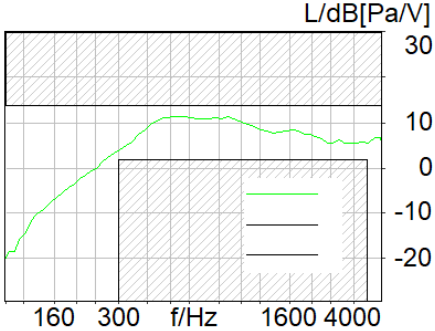
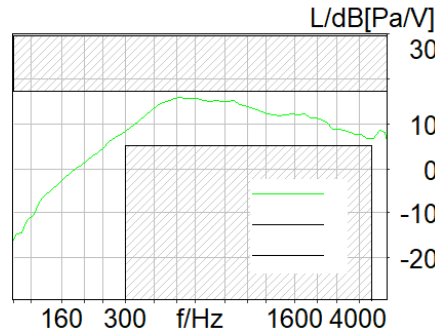
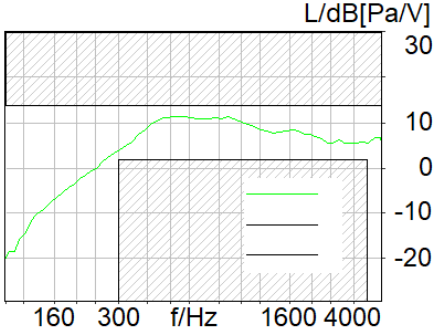
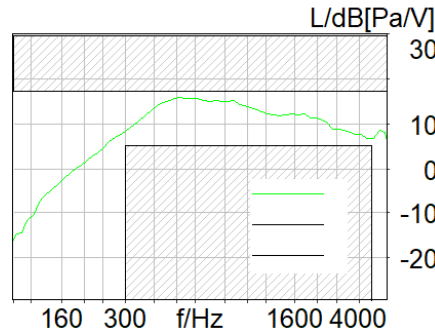
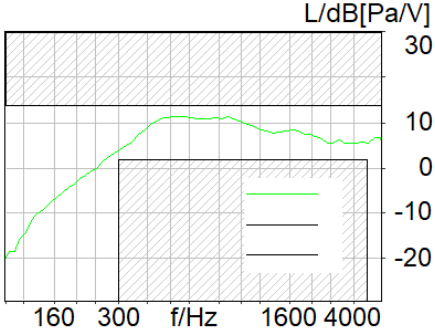
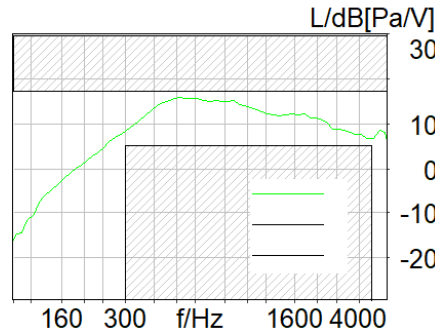
Center Freq	Limit	PN-SDNR(dB)					
		2.4G - 802.11b		2.4G - 802.11g		2.4G - 802.11n	
		2N	8N	2N	8N	2N	8N
250	20	29.28	29.04	29.78	28.96	28.71	29.43
315		32.00	31.36	31.73	31.85	32.03	32.18
400		32.98	32.60	33.07	32.24	33.22	32.73
500		35.22	34.53	35.15	34.33	35.41	32.96
630		34.44	34.77	35.85	33.85	34.89	35.11
800		34.72	39.76	39.99	39.40	39.72	39.56
1000		32.60	33.08	33.94	31.94	41.73	31.52
1250		34.29	23.30	24.35	34.40	24.59	23.48
1600		28.05	43.65	41.87	30.25	42.26	41.18
2000		25.03	43.56	27.66	25.32	43.51	29.48
2500		34.10	25.82	31.87	25.45	33.87	24.72
3150		38.63	26.07	41.48	25.80	40.89	25.50
4000		33.22	27.12	39.20	26.79	27.85	26.53
5000		40.69	37.02	36.59	34.13	32.05	36.33

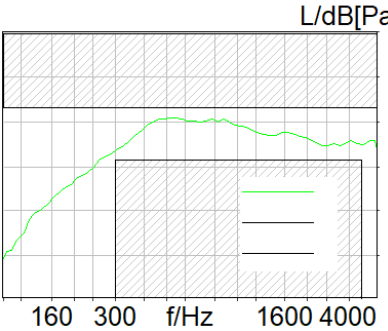
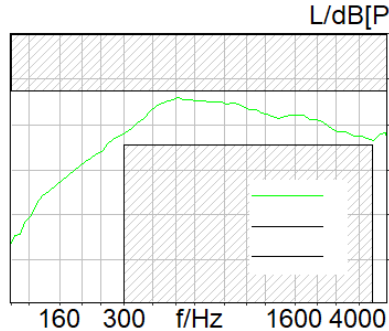
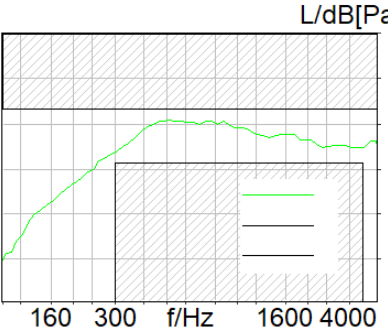
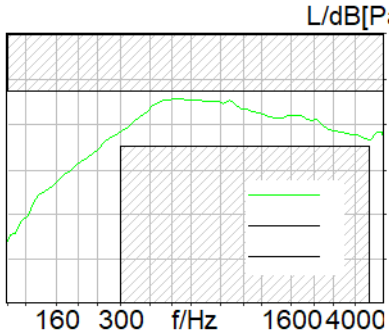
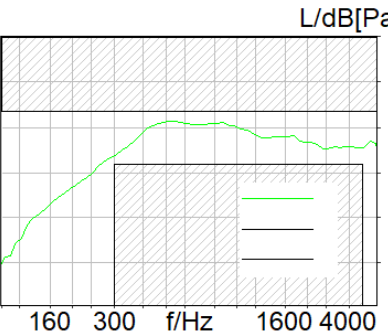
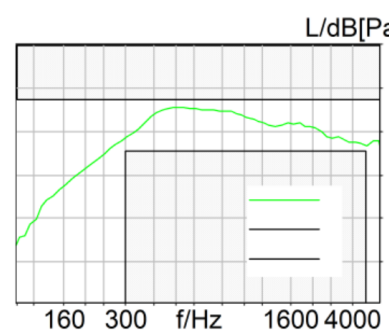
The receive frequency response shall be measured at the DRP in 1/12 octave bands. After translation to the FF, it shall fall between the applicable upper and lower limits.

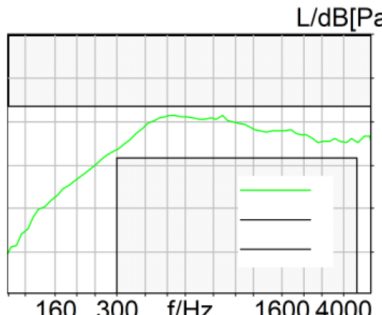
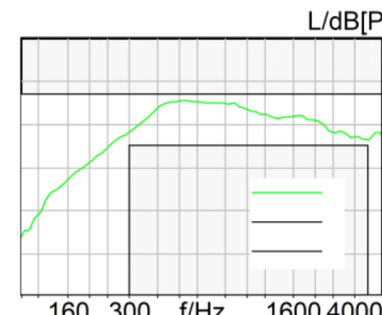
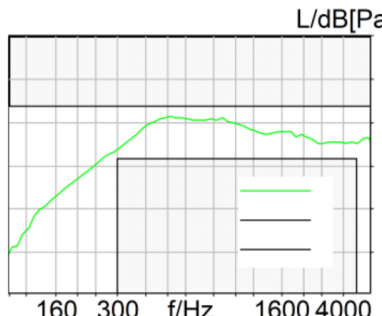
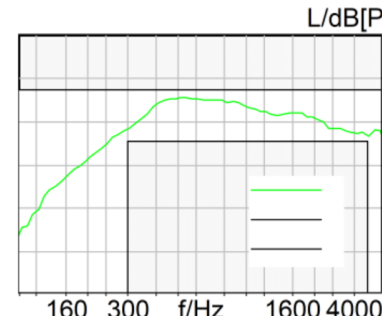
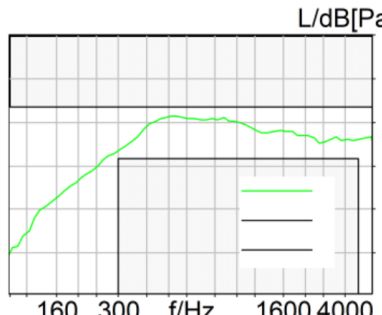
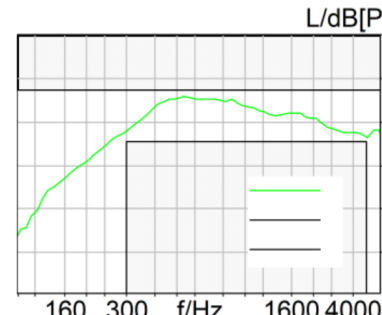
Volume Control: Max, LRP: FF

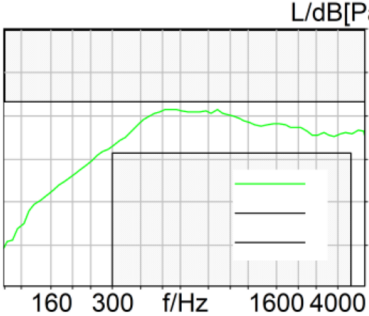
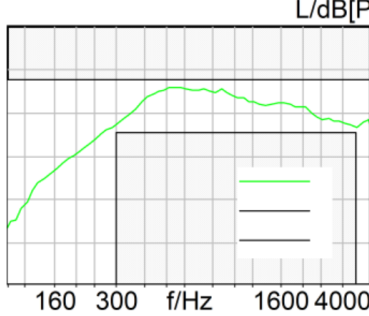
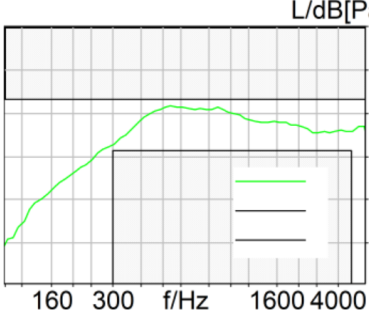
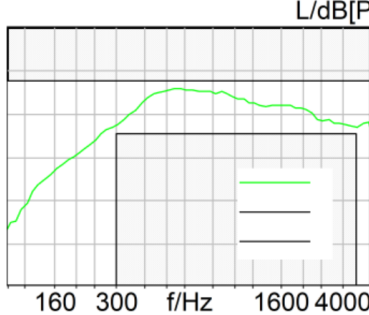
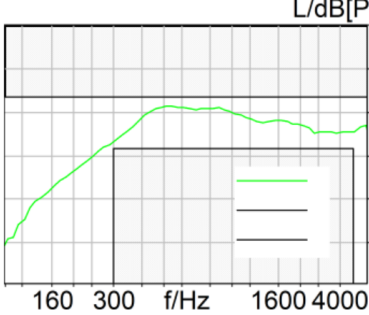
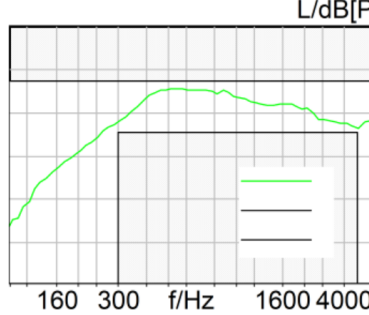
Verdict: Pass

3.1 Frequency Response Graph for EVS-NB 24.4 kbps and LTE

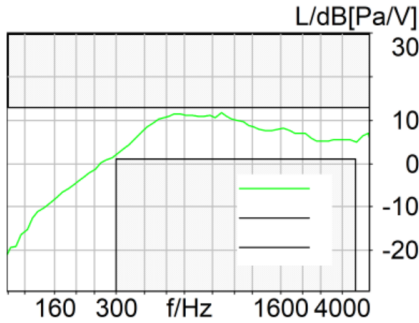
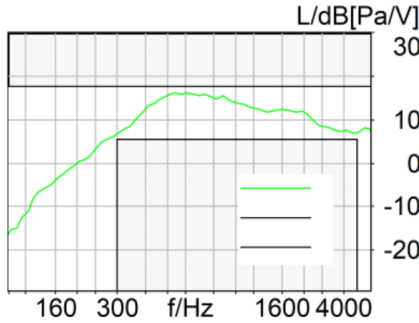
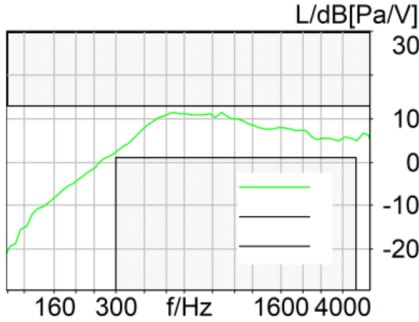
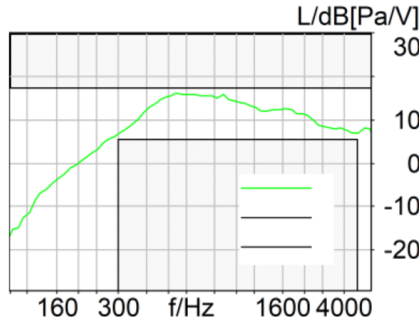
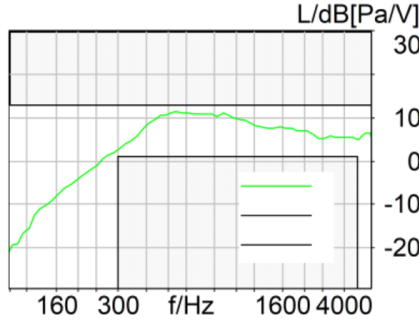
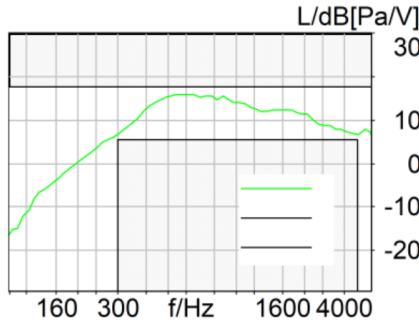
LTE Band	Frequency Response	
	2N	8N
Band 2	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 2.24 dB at 544.4 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.62 dB at 3245.6 Hz Ok
	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 2.17 dB at 873.9 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.42 dB at 514.4 Hz Ok
Band 4	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 2.17 dB at 873.9 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.42 dB at 514.4 Hz Ok
	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 2.17 dB at 873.9 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.42 dB at 514.4 Hz Ok

Band 5	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 2.43 dB at 514.4 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.61 dB at 514.4 Hz Ok
Band 7	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 2.51 dB at 514.4 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.59 dB at 544.4 Hz Ok
Band 12	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 2.24 dB at 544.4 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.78 dB at 514.4 Hz Ok

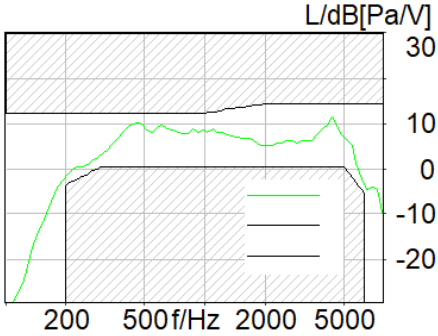
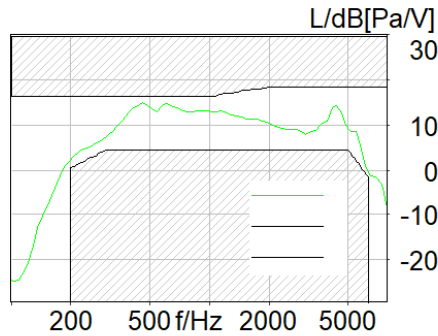
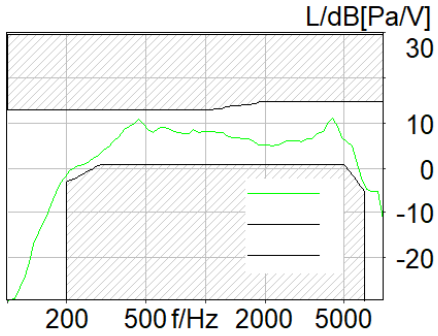
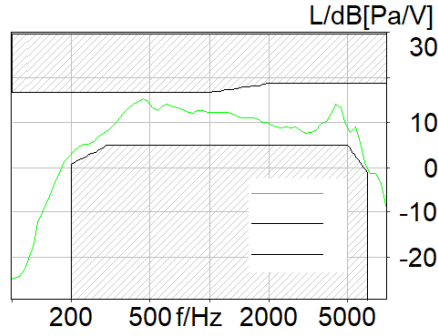
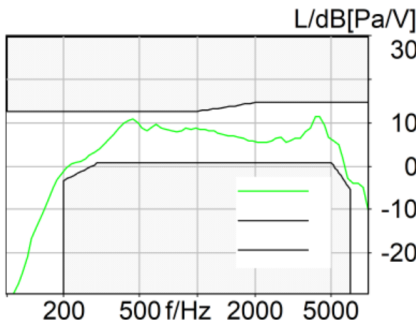
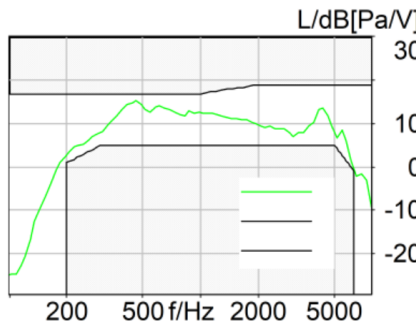
Band 13	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 2.21 dB at 514.4 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.55 dB at 514.4 Hz Ok
Band 17	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 2.35 dB at 514.4 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.76 dB at 514.4 Hz Ok
Band 26	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 2.11 dB at 544.4 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.69 dB at 3245.6 Hz Ok

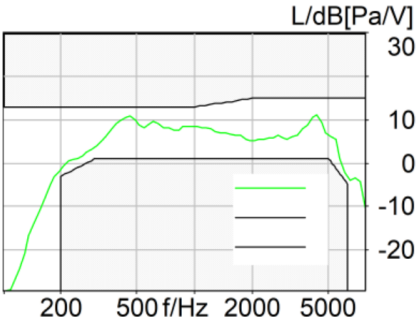
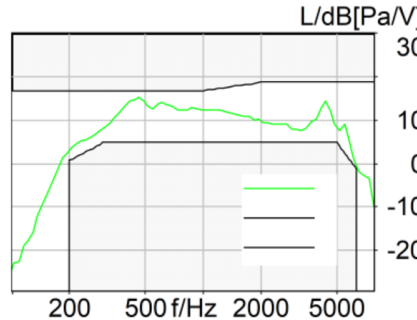
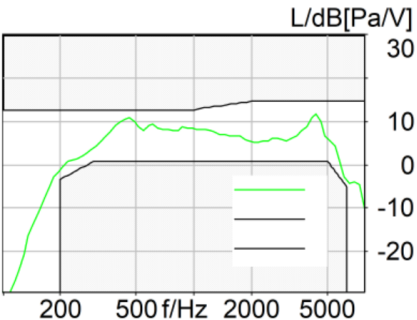
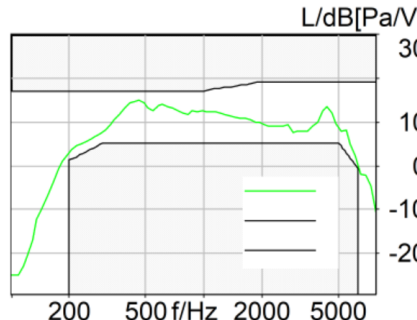
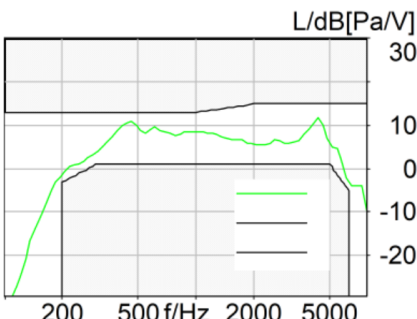
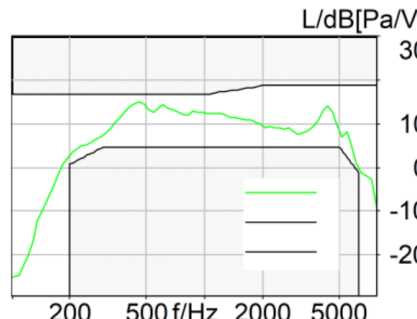
Band 38	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 1.77 dB at 873.9 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.67 dB at 544.4 Hz Ok
Band 41	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 1.68 dB at 544.4 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.79 dB at 3245.6 Hz Ok
Band 66	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 1.99 dB at 544.4 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.63 dB at 544.4 Hz Ok

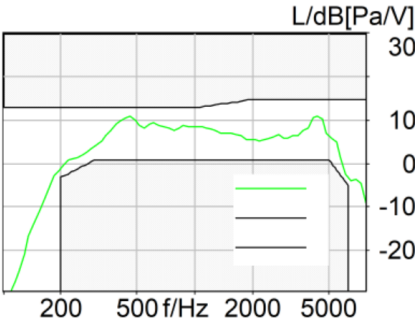
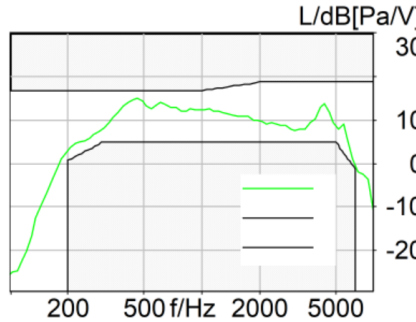
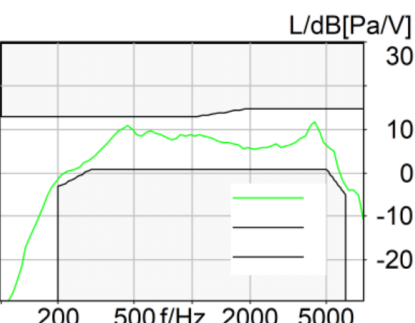
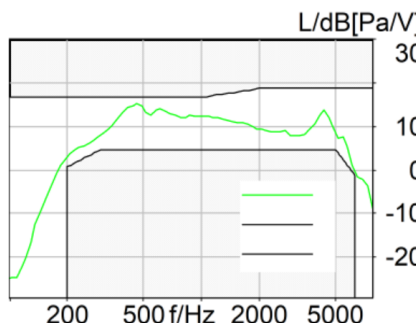
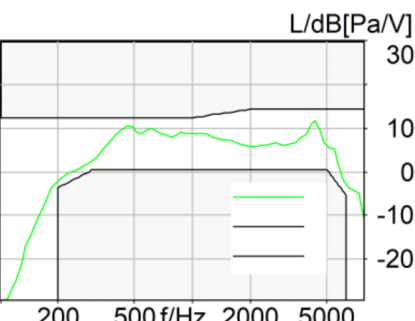
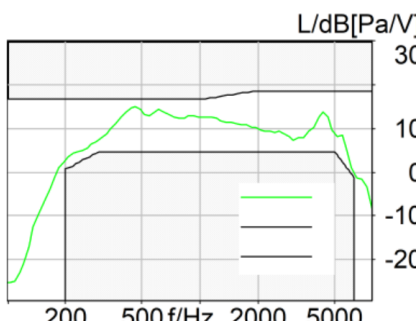
3.2 Frequency Response Graph for EVS-NB 24.4 kbps and WLAN

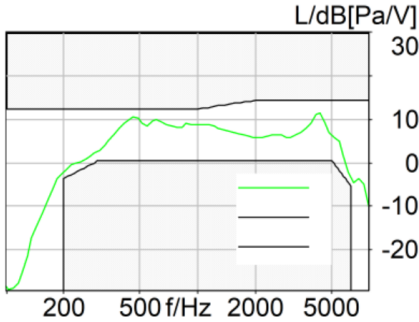
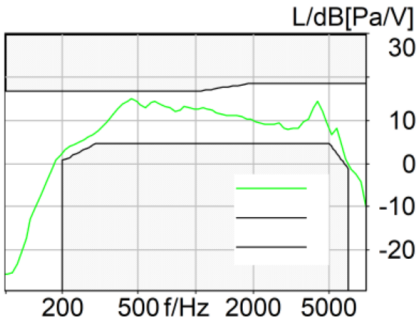
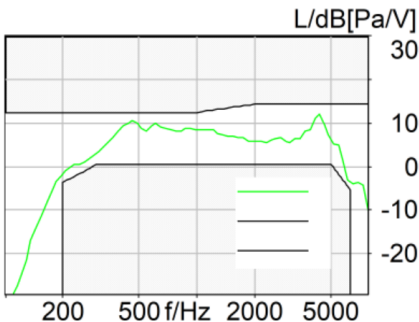
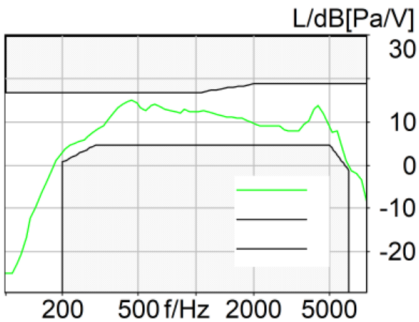
WLAN Band	Frequency Response	
	2N	8N
2.4G 802.11b	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 1.34 dB at 873.9 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.45 dB at 544.4 Hz Ok
2.4G 802.11g	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 1.50 dB at 873.9 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.42 dB at 544.4 Hz Ok
2.4G 802.11n	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 1.67 dB at 544.4 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.52 dB at 576.7 Hz Ok

3.3 Frequency Response Graph for EVS-WB 24.4 kbps and LTE

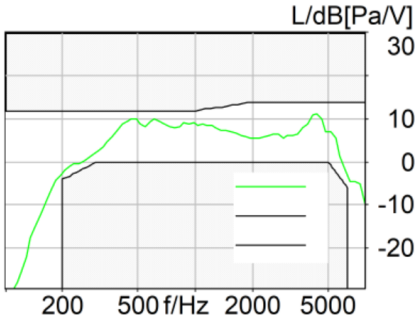
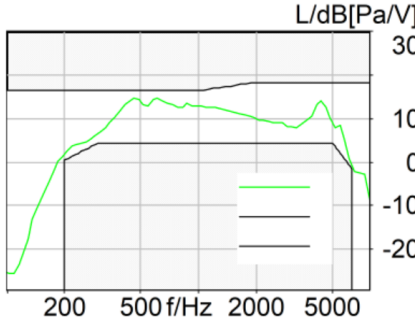
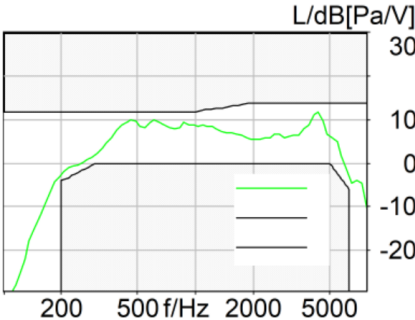
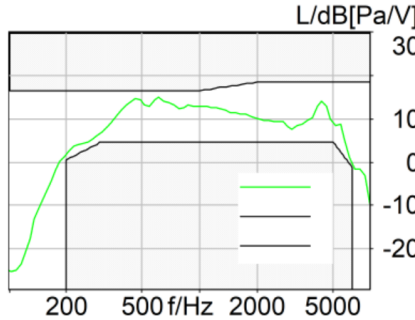
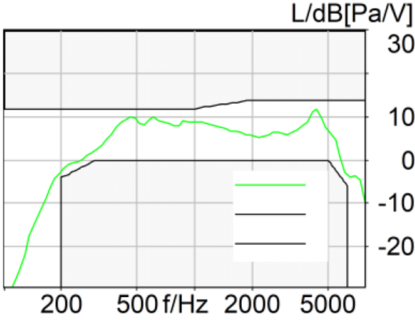
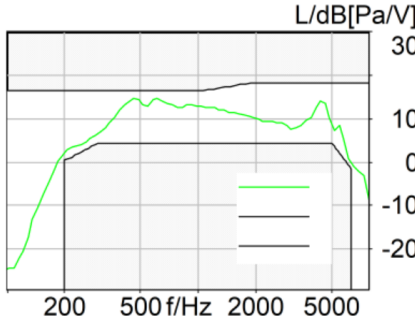
LTE Band	Frequency Response	
	2N	8N
Band 2	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 2.14 dB at 462.0 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.47 dB at 6117.2 Hz Ok
Band 4	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 2.03 dB at 462.0 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.48 dB at 462.0 Hz Ok
Band 5	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 1.77 dB at 462.0 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.65 dB at 462.0 Hz Ok

Band 7	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 2.03 dB at 462.0 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.59 dB at 462.0 Hz Ok
Band 12	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 1.79 dB at 462.0 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 2.13 dB at 462.0 Hz Ok
Band 13	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 2.10 dB at 462.0 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.60 dB at 462.0 Hz Ok

Band 17	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 1.95 dB at 462.0 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.65 dB at 462.0 Hz Ok
Band 26	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 2.06 dB at 462.0 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.52 dB at 462.0 Hz Ok
Band 38	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 1.84 dB at 462.0 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.66 dB at 462.0 Hz Ok

Band 41	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 1.83 dB at 462.0 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.59 dB at 6117.2 Hz Ok
Band 66	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 1.83 dB at 462.0 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.62 dB at 462.0 Hz Ok

3.4 Frequency Response Graph for EVS-WB 24.4 kbps and WLAN

WLAN Band	Frequency Response	
	2N	8N
2.4G 802.11b	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 1.85 dB at 462.0 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.59 dB at 611.7 Hz Ok
2.4G 802.11g	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 1.80 dB at 462.0 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.59 dB at 611.7 Hz Ok
2.4G 802.11n	<u>5.3 Frequency Response 2N FF</u>  Absolute minimal distance 1.84 dB at 243.2 Hz Ok	<u>5.3 Frequency Response 8N FF</u>  Absolute minimal distance 1.61 dB at 611.7 Hz Ok