

TEST REPORT

of

FCC Part 22 Subpart H, Part 24 Subpart E

FCC ID: 2AHTD-CFX

Equipment Under Test : CleanFLEX
Model Name : CFX
Applicant : Ecube Labs Co., Ltd.
Manufacturer : Ecube Labs Co., Ltd.
Date of Receipt : 2017.09.29
Date of Test(s) : 2017.11.12 ~ 2018.03.05
Date of Issue : 2018.07.20

In the configuration tested, the EUT complied with the standards specified above.

Tested By:



Date:

2018.07.20

Jinhyoung Cho

Technical
Manager:



Date:

2018.07.20

Jungmin Yang

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1. General information

1.1. Testing laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)

- Wireless Div. 2FL, 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- Designation number: KR0150

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>.

Telephone : +82 31 688 0901

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1.2. Details of applicant

Applicant : Ecube Labs Co., Ltd.
 Address : 506, Acetechnotower, 20, Digital-ro 31-gil, Guro-gu, Seoul
 Contact Person : Choi, Seong-Dong
 Phone No. : +82 2 2109 0293

1.3. Details of manufacturer

Applicant : Same as applicant
 Address : Same as applicant

1.4. Description of EUT

Kind of Product	CleanFLEX
Model Name	CFX
Approved Module FCC ID	XMR201510UC20
Power Supply	DC 3.6 V
Rated Power	WCDMA 2: 23.5 dB m, WCDMA 5: 24 dB m
Frequency Range	WCDMA 2: 1 850 MHz ~ 1 910 MHz, WCDMA 5: 824 MHz ~ 849 MHz
Emission Designator	WCDMA 2: 4M19F9W, WCDMA 5: 4M16F9W

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1.5. Test equipment list

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Signal Generator	Agilent	E8257D	MY51501169	Jul. 03, 2018	Annual	Jul. 03, 2019
Spectrum Analyzer	R&S	FSV30	101004	Jun. 21, 2018	Annual	Jun. 21, 2019
Spectrum Analyzer	Agilent	N9020A	MY53421758	Sep. 25, 2017	Annual	Sep. 25, 2018
Mobile Test Unit	R&S	CMW500	144034	Mar. 08, 2018	Annual	Mar. 09, 2019
Power Meter	Anritsu	ML2495A	1223004	Jun. 12, 2018	Annual	Jun. 12, 2019
Power Sensor	Anritsu	MA2411B	1207272	Jun. 12, 2018	Annual	Jun. 12, 2019
High Pass Filter	Wainwright Instrument GmbH	WHKX10-900-1000-1800-0-40SS	7	Mar. 21, 2018	Annual	Mar. 21, 2019
High Pass Filter	Wainwright Instrument GmbH	WHK3.0/18G-10SS	344	May 27, 2018	Annual	May 27, 2019
High Pass Filter	Wainwright Instrument GmbH	WHKX2.2/12.75G-10SS	8	Mar. 21, 2018	Annual	Mar. 21, 2019
High Pass Filter	Wainwright Instrument GmbH	WHKX1.5/15G-6SS	4	Jun. 14, 2018	Annual	Jun. 14, 2019
Preamplifier	H.P.	8447F	2944A03909	Aug. 11, 2017	Annual	Aug. 11, 2018
Preamplifier	R&S	SCU 18	10117	Apr. 08, 2017	Annual	Apr. 08, 2018
Preamplifier	MITEQ Inc.	JS44-18004000-35-8P	1546891	May 13, 2018	Annual	May 13, 2019
Test Receiver	R&S	ESU26	100109	Feb. 07, 2018	Annual	Feb. 07, 2019
Log-Periodic Antenna	R&S	HK116	837942/015	Dec. 01, 2017	Biennial	Dec. 01, 2019
Biconical Antenna	R&S	HL223	8374141/007	Dec. 01, 2017	Biennial	Dec. 01, 2019
Dipole Antenna	SCHWARZBECK MESSELEKTRONIK	UHA 9105	9105-2514	May 15, 2017	Biennial	May 15, 2019
Dipole Antenna	SCHWARZBECK MESSELEKTRONIK	VHA 9103	9103-2817	May 15, 2017	Biennial	May 15, 2019
Horn Antenna	SCHWARZBECK MESSELEKTRONIK	9120D	1436	Oct. 20, 2017	Biennial	Oct. 20, 2019
Horn Antenna	SCHWARZBECK MESSELEKTRONIK	BBHA 9170	BBHA9170431	Aug. 25, 2016	Biennial	Aug. 25, 2018
Horn Antenna	SCHWARZBECK MESSELEKTRONIK	BBHA 9170	BBHA9170223	Aug. 25, 2016	Biennial	Aug. 25, 2018
Antenna Master	Innco systems GmbH	MM4000	N/A	N.C.R.	N/A	N.C.R.
Turn Table	Innco systems GmbH	DS 1200S	N/A	N.C.R.	N/A	N.C.R.
Controller	Innco systems GmbH	CONTROLLER CO3000-4P	CO3000/963/383 30516/L	N.C.R.	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.4 m)	N/A	N.C.R.	N/A	N.C.R.
Coaxial Cable	SUCOFLEX	104 (3 m)	MY3258414	Jul. 04, 2018	Semi-annual	Jan. 04, 2019
Coaxial Cable	SUCOFLEX	104 (10 m)	MY3145814	Jul. 04, 2018	Semi-annual	Jan. 04, 2019

► Support equipment

Description	Manufacturer	Model	Serial Number
N/A	-	-	-

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1.6. Summary of test results

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 2, 22 and 24		
Section	Test Item	Result
§2.1046 §22.913(a)(5) §24.232(c)	RF Radiated Output Power	Complied
§2.1053 §22.917(a) §24.238(a)	Spurious Radiated Emission	Complied
§2.1046	Conducted Output Power	Complied

1.7. Test report revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL012589	2018.04.20	Initial
1	F690501/RF-RTL012589-1	2018.07.20	Added conducted output power result

1.8. Sample calculation for offset

Where relevant, the following sample calculation is provided:

1.8.1. Radiation test

E.R.P. & E.I.R.P. = [S.G level + Amp.] (dB m) - Cable loss (dB) + Ant. gain (dB d/dB i)

1.9. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty (dB)
Radiated Disturbance, 9 kHz to 30 MHz	± 3.59
Radiated Disturbance, below 1 GHz	± 5.88
Radiated Disturbance, above 1 GHz	± 5.94

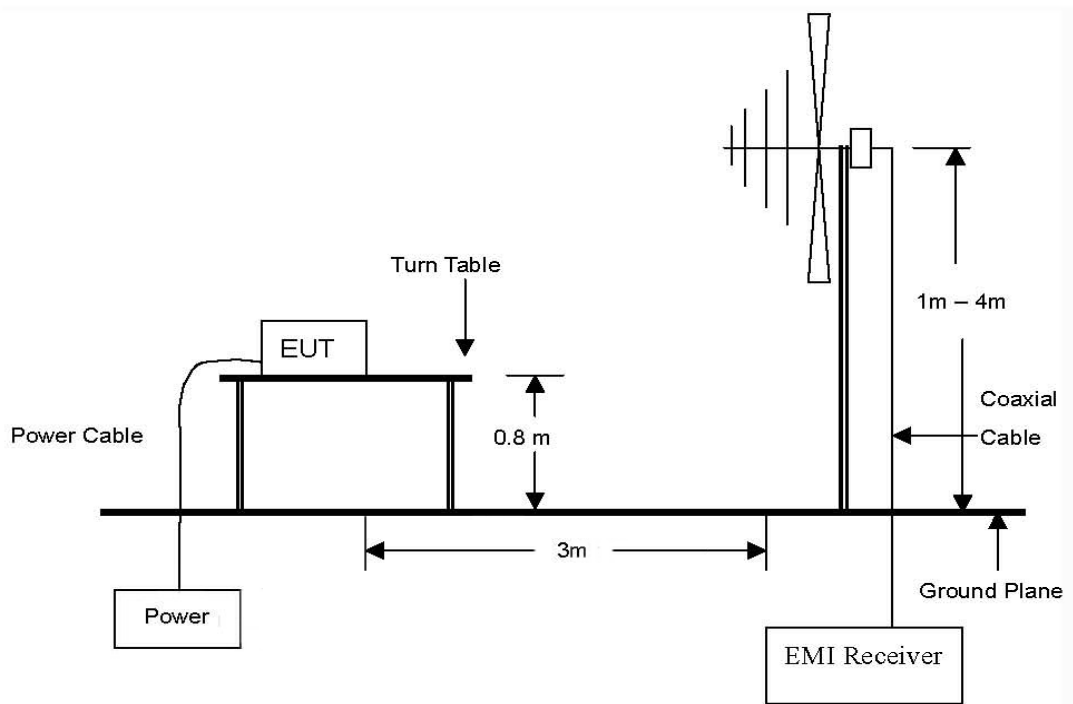
Uncertainty figures are valid to a confidence level of 95%.

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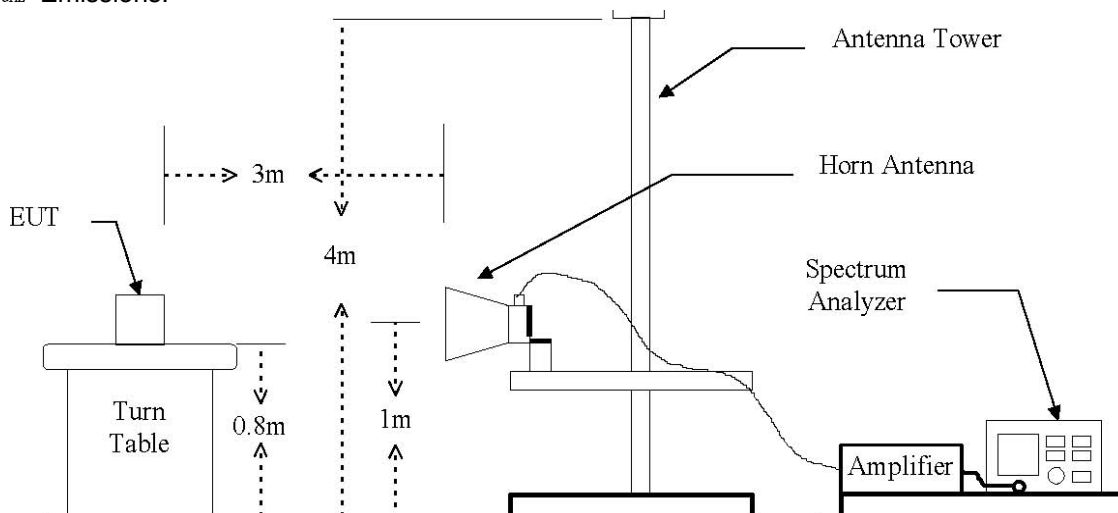
2. RF radiated output power & spurious radiated emission

2.1. Test setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.

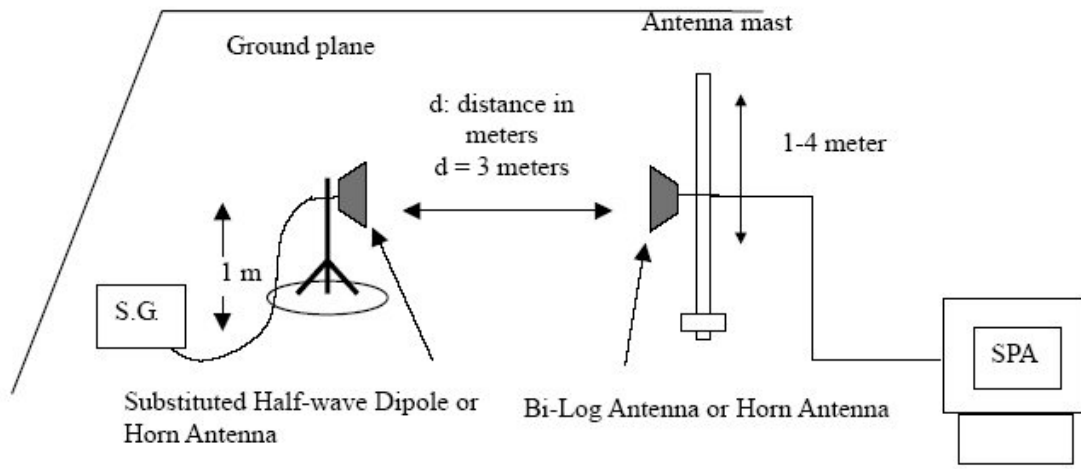


The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 20 GHz Emissions.



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The diagram below shows the test setup for substituted method.



2.2. Limit

2.2.1. Limit of radiated output power

- §22.913(a)(5), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

- §24.232(c), mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means to limiting power to the minimum necessary for successful communications.

2.2.2. Limit of spurious radiated emission

- §22.917(a), the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10\log(P)$ dB.

- §24.238(a), the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

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2.3. Test procedure: Based on ANSI/TIA 603E: 2016

1. On a test site, the EUT shall be placed at 80 cm height on a turn table, and in the position close to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to correspond to the fundamental frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the peak detector is used for the measurement.
4. The maximized power level is recorded using the spectrum analyzer "Channel Power" function with the integration band set to the emissions occupied bandwidth, RBW = 1-5 % of the OBW (not to exceed 1 MHz), VBW $\geq 3 \times$ RBW, Detector = power averaging (rms), sweep time = auto, trace average at least 100 traces in power averaging (rms) mode, per the guidelines of KDB 971168 D01 v03.
5. Radiated spurious emissions measurement method was set as follows:
RBW = 100 kHz for emissions below 1 GHz and 1 MHz for emissions above 1 GHz, VBW $\geq 3 \times$ RBW, Detector = Peak, trace mode = max hold, per the guidelines of KDB 971168 D01 v03.
6. The transmitter shall be switched on, the measuring receiver shall be tuned to the frequency of the transmitter under test.
7. The test antenna shall be raised and lowered through the specified range of height until the maximum signal level is detected by the measuring receiver.
8. The transmitter shall be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
9. The test antenna shall be raised and lowered again through the specified range of height until the maximum signal level is detected by the measuring receiver.
10. The maximum signal level detected by the measuring receiver shall be noted.
11. The EUT was replaced by half-wave dipole (1 GHz below) or horn antenna (1 GHz above) connected to a signal generator.
12. In necessary, the input attenuator setting on the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
13. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
14. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, which is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
15. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
16. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.

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2.4. Test result for RF radiated output power

Ambient temperature : (23 ± 1) °C

Relative humidity : 47 % R.H.

WCDMA 2

Frequency (MHz)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB i)	E.I.R.P.	
					(dB m)	(mW)
1 852.40	H	5.88	4.33	8.54	10.09	10.21
1 852.40	V	2.85	4.33	8.54	7.06	5.08
1 880.00	H	9.32	4.34	8.63	13.61	22.96
1 880.00	V	4.57	4.34	8.63	8.86	7.69
1 907.60	H	9.90	4.36	8.62	14.16	26.06
1 907.60	V	2.03	4.36	8.62	6.29	4.26

WCDMA 5

Frequency (MHz)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB d)	E.R.P.	
					(dB m)	(mW)
826.40	H	18.72	3.31	-5.18	10.23	10.54
826.40	V	15.38	3.31	-5.18	6.89	4.89
836.60	H	20.82	3.45	-5.14	12.23	16.71
836.60	V	18.85	3.45	-5.14	10.26	10.62
846.60	H	20.71	3.51	-4.25	12.95	19.72
846.60	V	19.05	3.51	-4.25	11.29	13.46

Remark:

1. E.R.P. & E.I.R.P. = [S.G level + Amp.] (dB m) - Cable loss (dB) + Ant. gain (dB d/dB i)

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2.5. Spurious radiated emission

- Measured output Power: 14.16 dB m = 0.026 06 W
- Modulation Signal: WCDMA 2 RMC
- Distance: 3 meters
- Limit: $43 + 10\log_{10}(W) = 27.16$ dB c

Frequency (MHz)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB i)	E.I.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (1 852.4 MHz)							
3 707.22	H	-48.05	6.00	9.07	-44.98	-13.00	31.98
3 706.76	V	-54.44	5.99	9.07	-51.36	-13.00	38.36
5 555.86	H	-53.52	7.53	10.63	-50.42	-13.00	37.42
5 555.88	V	-54.53	7.53	10.63	-51.43	-13.00	38.43
Middle Channel (1 880.0 MHz)							
3 757.38	H	-53.03	6.25	9.12	-50.16	-13.00	37.16
3 757.78	V	-53.38	6.25	9.12	-50.51	-13.00	37.51
5 639.20	H	-46.05	7.64	10.90	-42.79	-13.00	29.79
5 639.68	V	-43.75	7.64	10.90	-40.49	-13.00	27.49
High Channel (1 907.6 MHz)							
3 812.74	H	-51.62	6.50	9.15	-48.97	-13.00	35.97
3 812.76	V	-49.18	6.50	9.15	-46.53	-13.00	33.53
5 720.76	H	-42.28	7.85	11.27	-38.86	-13.00	25.86
5 720.58	V	-38.95	7.85	11.27	-35.53	-13.00	22.53

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- Measured output Power: 12.95 dB m = 0.019 72 W
- Modulation Signal: WCDMA 5 RMC
- Distance: 3 meters
- Limit: $43 + 10\log_{10}(W) = 25.95$ dB c

Frequency (MHz)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB d)	E.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (826.4 MHz)							
1 655.20	H	-51.57	4.02	8.19	-47.40	-13.00	34.40
1 651.04	V	-52.74	4.01	6.01	-50.74	-13.00	37.74
2 479.04	H	-35.37	4.80	7.01	-33.16	-13.00	20.16
2 481.84	V	-43.74	4.80	7.01	-41.53	-13.00	28.53
3 305.25	H	-59.25	5.55	6.72	-58.08	-13.00	45.08
3 302.50	V	-53.53	5.54	6.71	-52.36	-13.00	39.36
4 132.85	H	-52.05	6.73	7.14	-51.64	-13.00	38.64
4 132.50	V	-61.11	6.73	7.14	-60.70	-13.00	47.70
Middle Channel (836.6 MHz)							
1 675.64	H	-41.98	4.07	6.19	-39.86	-13.00	26.86
1 675.67	V	-44.78	4.07	6.19	-42.66	-13.00	29.66
2 510.14	H	-28.48	4.82	6.97	-26.33	-13.00	13.33
2 510.14	V	-38.65	4.82	6.97	-36.50	-13.00	23.50
3 351.35	H	-55.44	5.70	6.92	-54.22	-13.00	41.22
3 351.55	V	-47.32	5.70	6.92	-46.10	-13.00	33.10
4 189.30	H	-44.34	6.84	7.09	-44.09	-13.00	31.09
4 189.20	V	-53.34	6.84	7.09	-53.09	-13.00	40.09

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Frequency (MHz)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB d)	E.R.P. (dB m)	Limit (dB m)	Margin (dB)
High Channel (846.6 MHz)							
1 691.35	H	-40.14	4.10	6.31	-37.93	-13.00	24.93
1 691.56	V	-43.64	4.10	6.32	-41.42	-13.00	28.42
2 536.18	H	-25.68	4.86	6.91	-23.63	-13.00	10.63
2 536.08	V	-36.44	4.86	6.91	-34.39	-13.00	21.39
3 381.00	H	-55.37	5.80	7.05	-54.12	-13.00	41.12
3 390.72	V	-57.10	5.83	7.09	-55.84	-13.00	42.84
4 228.15	H	-41.97	6.89	7.04	-41.82	-13.00	28.82
4 229.10	V	-46.76	6.89	7.03	-46.62	-13.00	33.62

Remark:

1. E.R.P. & E.I.R.P. = S.G level (dB m) - Cable loss (dB) + Ant. gain (dB d/dB i)

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3. Conducted Output Power

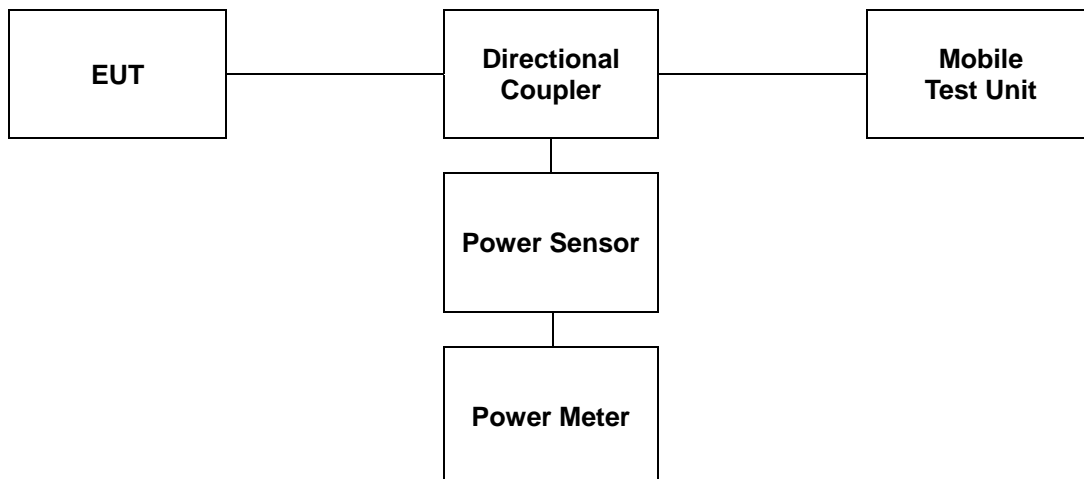
3.1. Limit

CFR 47, Section FCC §2.1046.

3.2. Test Procedure

Output power shall be measured at the RF output terminals for all configurations.

1. The RF output of the transmitter was connected to the input of the mobile test unit in order to establish communication with the EUT.
2. The EUT was set up for the max. output power with pseudo random data modulation by using mobile test unit parameters.
3. The measurement performed using a wideband RF power meter.
4. This EUT was tested under all configurations and the highest power was investigated and reported.



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3.3. Test Result

Ambient temperature : (23 ± 1) °C

Relative humidity : 47 % R.H.

- WCDMA

Band	3GPP Release Version	Channel		9262	9400	9538
		Frequency (MHz)		1 852.4	1 880.0	1 907.6
2	99	WCDMA	RMC	22.38	22.47	22.44
	5	HSDPA	Subtest 1	21.42	21.48	21.64
	5		Subtest 2	21.35	21.47	21.61
	5		Subtest 3	21.14	21.22	21.11
	5		Subtest 4	21.11	21.15	21.06
	6	HSUPA	Subtest 1	21.61	21.63	21.56
	6		Subtest 2	21.50	21.63	21.13
	6		Subtest 3	21.12	21.16	21.09
	6		Subtest 4	21.50	21.67	21.56
	6		Subtest 5	21.42	21.47	21.54

Band	3GPP Release Version	Channel		4132	4182	4233
		Frequency (MHz)		826.4	836.6	846.6
5	99	WCDMA	RMC	23.17	22.73	22.67
	5	HSDPA	Subtest 1	23.09	22.66	22.59
	5		Subtest 2	23.14	22.66	22.63
	5		Subtest 3	22.71	22.36	22.25
	5		Subtest 4	22.70	22.31	22.23
	6	HSUPA	Subtest 1	23.05	22.69	22.60
	6		Subtest 2	23.09	22.68	22.56
	6		Subtest 3	22.75	22.34	22.28
	6		Subtest 4	23.06	22.70	22.57
	6		Subtest 5	22.98	22.63	22.61

- End of the Test Report -

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