

Total Radiated Power and Total Isotropic Sensitivity Spherical Pattern Measurement.

NETRADYNE DRI-128 **PTCRB** REPORT

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CETECOM Inc.

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Manufacturer	Netradyne
Model	DRI-128
CTIA Request #	64871
Serial Number/ESN/IMEI	356207070042024
FCC ID Number	2AM8R-DRI128
Hardware Version	Rev D
Software Version	Module firmware 7.12.09/Device SW:0.2.1
Configuration of Primary Mechanical Mode	N/A
CTIA Test Plan Revision	3.7
Test date	7/20/2017 to 7/25/2017, 2018/01/29

IMEI	CATL/CHAMBER USED	Cellular Radio Modes	Band(s)	Test Types(s)	Test Conditions
356207070042024	CETECOM OTA3	UMTS / LTE	4 / 5 / 12 / 25	TRP/TIS/IC	FS

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1 SUMMATION TEST REPORT – WCDMA

Band	Channel	Frequency (MHz)	Conducted Power (dBm)	TRP (dBm)					NHPRP ± 45 (dBm)					NHPRP ± 30 (dBm)				
				FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR
UMTS 850	4132	826.4	N/A	13.11	-	-	-	-	11.44	-	-	-	-	9.82	-	-	-	-
	4183	836.6	N/A	12.79	-	-	-	-	11.10	-	-	-	-	9.47	-	-	-	-
	4233	846.6	N/A	12.52	-	-	-	-	10.80	-	-	-	-	9.13	-	-	-	-

Band	Channel	Frequency (MHz)	Conducted Power	TRP(dBm)					NHPRP ± 45 (dBm)					NHPRP ± 30 (dBm)				
				FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR
UMTS 1900	9262	1852.4	N/A	18.99	-	-	-	-	17.43	-	-	-	-	15.39	-	-	-	-
	9400	1880.0	N/A	18.99	-	-	-	-	17.44	-	-	-	-	15.39	-	-	-	-
	9538	1907.6	N/A	19.01	-	-	-	-	17.46	-	-	-	-	15.41	-	-	-	-

Band	Channel	Frequency (MHz)	Conducted Power	TRP(dBm)					NHPRP ± 45 (dBm)					NHPRP ± 30 (dBm)				
				FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR
UMTS 2100 /1700	1312	1712.4	N/A	21.25	-	-	-	-	19.58	-	-	-	-	17.84	-	-	-	-
	1413	1732.6	N/A	21.17	-	-	-	-	19.56	-	-	-	-	17.79	-	-	-	-
	1513	1752.6	N/A	21.17	-	-	-	-	19.64	-	-	-	-	17.93	-	-	-	-

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Antenna “a”

Band	Channel	Frequency (MHz)	Conducted Sensitivity (dBm)	TIS (dBm)					NHPIS ± 45 (dBm)					NHPIS ± 30 (dBm)				
				FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR
UMTS 850	4357	871.4	N/A	-92.13	--	--	--	--	-90.56	--	--	--	--	-88.77	--	--	--	--
	4408	881.6	N/A	-89.59	--	--	--	--	-88.09	--	--	--	--	-86.35	--	--	--	--
	4458	891.6	N/A	-89.24	--	--	--	--	-87.81	--	--	--	--	-86.14	--	--	--	--

Antenna “a”

Band	Channel	Frequency (MHz)	Conducted Sensitivity (dBm)	TIS (dBm)					NHPIS ± 45 (dBm)					NHPIS ± 30 (dBm)				
				FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR
UMTS 1900	9662	1932.4	N/A	-106.49	--	--	--	--	-105.17	--	--	--	--	-103.19	--	--	--	--
	9800	1960.0	N/A	-106.79	--	--	--	--	-105.38	--	--	--	--	-103.39	--	--	--	--
	9938	1987.6	N/A	-106.67	--	--	--	--	-105.29	--	--	--	--	-103.35	--	--	--	--

Antenna “a”

Band	Channel	Frequency (MHz)	Conducted Sensitivity (dBm)	TIS (dBm)					NHPIS ± 45 (dBm)					NHPIS ± 30 (dBm)				
				FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR
UMTS 2100 /1700	1537	2112.4	N/A	-108.63	--	--	--	--	-107.54	--	--	--	--	-106.01	--	--	--	--
	1638	2132.6	N/A	-108.24	--	--	--	--	-107.13	--	--	--	--	-105.57	--	--	--	--
	1738	2152.6	N/A	-108.41	--	--	--	--	-107.26	--	--	--	--	-105.68	--	--	--	--

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Antenna “b”

Band	Channel	Frequency (MHz)	Conducted Sensitivity (dBm)	TIS (dBm)					NHPIS ± 45 (dBm)					NHPIS ± 30 (dBm)				
				FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR
UMTS 850	4357	871.4	N/A	-86.05	--	--	--	--	-84.77	--	--	--	--	-83.14	--	--	--	--
	4408	881.6	N/A	-85.32	--	--	--	--	-84.06	--	--	--	--	-82.42	--	--	--	--
	4458	891.6	N/A	-84.15	--	--	--	--	-82.77	--	--	--	--	-81.09	--	--	--	--

Antenna “b”

Band	Channel	Frequency (MHz)	Conducted Sensitivity (dBm)	TIS (dBm)					NHPIS ± 45 (dBm)					NHPIS ± 30 (dBm)				
				FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR
UMTS 1900	9662	1932.4	N/A	-105.69	--	--	--	--	-104.12	--	--	--	--	-101.50	--	--	--	--
	9800	1960.0	N/A	-105.87	--	--	--	--	-104.37	--	--	--	--	-103.11	--	--	--	--
	9938	1987.6	N/A	-106.01	--	--	--	--	-104.60	--	--	--	--	-102.24	--	--	--	--

Antenna “b”

Band	Channel	Frequency (MHz)	Conducted Sensitivity (dBm)	TIS (dBm)					NHPIS ± 45 (dBm)					NHPIS ± 30 (dBm)				
				FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR
UMTS 2100 /1700	1537	2112.4	N/A	-104.67	--	--	--	--	-103.39	--	--	--	--	-101.50	--	--	--	--
	1638	2132.6	N/A	-106.13	--	--	--	--	-104.93	--	--	--	--	-103.11	--	--	--	--
	1738	2152.6	N/A	-105.27	--	--	--	--	-104.07	--	--	--	--	-102.24	--	--	--	--

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2 SUMMATION TEST REPORT – LTE

Band	Channel	Frequency (MHz)	Conducted Power (dBm)	TRP (dBm)					NHPRP ± 45 (dBm)					NHPRP ± 30 (dBm)				
				FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR
LTE FDD 4	20000	1715.0	N/A	20.88	-	-	-	-	19.05	-	-	-	-	17.19	-	-	-	-
	20175	1732.5	N/A	19.28	-	-	-	-	17.51	-	-	-	-	15.72	-	-	-	-
	20350	1750.0	N/A	20.36	-	-	-	-	18.76	-	-	-	-	17.10	-	-	-	-

Band	Channel	Frequency (MHz)	Conducted Power (dBm)	TRP (dBm)					NHPRP ± 45 (dBm)					NHPRP ± 30 (dBm)				
				FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR
LTE FDD 5	20450	829.0	N/A	12.02	-	-	-	-	9.97	-	-	-	-	8.27	-	-	-	-
	20525	836.5	N/A	11.84	-	-	-	-	9.80	-	-	-	-	8.09	-	-	-	-
	20600	844.0	N/A	11.25	-	-	-	-	9.08	-	-	-	-	7.29	-	-	-	-

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Band	Channel	Frequency (MHz)	Conducted Power (dBm)	TRP (dBm)					NHPRP ± 45 (dBm)					NHPRP ± 30 (dBm)				
				FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR
LTE FDD 12	23035	699.97	N/A	17.91	--	--	--	--	16.46	--	--	--	--	14.82	--	--	--	--
	23095	707.50	N/A	17.88	--	--	--	--	15.96	--	--	--	--	14.30	--	--	--	--
	23155	715.03	N/A	13.75	--	--	--	--	12.12	--	--	--	--	10.61	--	--	--	--

Band	Channel	Frequency (MHz)	Conducted Power (dBm)	TRP (dBm)					NHPRP ± 45 (dBm)					NHPRP ± 30 (dBm)				
				FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR
LTE FDD 25	18650	1851.6	N/A	18.33	--	--	--	--	16.94	--	--	--	--	15.20	--	--	--	--
	18900	1880.0	N/A	18.60	--	--	--	--	17.12	--	--	--	--	15.31	--	--	--	--
	19150	1908.4	N/A	18.82	--	--	--	--	17.02	--	--	--	--	14.90	--	--	--	--

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Antenna “a”

Band	Channel	Frequency (MHz)	Conducted Sensitivity (dBm)	TIS (dBm)					NHPIS ± 45 (dBm)					NHPIS ± 30 (dBm)				
				FS	HL	HR	BHHL	BHR	FS	HL	HR	BHHL	BHR	FS	HL	HR	BHHL	BHR
LTE FDD 4	2000	2115.0	N/A	-96.57	--	--	--	--	-95.23	--	--	--	--	-93.58	--	--	--	--
	2175	2132.5	N/A	-96.89	--	--	--	--	-95.50	--	--	--	--	-93.83	--	--	--	--
	2350	2150.0	N/A	-96.19	--	--	--	--	-94.77	--	--	--	--	-93.09	--	--	--	--

Antenna “a”

Band	Channel	Frequency (MHz)	Conducted Sensitivity (dBm)	TIS (dBm)					NHPIS ± 45 (dBm)					NHPIS ± 30 (dBm)				
				FS	HL	HR	BHHL	BHR	FS	HL	HR	BHHL	BHR	FS	HL	HR	BHHL	BHR
LTE FDD 5	2450	874	N/A	-85.92	--	--	--	--	-84.27	--	--	--	--	-82.71	--	--	--	--
	2525	881.5	N/A	-85.69	--	--	--	--	-84.02	--	--	--	--	-82.46	--	--	--	--
	2600	889	N/A	-84.82	--	--	--	--	-83.09	--	--	--	--	-81.48	--	--	--	--

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Antenna “a”

Band	Channel	Frequency (MHz)	Conducted Sensitivity (dBm)	TIS (dBm)					NHPIS ± 45 (dBm)					NHPIS ± 30 (dBm)				
				FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR
LTE FDD 12	5035	731.5	N/A	-89.08	-	-	-	-	-87.60	-	-	-	-	-85.91	-	-	-	-
	5095	737.5	N/A	-92.90	-	-	-	-	-91.19	-	-	-	-	-89.50	-	-	-	-
	5155	743.5	N/A	-91.11	-	-	-	-	-89.33	-	-	-	-	-87.60	-	-	-	-

Antenna “a”

Band	Channel	Frequency (MHz)	Conducted Sensitivity (dBm)	TIS (dBm)					NHPIS ± 45 (dBm)					NHPIS ± 30 (dBm)				
				FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR
LTE FDD 25	8065	1932.5	N/A	-96.12	-	-	-	-	-95.04	-	-	-	-	-93.77	-	-	-	-
	8365	1962.5	N/A	-96.94	-	-	-	-	-95.89	-	-	-	-	-94.58	-	-	-	-
	8665	1992.5	N/A	-96.68	-	-	-	-	-95.63	-	-	-	-	-94.24	-	-	-	-

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Antenna “b”

Band	Channel	Frequency (MHz)	Conducted Sensitivity (dBm)	TIS (dBm)					NHPIS ± 45 (dBm)					NHPIS ± 30 (dBm)				
				FS	HL	HR	BHHL	BHR	FS	HL	HR	BHHL	BHR	FS	HL	HR	BHHL	BHR
LTE FDD 4	2000	2115.0	N/A	-96.85	--	--	--	--	-95.53	--	--	--	--	-93.89	--	--	--	--
	2175	2132.5	N/A	-97.27	--	--	--	--	-95.96	--	--	--	--	-94.34	--	--	--	--
	2350	2150.0	N/A	-96.59	--	--	--	--	-95.32	--	--	--	--	-93.72	--	--	--	--

Antenna “b”

Band	Channel	Frequency (MHz)	Conducted Sensitivity (dBm)	TIS (dBm)					NHPIS ± 45 (dBm)					NHPIS ± 30 (dBm)				
				FS	HL	HR	BHHL	BHR	FS	HL	HR	BHHL	BHR	FS	HL	HR	BHHL	BHR
LTE FDD 5	2450	874	N/A	-86.02	--	--	--	--	-84.14	--	--	--	--	-82.36	--	--	--	--
	2525	881.5	N/A	-85.71	--	--	--	--	-83.81	--	--	--	--	-82.06	--	--	--	--
	2600	889	N/A	-84.87	--	--	--	--	-82.95	--	--	--	--	-81.17	--	--	--	--

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Antenna “b”

Band	Channel	Frequency (MHz)	Conducte d Sensitivit y (dBm)	TIS (dBm)					NHPIS ± 45 (dBm)					NHPIS ± 30 (dBm)				
				FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR
LTE FDD 12	5035	731.5	N/A	-91.35	--	--	--	--	-89.48	--	--	--	--	-87.66	--	--	--	--
	5095	737.5	N/A	-92.98	--	--	--	--	-91.09	--	--	--	--	-89.29	--	--	--	--
	5155	743.5	N/A	-91.32	--	--	--	--	-89.76	--	--	--	--	-87.76	--	--	--	--

Antenna “b”

Band	Channel	Frequency (MHz)	Conducted Sensitivity (dBm)	TIS (dBm)					NHPIS ± 45 (dBm)					NHPIS ± 30 (dBm)				
				FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR	FS	HL	HR	BHHL	BHHR
LTE FDD 25	8065	1932.5	N/A	-97.49	--	--	--	--	-96.26	--	--	--	--	-94.84	--	--	--	--
	8365	1962.5	N/A	-98.34	--	--	--	--	-97.07	--	--	--	--	-95.66	--	--	--	--
	8665	1992.5	N/A	-97.73	--	--	--	--	-96.38	--	--	--	--	-94.95	--	--	--	--

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3 INTERMEDIATE CHANNEL RELATIVE SENSITIVITY – WCDMA

Antenna “a” only and Antenna “b” only

UMTS 850	Channel	FS	BHHR
	4357	PASS	--
	4360	PASS	--
	4372	PASS	--
	4384	PASS	--
	4396	PASS	--
	4408	PASS	--
	4420	PASS	--
	4432	PASS	--
	4444	PASS	--
	4456	PASS	--
	4458	PASS	--

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Antenna “a” only and Antenna “b” only

UMTS 1900	Channel	FS	BHHR
	9662	PASS	--
	9668	PASS	--
	9680	PASS	--
	9692	PASS	--
	9704	PASS	--
	9716	PASS	--
	9728	PASS	--
	9740	PASS	--
	9752	PASS	--
	9764	PASS	--
	9776	PASS	--
	9788	PASS	--
	9800	PASS	--
	9812	PASS	--
	9824	PASS	--
	9836	PASS	--
	9848	PASS	--
	9860	PASS	--
	9872	PASS	--
	9884	PASS	--
	9896	PASS	--
	9908	PASS	--
	9920	PASS	--
	9932	PASS	--
	9938	PASS	--

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CETECOM Inc. is a Delaware Corporation with Corporation number: 2113686

Antenna “a” only and Antenna “b” only

UMTS 2100	Channel	FS	BHHR
	1537	PASS	--
	1542	PASS	--
	1554	PASS	--
	1566	PASS	--
	1578	PASS	--
	1590	PASS	--
	1602	PASS	--
	1614	PASS	--
	1626	PASS	--
	1638	PASS	--
	1650	PASS	--
	1662	PASS	--
	1674	PASS	--
	1686	PASS	--
	1698	PASS	--
	1710	PASS	--
	1722	PASS	--
	1734	PASS	--
	1738	PASS	--

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4 INTERMEDIATE CHANNEL RELATIVE SENSITIVITY – LTE

Antenna “a” only and Antenna “b” only

Band	Channel Bandwidth (MHz)	Channel	Frequency (MHz)	FS EIS (dBm)	BHHR EIS (dBm)
4	10	2000	2115	-97.21	--
4	10	2090	2124	-97.06	--
4	10	2175	2132.5	-97.19	--
4	10	2260	2141	-96.84	--
4	10	2350	2150	-95.81	--
12	5	5035	731.5	-91.59	--
12	5	5065	734.5	-90.30	--
12	5	5095	737.5	-90.89	--
12	5	5125	740.5	-89.11	--
12	5	5155	743.5	-87.30	--
25	5	8065	1932.5	-101.01	--
25	5	8105	1936.5	-102.00	--
25	5	8145	1940.5	-101.97	--
25	5	8185	1944.5	-101.97	--
25	5	8225	1948.5	-101.48	--
25	5	8265	1952.5	-102.02	--
25	5	8305	1956.5	-102.00	--
25	5	8345	1960.5	-101.98	--

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25	5	8365	1962.5	-101.99	--
25	5	8385	1964.5	-102.02	--
25	5	8425	1968.5	-101.52	--
25	5	8465	1972.5	-101.54	--
25	5	8505	1976.5	-101.56	--
25	5	8545	1980.5	-102.04	--
25	5	8585	1984.5	-102.57	--
25	5	8625	1988.5	-102.09	--
25	5	8665	1992.5	-101.60	--

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5 MINIMUM TRP LEVEL REQUIREMENT FOR THE PRIMARY MECHANICAL MODE – WCDMA

Device Held Up to Head for Voice (Yes/No)	Device Power Class	Channel	Frequency (MHz)	UMTS 850									BHHL			BHHR		
				FS			HL			HR			BHHL			BHHR		
				Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info
No	3	4132	826.40	17	13.11	Fail	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--
		4183	836.60		12.79	Fail		--	--		--	--		--	--		--	--
		4233	846.60		12.52	Fail		--	--		--	--		--	--		--	--
	4	4132	826.40	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--
		4183	836.60		--	--		--	--		--	--		--	--		--	--
		4233	846.60		--	--		--	--		--	--		--	--		--	--
Yes	3	4132	826.40	TBD	--	--	N/A	--	--	N/A	--	--	N/A	--	--	N/A	--	--
		4183	836.60		--	--		--	--		--	--		--	--		--	--
		4233	846.60		--	--		--	--		--	--		--	--		--	--
	4	4132	826.40	TBD	--	--	N/A	--	--	N/A	--	--	N/A	--	--	N/A	--	--
		4183	836.60		--	--		--	--		--	--		--	--		--	--
		4233	846.60		--	--		--	--		--	--		--	--		--	--

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				UMTS 1900														
Device Held Up to Head for Voice (Yes/No)	Device Power Class	Channel	Frequency (MHz)	FS			HL			HR			BHHL			BHHR		
				Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info
No	3	9262	1852.40	18.5	18.99	Pass	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--
		9400	1880.00		18.99	Pass		--	--		--	--		--	--			
		9538	1907.60		19.01	Pass		--	--		--	--		--	--			
	4	9262	1852.40	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--
		9400	1880.00		--	--		--	--		--	--		--	--			
		9538	1907.60		--	--		--	--		--	--		--	--			
Yes	3	9262	1852.40	TBD	--	--	N/A	--	--	N/A	--	--	N/A	--	--	N/A	--	--
		9400	1880.00		--	--		--	--		--	--		--	--			
		9538	1907.60		--	--		--	--		--	--		--	--			
	4	9262	1852.40	TBD	--	--	N/A	--	--	N/A	--	--	N/A	--	--	N/A	--	--
		9400	1880.00		--	--		--	--		--	--		--	--			
		9538	1907.60		--	--		--	--		--	--		--	--			

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Device Held Up to Head for Voice (Yes/No)				UMTS 2100/1700														
Device Power Class	Channel	Frequency (MHz)	FS			HL			HR			BHHL			BHHR			
			Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	
No	3	1312	1712.40	19.5	21.25	Pass	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--
		1413	1732.60		21.17	Pass		--	--		--	--						
		1513	1752.60		21.17	Pass		--	--		--	--						
	4	1312	1712.40	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--
		1413	1732.60		--	--		--	--		--	--						
		1513	1752.60		--	--		--	--		--	--						
Yes	3	1312	1712.40	TBD	--	--	N/A	--	--	N/A	--	--	N/A	--	--	N/A	--	--
		1413	1732.60		--	--		--	--		--	--						
		1513	1752.60		--	--		--	--		--	--						
	4	1312	1712.40	TBD	--	--	N/A	--	--	N/A	--	--	N/A	--	--	N/A	--	--
		1413	1732.60		--	--		--	--		--	--						
		1513	1752.60		--	--		--	--		--	--						

6 MINIMUM TRP LEVEL REQUIREMENT FOR THE PRIMARY MECHANICAL MODE – LTE

No limits defined as of CTIA Test Plan for Wireless Device Over the Air Performance, June 2017, Revision 3.7

Informational only

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7 MAXIMUM TIS LEVEL REQUIREMENT FOR THE PRIMARY MECHANICAL MODE – WCDMA

				UMTS 850 Antenna “A”														
Device Held Up to Head for Voice (Yes/No)	Device Power Class	Channel	Frequency (MHz)	FS			HL			HR			BHHL			BHHR		
				Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info
No	3	4357	871.40	-100	-92.13	Fail	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--
		4408	881.60		-89.59	Fail		--	--		--	--						
		4458	891.60		-89.24	Fail		--	--		--	--						
	4	4357	871.40	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--
		4408	881.60		--	--		--	--		--	--						
		4458	891.60		--	--		--	--		--	--						
Yes	3	4357	871.40	TBD	--	--	N/A	--	--	N/A	--	--	N/A	--	--	N/A	--	--
		4408	881.60		--	--		--	--		--	--						
		4458	891.60		--	--		--	--		--	--						
	4	4357	871.40	TBD	--	--	N/A	--	--	N/A	--	--	N/A	--	--	N/A	--	--
		4408	881.60		--	--		--	--		--	--						
		4458	891.60		--	--		--	--		--	--						

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UMTS 1900 Antenna "A"																	
Device Held Up to Head for Voice (Yes/No)	Device Power Class	Channel	FS			HL			HR			BHHL			BHHR		
			Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info
No	3	9662	-102	-106.49	Pass	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--
		9800		-106.79	Pass		--	--		--	--		--	--		--	--
		9938		-106.67	Pass		--	--		--	--		--	--		--	--
	4	9662	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--
		9800		--	--		--	--		--	--		--	--		--	--
		9938		--	--		--	--		--	--		--	--		--	--
Yes	3	9662	TBD	--	--	N/A	--	--	N/A	--	--	N/A	--	--	N/A	--	--
		9800		--	--		--	--		--	--		--	--		--	--
		9938		--	--		--	--		--	--		--	--		--	--
	4	9262	TBD	--	--	N/A	--	--	N/A	--	--	N/A	--	--	N/A	--	--
		9400		--	--		--	--		--	--		--	--		--	--
		9538		--	--		--	--		--	--		--	--		--	--

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UMTS 2100/1700 Antenna "A"																	
Device Held Up to Head for Voice (Yes/No)	Device Power Class	Channel	FS			HL			HR			BHHL			BHHR		
			Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info
No	3	1537	-105	-108.63	Pass	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--
		1638		-108.24	Pass		--	--		--	--		--	--		--	--
		1738		-108.41	Pass		--	--		--	--		--	--		--	--
	4	1537	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--
		1638		--	--		--	--		--	--		--	--		--	--
		1738		--	--		--	--		--	--		--	--		--	--
Yes	3	1537	TBD	--	--	N/A	--	--	N/A	--	--	N/A	--	--	N/A	--	--
		1638		--	--		--	--		--	--		--	--		--	--
		1738		--	--		--	--		--	--		--	--		--	--
	4	1537	TBD	--	--	N/A	--	--	N/A	--	--	N/A	--	--	N/A	--	--
		1638		--	--		--	--		--	--		--	--		--	--
		1738		--	--		--	--		--	--		--	--		--	--

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				UMTS 850 Antenna "B"														
Device Held Up to Head for Voice (Yes/No)	Device Power Class	Channel	Frequency (MHz)	FS			HL			HR			BHHL			BHHR		
				Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info
No	3	4357	871.40	TBD	-86.05	Info	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--
		4408	881.60		-85.32	Info		--	--		--	--		--	--		--	--
		4458	891.60		-84.15	Info		--	--		--	--		--	--		--	--
	4	4357	871.40	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--
		4408	881.60		--	--		--	--		--	--		--	--		--	--
		4458	891.60		--	--		--	--		--	--		--	--		--	--
Yes	3	4357	871.40	TBD	--	--	N/A	--	--	N/A	--	--	N/A	--	--	N/A	--	--
		4408	881.60		--	--		--	--		--	--		--	--		--	--
		4458	891.60		--	--		--	--		--	--		--	--		--	--
	4	4357	871.40	TBD	--	--	N/A	--	--	N/A	--	--	N/A	--	--	N/A	--	--
		4408	881.60		--	--		--	--		--	--		--	--		--	--
		4458	891.60		--	--		--	--		--	--		--	--		--	--

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UMTS 1900 Antenna "B"																	
Device Held Up to Head for Voice (Yes/No)	Device Power Class	Channel	FS			HL			HR			BHHL			BHHR		
			Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info
No	3	9662	TBD	-105.69	Info	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--
		9800		-105.87	Info		--	--		--	--		--	--		--	--
		9938		-106.01	Info		--	--		--	--		--	--		--	--
	4	9662	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--
		9800		--	--		--	--		--	--		--	--		--	--
		9938		--	--		--	--		--	--		--	--		--	--
Yes	3	9662	TBD	--	--	N/A	--	--	N/A	--	--	N/A	--	--	N/A	--	--
		9800		--	--		--	--		--	--		--	--		--	--
		9938		--	--		--	--		--	--		--	--		--	--
	4	9262	TBD	--	--	N/A	--	--	N/A	--	--	N/A	--	--	N/A	--	--
		9400		--	--		--	--		--	--		--	--		--	--
		9538		--	--		--	--		--	--		--	--		--	--

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UMTS 2100/1700 Antenna "B"																	
Device Held Up to Head for Voice (Yes/No)	Device Power Class	Channel	FS			HL			HR			BHHL			BHHR		
			Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info	Limit (dBm)	Test Results (dBm)	Pass / Fail / Info
No	3	1537	TBD	-104.67	Info	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--
		1638		-106.13	Info		--	--		--	--		--	--		--	--
		1738		-105.27	Info		--	--		--	--		--	--		--	--
	4	1537	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--	TBD	--	--
		1638		--	--		--	--		--	--		--	--		--	--
		1738		--	--		--	--		--	--		--	--		--	--
Yes	3	1537	TBD	--	--	N/A	--	--	N/A	--	--	N/A	--	--	N/A	--	--
		1638		--	--		--	--		--	--		--	--		--	--
		1738		--	--		--	--		--	--		--	--		--	--
	4	1537	TBD	--	--	N/A	--	--	N/A	--	--	N/A	--	--	N/A	--	--
		1638		--	--		--	--		--	--		--	--		--	--
		1738		--	--		--	--		--	--		--	--		--	--

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8 MAXIMUM TIS LEVEL AND BPD LEVEL REQUIREMENTS FOR THE PRIMARY MECHANICAL MODE – LTE

No limits defined as of CTIA Test Plan for Wireless Device Over the Air Performance, June 2017, Revision 3.7

Informational only

FS = Free Space

BH = Beside Head (Head Phantom Only)

BHL = Beside Head Left Side (Head Phantom Only)

BHR = Beside Head Right Side (Head Phantom Only)

BHHR = Beside Head and Hand Right Side (Head and Hand Phantom)

HR = Hand Right (Hand Phantom Only)

* Mark values exceeding pass/fail limits in **RED**.

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Milpitas 2018-01-30

Technical responsibility for area of testing:

01/30/2018	OTA	Nicolas Stamber (OTA Lab Manager)	
Date	Section	Name	Signature

This report is reviewed by:

01/30/2018	OTA	Thy Tran (OTA Associate Engineer)	
Date	Section	Name	Signature

The test results of this test report relate exclusively to the test item specified in Identification of the Equipment under Investigation. The CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM Inc USA.

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9 Physical Layout and Site Description

9.1 Wireless Test Facility

All tests were performed in CETECOM's state-of-the-art Wireless Test Facility consisting of a fully anechoic rectangular chamber equipped with a Phi Axis Positioner (Mast) & a Theta Axis positioner (turntable), SAM head phantom, dual polarized quad-ridge wave guide horn, and a circularly polarized communication antenna.

A base station simulator (Rohde & Schwarz CMU200 or CMW500) is used to establish communication with the EUT and place it in the proper mode.

A power meter with 2 separate power sensors and a RF switch is used for measuring the uplink signal from the EUT at each position simultaneously on both polarizations. Rohde & Schwarz's proprietary AMS32 Pattern Measurement Software is used for data acquisition, post-processing and generation of the required output.

9.2 Anechoic Rectangular Chamber

The rectangular ETS-Lindgren chamber with 7.6m measurement distance consists of an enclosure constructed of shielded modular panel sections that are assembled with screws. The chamber is all over equipped with RF absorbers. Lighting installed in the chamber ceiling won't introduce RF noise into the chamber. The chamber is forced air ventilated to maintain it at the same ambient as the surrounding facility.

A single leaf pneumatic swing type shielded door is provided for equipment and personal.

The Anechoic Rectangular Chamber is capable of meeting RF attenuation level of over 100dB throughout the frequency range of 600 MHz to 6 GHz, so that testing performed within the chamber does not interfere with other testing activities at the facility and vice versa. Power is supplied on separate circuits to the chamber and control area. All power filters provide a minimum of 100dB attenuation over a frequency range of 14 kHz to 18 GHz when tested per Mil Std 220A.

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9.3 Phi Axis & Theta Axis Positioner

The Phi Axis Positioner (Medium duty mast, MAPS positioning system) is capable of rotating the Equipment Under Test (EUT) in the Phi axes with full 360 degrees angular range. The Theta Axis Positioner is an absorber covered turntable that moves the MAPS positioner with the EUT from 0 degrees (facing the Horn antenna) to 180 degrees. Under normal conditions it provides 0.1 degree positioning accuracy. In conjunction with the AMS32 Software, it can perform positioning for data acquisition in both continuous and stepped movement modes.

A SAM head (eventually together with hand phantoms) can be mounted on the Phi positioner to simulate the effect of human tissue on RF performance. The electrically driven Phi Axis Positioner does not introduce conducted or radiated electrical noise above the ambient levels existing within the chamber.

9.4 SAM Head Phantom / Hand Phantoms

A SAM head phantom meeting the requirement for CTIA Certification Program Test Plan is used for the phantom head testing. Additionally, four different types of hand phantoms are available to simulate the effect of a human hand on the EUT's RF performance. The proper hand is selected depending on the physical design and dimensions of the EUT.

9.5 Quiet Zone

A 50 cm diameter by 40 cm tall cylindrical quiet zone volume was qualified for each axis (Theta/Phi) of the positioning system during the Ripple Test. This test is done on both polarizations using reference dipole and magnetic loop antennas. The measurement was performed after completion of the chamber construction by ETS-Lindgren to ensure compliance of the test chamber with the requirements of the CTIA test plan for Wireless Device Over the Air Performance, June 2017, Revision 3.7. It will be repeated on an annual cycle to ensure consistent chamber performance. The associated effects are included in the measurement uncertainty reported.

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9.6 ETS-Lindgren Quad Ridge Horn Antenna 3164-03

The Model 3164-03 is a broad bandwidth, dual polarized horn antenna designed for wireless device measurements. It can be used as the measurement antenna in all ETS-Lindgren Test Labs. The 3164-03 is designed with a minimum overall length in order to maximize the range length in the wireless test lab. The horn antenna serves as measurement antenna during TRP measurements and provides the downlink during TIS measurements.

9.7 Circularly Polarized Communication Antenna

The top of the Theta turntable – in between the absorbers - is fitted with a broadband circularly polarized communication antenna (Model ETS 3102) to provide a low loss link to the base station simulator in any position. This antenna is used as communication antenna during TRP measurements, handling both uplink and downlink with the base station emulator. During sensitivity measurements (TIS), the antenna is used to provide the uplink from the EUT to the base station.

9.8 Range Reference Measurements

All CETECOM OTA chambers are calibrated in a one-step-process from the centre of the quiet zone (rotational centre of the EUT antenna) to the measurement device. In case of TRP this is the input of the power sensor, for TIS this is the output of the base station emulator. Those tests are performed with reference dipoles that are specific for a certain frequency range, and are repeated for both polarizations and all possible RF paths.

The result is a frequency depending correction table that is automatically applied on all power or sensitivity values measured, so that each value represents the EIRP or EIS value at each given point. The calibration data is provided in a separate file.

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9.9 Test Equipment

The test was performed using the following additional test equipment

Rohde & Schwarz CMU200 Base Station Simulator or
Rohde & Schwarz CMW500 Base Station Simulator
Rohde & Schwarz OSP 130 RF Switch
Rohde & Schwarz NRP2 Power Meter
ETS Lindgren 2090 Position Controller

9.10 AMS32 Software

Rohde & Schwarz's AMS32 proprietary pattern measurement software is used to automate the data acquisition process and provides all post-processing calculations and data output required by the CTIA. Its parameterized test configuration system and conscientiously validated design helps to insure repeatable and correct results. Safeguards prevent data tampering and ensure that the original raw measured data is always available for review.

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10 Test Method

10.1 Total Radiated Power

The Total Radiated Power (TRP) test is performed according to the CTIA Test Plan for Wireless Device Over the Air Performance, June 2017, Revision 3.7, using the great circle cut data acquisition order.

The call is established using the communication antenna and the EUT is positioned in the center of the quiet zone, either on the free space mount (FS), phantom head with hand (BHHR/BHHL), or hand only position (HR/HL). The call parameters are adjusted on the base station simulator to bring the EUT to the required traffic channel and output power level. The EUT is then stepped between 0 and 180 degrees along the theta axis in 15-degree increments. At each theta position, the phi axis is stepped from 0-345 degrees or from 345-0 degrees, alternating to minimize test time in 15-degree increments. Data is recorded using the power meter with two independent power sensors to measure both theta and phi polarization at each position simultaneously. Upon completion of the test, the net power (Angular dependent EIRP) is calculated at each measurement point and the required values of TRP and Near Horizon Partial Radiated Power (NHPRP) are automatically calculated. This test procedure is repeated for each channel, band, and configuration as required. GPRS and EGPRS, respectively 1xRTT and 1xEV-DO are calculated through CTIA's single point offset test.

10.2 Total Isotropic Sensitivity

The Total Isotropic Sensitivity (TIS) test is performed according to the CTIA Test Plan for Wireless Device Over the Air Performance, June 2017, Revision 3.7, using the great circle cut data acquisition order. The call is established using the horn antenna for the downlink and the communication antenna for the uplink. The EUT is positioned in the center of the quiet zone, either on the free space mount (FS), phantom head with hand (BHHR/BHHL), or hand only position (HR/HL). The call parameters are adjusted on the base station simulator to bring the EUT to the required traffic channel and ensuring the receive signal at the position of the EUT is high enough to provide a stable connection. The EUT is then stepped between 0 and 180 degrees along the theta axis in 30-degree increments. At each theta position, the phi axis is stepped from 0-330 degrees or from 330-0 degrees, alternating to minimize the test time in 30-degree increments. At each spherical point and on each polarization the base station emulator lowers the downlink power until a certain BER/BLER limit is exceeded. The

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chamber path loss will then be subtracted from the base station output power to calculate the receive signal strength at the position of the EUT. These values are recorded by the AMS32 software and later used to calculate the TIS and NHPIS according to the formula specified in Appendix E of the CTIA Test Plan. This test procedure is repeated for each channel, band and configuration as required. GPRS and EGPRS respectively 1xRTT and 1xEV-DO are calculated through CTIA's single point offset test.

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11 Measurement Uncertainty OTA3 Chamber

11.1 TRP uncertainty

Free Space	LTE700 699-798 MHz	Cellular 824-894 MHz	AWS-1 Tx 1710-1755 MHz	PCS 1850-1995 MHz	LTE/WLAN 2300-2800 MHz	WLAN 5150-5825 MHz
Standard Uncertainty, u	0.76	0.76	0.74	0.75	0.91	N/A
Expanded Uncertainty, U, with 95% Confidence Interval	1.52	1.52	1.48	1.49	1.82	N/A

Phantom Head and Hand	LTE700 699-798 MHz	Cellular 824-894 MHz	AWS-1 Tx 1710-1755 MHz	PCS 1850-1995 MHz	LTE/WLAN 2300-2800 MHz	WLAN 5150-5825 MHz
Standard Uncertainty, u	0.89	0.89	0.87	0.88	1.02	N/A
Expanded Uncertainty, U, with 95% Confidence Interval	1.78	1.78	1.74	1.76	2.04	N/A

Phantom Hand Only	LTE700 699-798 MHz	Cellular 824-894 MHz	AWS-1 Tx 1710-1755 MHz	PCS 1850-1995 MHz	LTE/WLAN 2300-2800 MHz	WLAN 5150-5825 MHz
Standard Uncertainty, u	0.77	0.77	0.75	0.76	0.92	N/A
Expanded Uncertainty, U, with 95% Confidence Interval	1.54	1.54	1.51	1.52	1.84	N/A

Laptops over 30 cm	LTE700 699-798 MHz	Cellular 824-894 MHz	AWS-1 Tx 1710-1755 MHz	PCS 1850-1995 MHz	LTE/WLAN 2300-2800 MHz	WLAN 5150-5825 MHz
Standard Uncertainty, u	0.97	0.76	0.96	0.96	0.96	N/A
Expanded Uncertainty, U, with 95% Confidence Interval	1.94	1.52	1.91	1.91	1.91	N/A

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11.2 TRP uncertainty alternate methods (worst case)

Free Space	LTE700 699-798 MHz	Cellular 824-894 MHz	AWS-1 Tx 1710-1755 MHz	PCS 1850-1995 MHz	LTE/WLAN 2300-2800 MHz	WLAN 5150-5825 MHz
Standard Uncertainty, u	0.82	0.82	0.80	0.81	0.96	N/A
Expanded Uncertainty, U, with 95% Confidence Interval	1.64	1.64	1.60	1.61	1.92	N/A

Phantom Head and Hand	LTE700 699-798 MHz	Cellular 824-894 MHz	AWS-1 Tx 1710-1755 MHz	PCS 1850-1995 MHz	LTE/WLAN 2300-2800 MHz	WLAN 5150-5825 MHz
Standard Uncertainty, u	0.94	0.94	0.93	0.93	1.07	N/A
Expanded Uncertainty, U, with 95% Confidence Interval	1.88	1.88	1.85	1.86	2.13	N/A

Phantom Hand Only	LTE700 699-798 MHz	Cellular 824-894 MHz	AWS-1 Tx 1710-1755 MHz	PCS 1850-1995 MHz	LTE/WLAN 2300-2800 MHz	WLAN 5150-5825 MHz
Standard Uncertainty, u	0.83	0.83	0.82	0.82	0.97	N/A
Expanded Uncertainty, U, with 95% Confidence Interval	1.67	1.67	1.63	1.64	1.94	N/A

Laptops over 30 cm	LTE700 699-798 MHz	Cellular 824-894 MHz	AWS-1 Tx 1710-1755 MHz	PCS 1850-1995 MHz	LTE/WLAN 2300-2800 MHz	WLAN 5150-5825 MHz
Standard Uncertainty, u	1.02	0.82	1.00	1.00	1.00	N/A
Expanded Uncertainty, U, with 95% Confidence Interval	2.04	1.64	2.01	2.01	2.01	N/A

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11.3 TIS uncertainty

Free Space	LTE700 699-798 MHz	Cellular 824-894 MHz	GPS 1575.42 MHz	PCS 1850-1990 MHz	AWS-1 Rx 2110-2155 MHz	LTE/WLAN 2300-2800 MHz
Standard Uncertainty, u	0.90	0.79	N/A	0.93	0.95	1.01
Expanded Uncertainty, U, with 95% Confidence Interval	1.81	1.57	N/A	1.87	1.91	2.03

Phantom Head and Hand	LTE700 699-798 MHz	Cellular 824-894 MHz	GPS 1575.42 MHz	PCS 1850-1990 MHz	AWS-1 Rx 2110-2155 MHz	LTE/WLAN 2300-2800 MHz
Standard Uncertainty, u	1.03	0.93	N/A	1.06	1.08	1.13
Expanded Uncertainty, U, with 95% Confidence Interval	2.07	1.87	N/A	2.12	2.15	2.26

Phantom Hand Only	LTE700 699-798 MHz	Cellular 824-894 MHz	GPS 1575.42 MHz	PCS 1850-1990 MHz	AWS-1 Rx 2110-2155 MHz	LTE/WLAN 2300-2800 MHz
Standard Uncertainty, u	0.93	0.82	N/A	0.96	0.98	1.04
Expanded Uncertainty, U, with 95% Confidence Interval	1.86	1.63	N/A	1.92	1.95	2.07

Laptops over 30 cm	LTE700 699-798 MHz	Cellular 824-894 MHz	GPS 1575.42 MHz	PCS 1850-1990 MHz	AWS-1 Rx 2110-2155 MHz	LTE/WLAN 2300-2800 MHz
Standard Uncertainty, u	1.07	0.84	N/A	1.06	1.14	1.06
Expanded Uncertainty, U, with 95% Confidence Interval	2.14	1.69	N/A	2.11	2.27	2.11

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11.4 TIS uncertainty RSS based

Free Space	LTE700 699-798 MHz	Cellular 824-894 MHz	GPS 1575.42 MHz	PCS 1850-1990 MHz	AWS-1 Rx 2110-2155 MHz	LTE/WLAN 2300-2800 MHz
Standard Uncertainty, u	1.01	0.90	1.02	1.03	1.05	1.10
Expanded Uncertainty, U, with 95% Confidence Interval	2.01	1.81	2.03	2.07	2.10	2.21

Phantom Head and Hand	LTE700 699-798 MHz	Cellular 824-894 MHz	GPS 1575.42 MHz	PCS 1850-1990 MHz	AWS-1 Rx 2110-2155 MHz	LTE/WLAN 2300-2800 MHz
Standard Uncertainty, u	1.12	1.03	1.13	1.15	1.16	1.21
Expanded Uncertainty, U, with 95% Confidence Interval	2.25	2.07	2.27	2.30	2.33	2.43

Phantom Hand Only	LTE700 699-798 MHz	Cellular 824-894 MHz	GPS 1575.42 MHz	PCS 1850-1990 MHz	AWS-1 Rx 2110-2155 MHz	LTE/WLAN 2300-2800 MHz
Standard Uncertainty, u	1.03	0.93	1.04	1.05	1.07	1.13
Expanded Uncertainty, U, with 95% Confidence Interval	2.06	1.86	2.08	2.11	2.14	2.25

Laptops over 30 cm	LTE700 699-798 MHz	Cellular 824-894 MHz	GPS 1575.42 MHz	PCS 1850-1990 MHz	AWS-1 Rx 2110-2155 MHz	LTE/WLAN 2300-2800 MHz
Standard Uncertainty, u	1.16	0.95	1.09	1.14	1.22	1.14
Expanded Uncertainty, U, with 95% Confidence Interval	2.31	1.90	2.17	2.29	2.44	2.29

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11.5 TIS uncertainty alternate methods (worst case)

Free Space	LTE700 699-798 MHz	Cellular 824-894 MHz	GPS 1575.42 MHz	PCS 1850-1990 MHz	AWS-1 Rx 2110-2155 MHz	LTE/WLAN 2300-2800 MHz
Standard Uncertainty, u	1.00	0.89	N/A	1.02	1.04	1.10
Expanded Uncertainty, U, with 95% Confidence Interval	1.99	1.79	N/A	2.05	2.08	2.19

Phantom Head and Hand	LTE700 699-798 MHz	Cellular 824-894 MHz	GPS 1575.42 MHz	PCS 1850-1990 MHz	AWS-1 Rx 2110-2155 MHz	LTE/WLAN 2300-2800 MHz
Standard Uncertainty, u	1.12	1.02	N/A	1.14	1.16	1.21
Expanded Uncertainty, U, with 95% Confidence Interval	2.23	2.05	N/A	2.28	2.31	2.41

Phantom Hand Only	LTE700 699-798 MHz	Cellular 824-894 MHz	GPS 1575.42 MHz	PCS 1850-1990 MHz	AWS-1 Rx 2110-2155 MHz	LTE/WLAN 2300-2800 MHz
Standard Uncertainty, u	1.02	0.92	N/A	1.05	1.06	1.12
Expanded Uncertainty, U, with 95% Confidence Interval	2.04	1.84	N/A	2.09	2.13	2.24

Laptops over 30 cm	LTE700 699-798 MHz	Cellular 824-894 MHz	GPS 1575.42 MHz	PCS 1850-1990 MHz	AWS-1 Rx 2110-2155 MHz	LTE/WLAN 2300-2800 MHz
Standard Uncertainty, u	1.15	0.94	N/A	1.14	1.21	1.14
Expanded Uncertainty, U, with 95% Confidence Interval	2.30	1.89	N/A	2.27	2.43	2.27

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12 Test Equipment List

Test equipment used for measuring TRP & TIS (OTA1)

TYPE OF EQUIPMENT	MODEL NUMBER	MANUFACTURER	SN	CALIBRATION DUE DATE
Tapered Anechoic Chamber	N/A	ETS-Lindgren	N/A	November 2018
Quad-Ridge Horn Antenna 400MHz-6GHz	3164-03	ETS-Lindgren	23856	N/R
Circularly Polarized Communication Antenna	3102	ETS-Lindgren	21066	N/A
Antenna Position Controller	2092	ETS-Lindgren	23531	N/A
MAPS Positioner	2015	ETS-Lindgren	00021334	N/A
Low loss phase matched RF Cables	Lab-Flex tm 200	Florida RF Labs	N/A	N/R
Desktop Computer	Workstation	Dell Computer	N/A	N/A
Pattern Measurement Software	EMQuest tm EMQ-100	ETS-Lindgren	1013	N/A
Base Station Emulator	CMU-200	Rhode & Schwarz	110229	July 2019
Spectrum Analyzer	FSP	Rhode & Schwarz	834720	July 2019
RF Switch	TS-RSP	Rhode & Schwarz	100036	N/R
Head Phantom	V4.5 BS	SPEAG	3067	N/A
Hand Phantom	SHOV2RP / SHOV2LP	SPEAG	25376 / 20064	N/A

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Test equipment used for measuring TRP & TIS (OTA3)

TYPE OF EQUIPMENT	MODEL NUMBER	MANUFACTURER	SN	CALIBRATION DUE DATE
Rectangular Anechoic Chamber	N/A	ETS-Lindgren	N/A	November 2018
Quad-Ridge Horn Antenna 400MHz-6GHz	3164-03	ETS-Lindgren	0010181172	N/R
Circularly Polarized Communication Antenna	3102	ETS-Lindgren	00092324	N/A
Antenna Position Controller	2092	ETS-Lindgren	00108015	N/A
MAPS Positioner	2010/2015	ETS-Lindgren	N/A	N/A
Low loss phase matched RF Cables	Lab-Flex [™] 200	Florida RF Labs	N/A	N/R
Desktop Computer	Workstation	Dell Computer	N/A	N/A
Pattern Measurement Software	AMS32	Rhode & Schwarz	N/A	N/A
Vector Signal Generator	SMU-200A	Rhode & Schwarz	101935	July 2019
Base Station Emulator	CMU-200	Rhode & Schwarz	111629	July 2019
Base Station Emulator	CMW-500	Rhode & Schwarz	109825	July 2019
RF Switch	OSP 130	Rhode & Schwarz	100030	N/R

Note: **N/A** = Equipment does not need to be calibrated.

N/R = Equipment is not required to be calibrated, due to the fact that it is included in the chamber calibration.

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13 Setup Photos

13.1 Test Chamber



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13.2 EUT Reference Setup

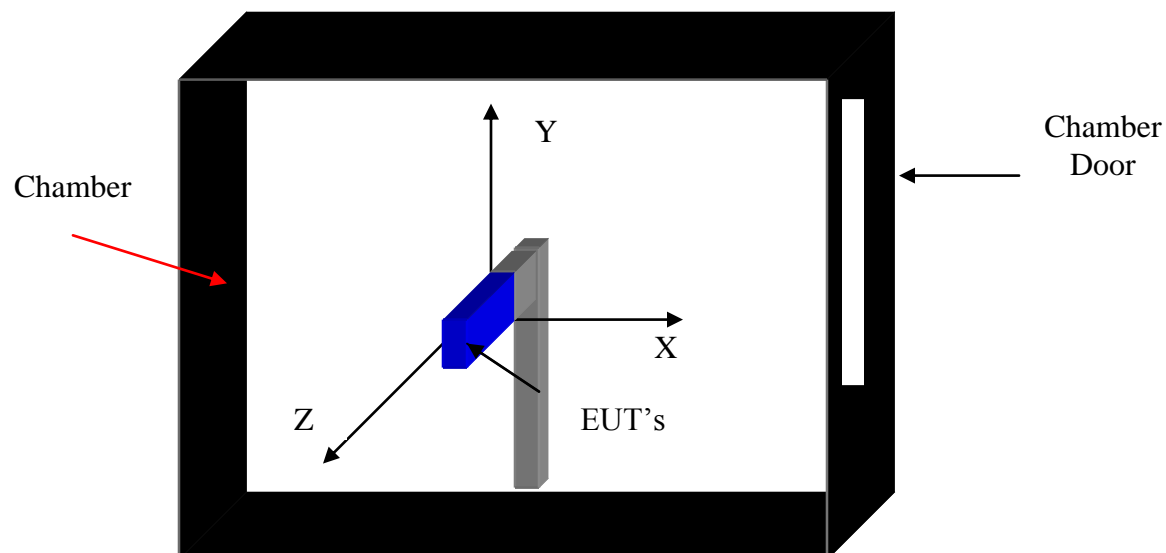


Figure A-1

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14 Revision History

Version	Date	By	Status / changes
1.0	2017-09-12	NS	Official report
1.1	2018-01-30	NS	Added LTE band 25 instead of band 2, updated CTIA revision

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