

TEST REPORT

Reference No...... : WTF18S09122915-6W
FCC ID : 2AAGEAV5AV72
Applicant..... : Chengdu Vantron Technology, Ltd.
Address..... : No.5 Gaopeng Road, Hi-Tech Zone, Chengdu, Sichuan, P.R. China
610045
Manufacturer : The same as above
Address..... : The same as above
Product..... : M2M Gateway
Model(s) : AV5, AV7
Brand Name..... : NA
Standards..... : FCC CFR47 Part 22 Subpart H: 2017
FCC CFR47 Part 24 Subpart E: 2017
Date of Receipt sample : 2018-09-04
Date of Test : 2018-09-05 to 2018-09-28
Date of Issue..... : 2018-09-29
Test Result..... : **Pass**

Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

Prepared By:

Waltek Services (Shenzhen) Co., Ltd.

Address: 1/F., Fukangtai Building, West Baima Road, Songgang Street, Baoan District, Shenzhen, Guangdong, China

Tel :+86-755-83551033

Fax:+86-755-83552400

Compiled by:

Ford Wang

Ford Wang / Project Engineer

Approved by:



Philo Zhong

Philo Zhong / Manager

2 Laboratories Introduction

Waltek Services (Shenzhen) Co., Ltd is a professional third-party testing and certification laboratory with multi-year product testing and certification experience, established strictly in accordance with ISO/IEC 17025 requirements, and accredited by ILAC (International Laboratory Accreditation Cooperation) member. A2LA (American Association for Laboratory Accreditation, the certification number is 4243.01) of USA, CNAS (China National Accreditation Service for Conformity Assessment, the registration number is L3110) of China. Meanwhile, Waltek has got recognition as registration and accreditation laboratory from EMSD (Electrical and Mechanical Services Department), and American Energy star, FCC (The Federal Communications Commission), CEC (California energy efficiency), ISED (Innovation, Science and Economic Development Canada). It's the strategic partner and data recognition laboratory of international authoritative organizations, such as Intertek (ETL-SEMKO), TÜV Rheinland, TÜV SÜD, etc.



Waltek Services (Shenzhen) Co., Ltd is one of the largest and the most comprehensive third party testing laboratory in China. Our test capability covered four large fields: safety test. Electro Magnetic Compatibility (EMC), and energy performance, wireless radio. As a professional, comprehensive, justice international test organization, we still keep the scientific and rigorous work attitude to help each client satisfy the international standards and assist their product enter into globe market smoothly.

Test Facility:**A. Accreditations for Conformity Assessment (International)**

Country/Region	Scope Covered By	Scope	Note
USA	ISO/IEC 17025	FCC ID \ DOC \ VOC	1
Canada		IC ID \ VOC	2
Japan		MIC-T \ MIC-R	-
Europe		EMCD \ RED	-
Taiwan		NCC	-
Hong Kong		OFCA	-
Australia		RCM	-
India		WPC	-
Thailand		NTC	-
Singapore		IDA	-
Note:			
1. FCC Designation No.: CN1201. Test Firm Registration No.: 523476.			
2. ISED Canada Registration No.: 7760A			

B. TCBs and Notify Bodies Recognized Testing Laboratory.

Recognized Testing Laboratory of ...	Notify body number
TUV Rheinland	Optional.
Intertek	
TUV SUD	
SGS	
Phoenix Testlab GmbH	0700
Element Materials Technology Warwick Ltd	0891
Timco Engineering, Inc.	1177
Eurofins Product Service GmbH	0681

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4 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTF18S09122 915-6W	2018-09-04	2018-09-04 to 2019-09- 28	2018-09-29	original	-	Vaild

5 General Information

5.1 General Description of E.U.T.

Product:	M2M Gateway
Model(s):	AV5, AV7
Model Description:	The models are different in size and appearance. Two models were tested. The worst data of AV 5 is recorded in the report.
WCDMA Band(s)	Band2/5
LTE Band(s):	FDD Band 2/4/5/12/13/17
Wi-Fi Specification:	2.4G-802.11b/g/n HT20 802.11n HT40
NFC:	Support
Highest frequency (Exclude Radio):	1.0GHz
Note:	NA.

5.2 Details of E.U.T.

Operation Frequency:	WCDMA Band II: 1850~1910MHz WCDMA Band V: 824~849MHz
Max. RF output power:	WCDMA Band II: 0.232W WCDMA Band V: 0.229W
Type of Modulation:	WCDMA: BPSK, 16QAM
Antenna installation:	WCDMA: internal permanent antenna
Antenna Gain:	WCDMA Band II: 1.71dBi WCDMA Band V: 1.86dBi
Ratings:	DC 12-34V by DC Power DC 5V 1A by PC

5.3 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Support Band	Test Mode	Channel Frequency	Channel Number
WCDMA Band V	WCDMA/HSUPA/HSDPA	826.4 MHz	4132
		836.6 MHz	4183
		846.6 MHz	4233
WCDMA Band II	WCDMA/HSUPA/HSDPA	1852.4MHz	9262
		1880.0MHz	9400
		1907.6MHz	9538
Remark: All mode(s) were tested and the worst data was recorded.			

6 Test Summary

Test Items	Test Requirement	Result
(a)RF Output Power	2.1046 22.913 (a) 24.232 (c)	PASS
(b)Peak-to-Average Ratio	24.232 (d)	PASS
(c)Bandwidth	2.1049 22.905 22.917 24.238	PASS
(d)Spurious Emissions at Antenna Terminal	2.1051 22.917 (a) 24.238 (a)	PASS
(e)Field Strength of Spurious Radiation	2.1053 22.917 (a) 24.238 (a)	PASS
(f)Out of band emission, Band Edge	22.917 (a) 24.238 (a)	PASS
(g)Frequency Stability	2.1055 22.355 24.235	PASS
Remark: test items for(a,b,c,f,g), which can cite data from the original module(FCC ID:RI7LE910NAV2) report.		

7 Equipment Used during Test

7.1 Equipments List

Conducted Emissions Test Site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	100947	2018-09-12	2019-09-11
2.	LISN	R&S	ENV216	101215	2018-09-12	2019-09-11
3.	Cable	Top	TYPE16(3.5M)	-	2018-09-12	2019-09-11
Conducted Emissions Test Site 2#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	101155	2018-09-12	2019-09-11
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	2018-09-12	2019-09-11
3.	Limiter	York	MTS-IMP-136	261115-001-0024	2018-09-12	2019-09-11
4.	Cable	LARGE	RF300	-	2018-09-12	2019-09-11
3m Semi-anechoic Chamber for Radiation Emissions Test site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Spectrum Analyzer	R&S	FSP	100091	2018-04-29	2019-04-28
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	2018-04-09	2019-04-08
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	2018-04-09	2019-04-08
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	2018-09-12	2019-09-11
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	2018-04-09	2019-04-08
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	2018-04-09	2019-04-08
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	2018-04-13	2019-04-12
8	Coaxial Cable (above 1GHz)	Top	1GHz-25GHz	EW02014-7	2018-04-13	2019-04-12
9	Universal Radio Communication Tester	R&S	CMU 200	112461	2018-04-13	2019-04-12
10	Signal Generator	R&S	SMR20	100046	2018-09-12	2019-09-11
11	Smart Antenna	SCHWARZBECK	HA08	-	2018-04-09	2019-04-08
3m Semi-anechoic Chamber for Radiation Emissions Test site 2#						
Item	Equipment	Manufacturer	Model No.	Serial No	Last Calibration Date	Calibration Due Date

1	Test Receiver	R&S	ESCI	101296	2018-04-13	2019-04-12
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2018-04-09	2019-04-08
3	Amplifier	Compliance pirection systems inc	PAP-0203	22024	2018-04-13	2019-04-12
4	Cable	HUBER+SUHNER	CBL2	525178	2018-04-13	2019-04-12
RF Conducted Testing						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMC Analyzer (9k~26.5GHz)	Agilent	E7405A	MY45114943	2018-09-12	2019-09-11
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	2018-09-12	2019-09-11
3.	Universal Radio Communication Tester	R&S	CMU 200	112461	2018-09-12	2019-09-11
4	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	2018-09-12	2019-09-11

7.2 Measurement Uncertainty

Parameter	Uncertainty
Conducted Emission	± 3.64 dB(AC mains 150KHz~30MHz)
Radiated Spurious Emissions	± 5.08 dB (Bilog antenna 30M~1000MHz)
	± 5.47 dB (Horn antenna 1000M~25000MHz)
Radio Frequency	± 1 x 10 ⁻⁷ Hz
RF Power	± 0.42 dB
RF Power Density	± 0.7dB
Conducted Spurious Emissions	± 2.76 dB (9kHz~26500MHz)
Confidence interval: 95%. Confidence factor:k=2	

7.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

Radiated Power

ERP and EIRP

WCDMA Band V (Part 22H)

Frequency	Receiver Reading	Turn table Angle	RX Antenna		Substituted			Absolute Level	Part 22H	
			Height	Polar	SG Level	Cable	Antenna Gain		Limit	Margin
(MHz)	(dBμV)	Degree	(m)	(H/V)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)
WCDMA Band V Voice Channel 4132										
826.40	91.58	295	1.3	H	24.55	0.20	0.00	24.35	38.45	-14.10
826.40	92.14	307	1.4	V	25.04	0.20	0.00	24.84	38.45	-13.61
WCDMA Band V Voice Channel 4183										
836.60	91.54	79	1.7	H	24.51	0.20	0.00	24.31	38.45	-14.14
836.60	92.10	215	1.5	V	25.00	0.20	0.00	24.80	38.45	-13.65
WCDMA Band V Voice Channel 4233										
846.60	91.53	85	1.9	H	24.50	0.20	0.00	24.30	38.45	-14.15
846.60	92.11	344	1.8	V	25.01	0.20	0.00	24.81	38.45	-13.64
WCDMA Band V HSDPA Channel 4132										
826.40	91.46	342	1.0	H	24.43	0.20	0.00	24.23	38.45	-14.22
826.40	92.17	93	1.8	V	25.07	0.20	0.00	24.87	38.45	-13.58
WCDMA Band V HSDPA Channel 4183										
836.60	91.45	188	1.9	H	24.42	0.20	0.00	24.22	38.45	-14.23
836.60	92.05	290	1.5	V	24.95	0.20	0.00	24.75	38.45	-13.70
WCDMA Band V HSDPA Channel 4233										
846.60	91.43	201	1.6	H	24.40	0.20	0.00	24.20	38.45	-14.25
846.60	92.06	129	2.1	V	24.96	0.20	0.00	24.76	38.45	-13.69
WCDMA Band V HSUPA Channel 4132										
826.40	91.58	149	2.3	H	24.55	0.20	0.00	24.35	38.45	-14.10
826.40	92.04	6	2.1	V	24.94	0.20	0.00	24.74	38.45	-13.71
WCDMA Band V HSUPA Channel 4183										
836.60	91.57	337	1.8	H	24.54	0.20	0.00	24.34	38.45	-14.11
836.60	92.16	141	2.0	V	25.06	0.20	0.00	24.86	38.45	-13.59
WCDMA Band V HSUPA Channel 4233										
846.60	91.39	37	2.2	H	24.36	0.20	0.00	24.16	38.45	-14.29
846.60	92.18	1	1.6	V	25.08	0.20	0.00	24.88	38.45	-13.57

WCDMA Band II (Part 24E)

Frequency	Receiver Reading	Turn table Angle	RX Antenna		Substituted			Absolute Level	Part 24E	
			Height	Polar	SG Level	Cable	Antenna Gain		Limit	Margin
(MHz)	(dBμV)	Degree	(m)	(H/V)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)
WCDMA Band II Voice Channel 9262										
1852.40	88.10	33	1.5	H	14.13	0.31	10.40	24.22	33	-8.78
1852.40	87.25	17	2.3	V	13.97	0.31	10.40	24.06	33	-8.94
WCDMA Band II Voice Channel 9400										
1880.00	88.16	248	2.3	H	14.31	0.31	10.40	24.40	33	-8.60
1880.00	87.23	142	1.3	V	14.11	0.31	10.40	24.20	33	-8.80
WCDMA Band II Voice Channel 9538										
1907.60	88.12	198	2.2	H	14.39	0.32	10.40	24.47	33	-8.53
1907.60	87.26	101	1.7	V	14.30	0.32	10.40	24.38	33	-8.62
WCDMA Band II HSDPA Channel 9262										
1852.40	88.14	150	1.6	H	14.17	0.31	10.40	24.26	33	-8.74
1852.40	87.25	300	2.5	V	13.97	0.31	10.40	24.06	33	-8.94
WCDMA Band II HSDPA Channel 9400										
1880.00	88.10	143	2.3	H	14.25	0.31	10.40	24.34	33	-8.66
1880.00	87.30	85	2.4	V	14.18	0.31	10.40	24.27	33	-8.73
WCDMA Band II HSDPA Channel 9538										
1907.60	88.13	186	1.4	H	14.40	0.32	10.40	24.48	33	-8.52
1907.60	87.34	287	1.4	V	14.38	0.32	10.40	24.46	33	-8.54
WCDMA Band II HSUPA Channel 9262										
1852.40	88.16	18	1.6	H	14.19	0.31	10.40	24.28	33	-8.72
1852.40	87.33	230	1.8	V	14.05	0.31	10.40	24.14	33	-8.86
WCDMA Band II HSUPA Channel 9400										
1880.00	88.19	244	1.8	H	14.34	0.31	10.40	24.43	33	-8.57
1880.00	87.38	272	1.9	V	14.26	0.31	10.40	24.35	33	-8.65
WCDMA Band II HSUPA Channel 9538										
1907.60	88.16	124	1.1	H	14.43	0.32	10.40	24.51	33	-8.49
1907.60	87.35	33	2.4	V	14.39	0.32	10.40	24.47	33	-8.53

8 SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Requirement:	FCC Part 2.1051, 22.917(a), 24.238(a)
Test Method:	TIA/EIA-603-D:2010 KDB971168 D01 v03
Test Mode:	TX transmitting

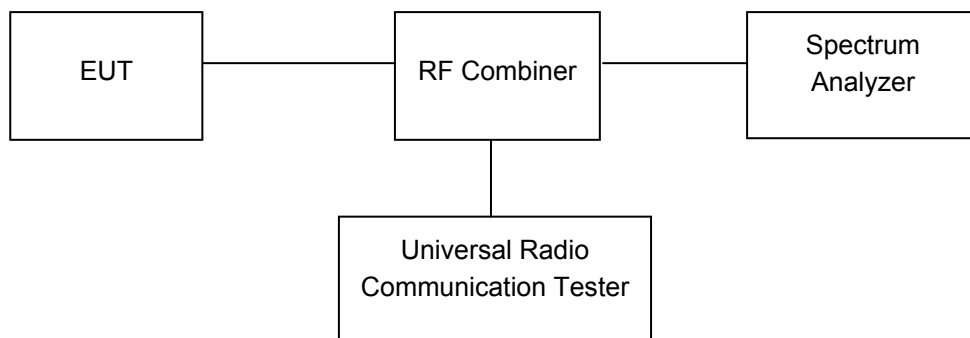
8.1 EUT Operation

Operating Environment :

Temperature:	23.5 °C
Humidity:	52.1 % RH
Atmospheric Pressure:	101.3kPa

8.2 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 1MHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonics.



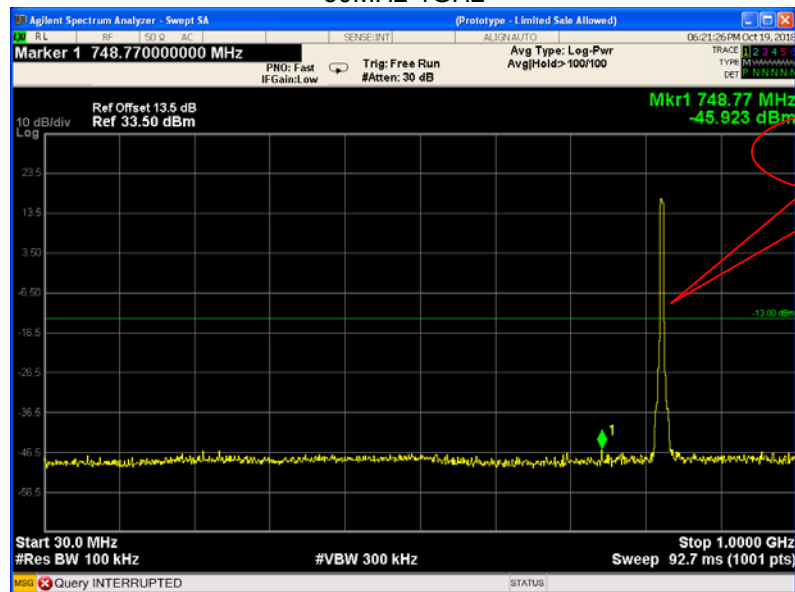
8.3 Test Result

Remark: All test data were reported and only the worst case (middle channel mode) test graphs were showed in test report.

Cellular Band (Part 22H)

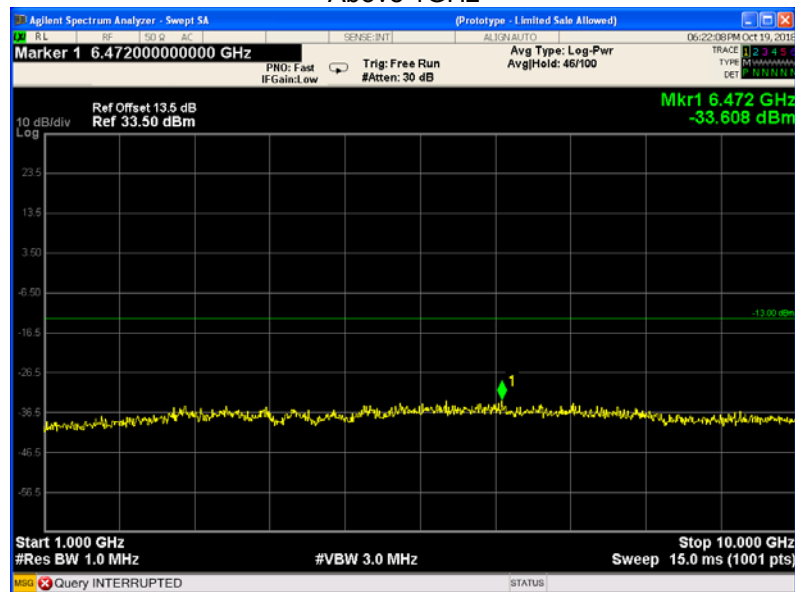
WCDMA band V - channel 4183

30MHz-1GHz



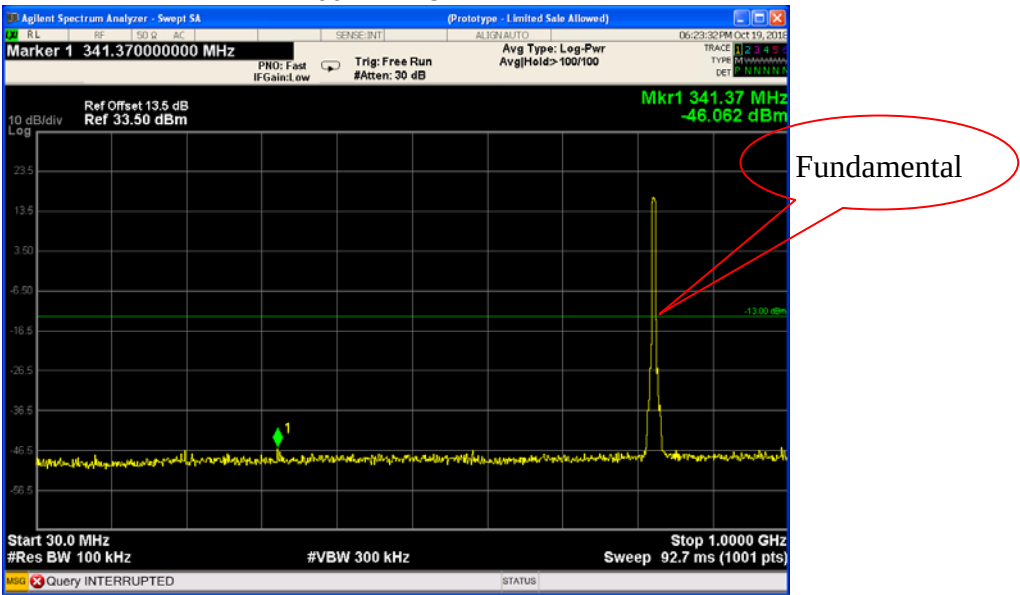
Fundamental

Above 1GHz

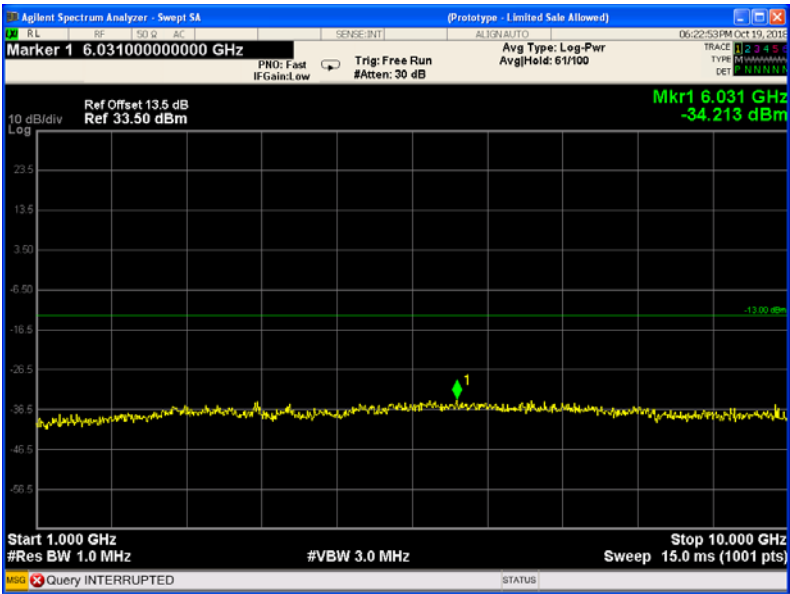


WCDMA band V - channel 4183 (HSDPA)

30MHz-1GHz

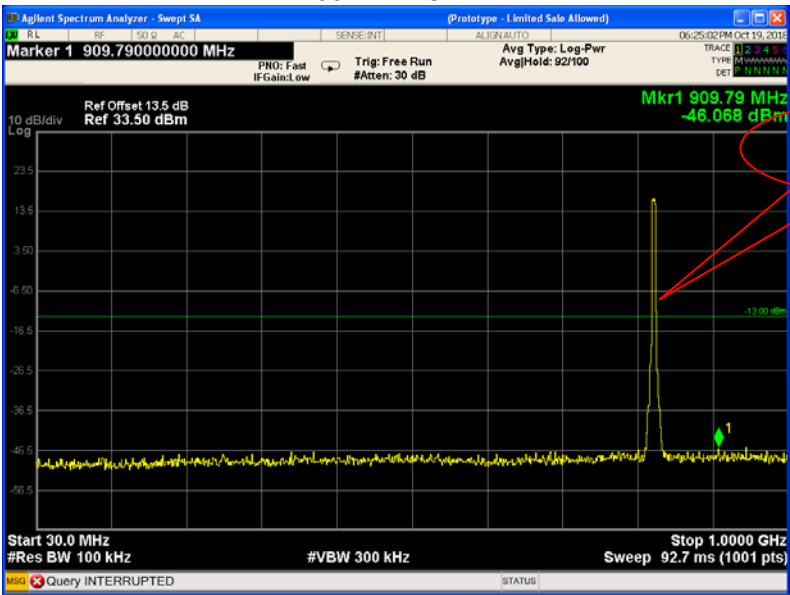


Above 1GHz



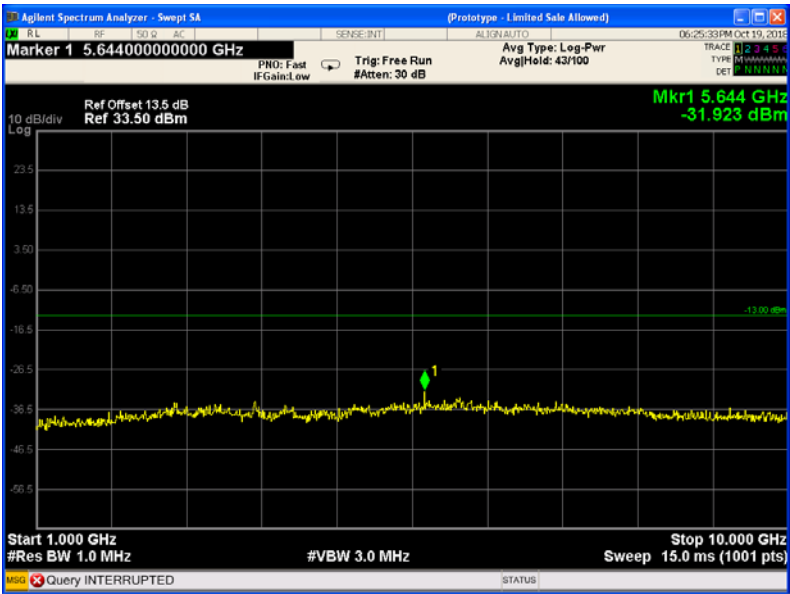
WCDMA band V - channel 4183 (HSUPA)

30MHz-1GHz

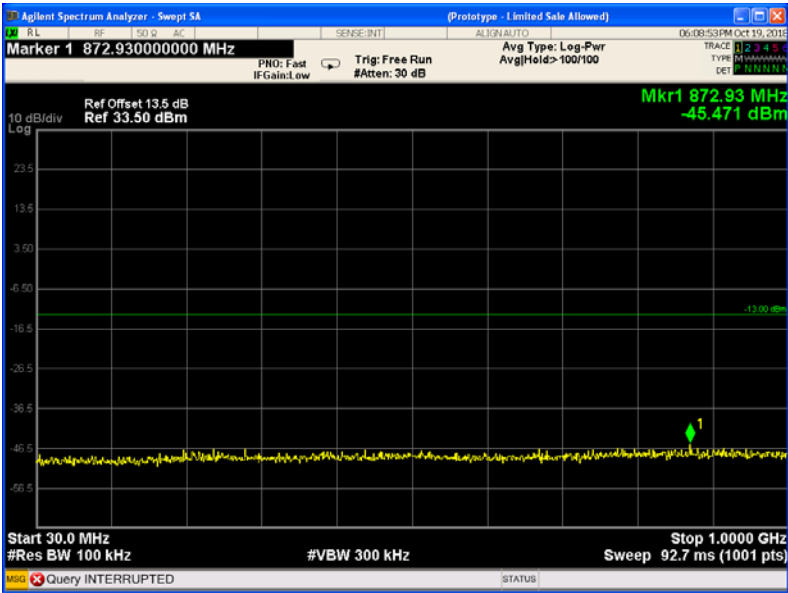


Fundamental

Above 1GHz

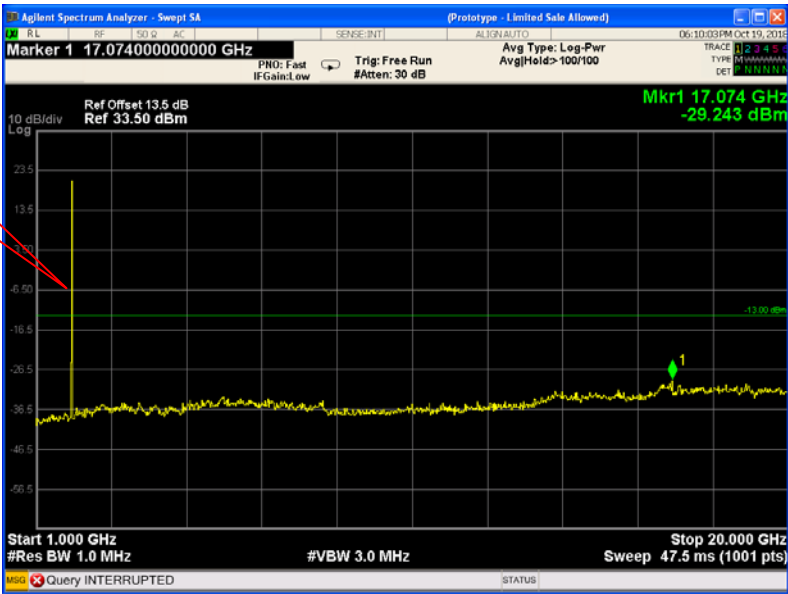


Cellular Band (Part 24E)
WCDMA band II - channel 9400
30MHz-1GHz



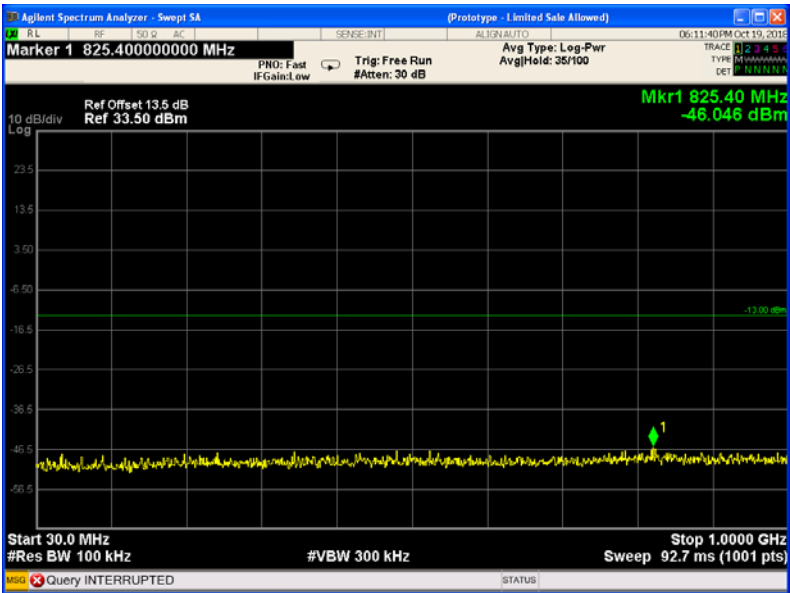
Above 1GHz

Fundamental



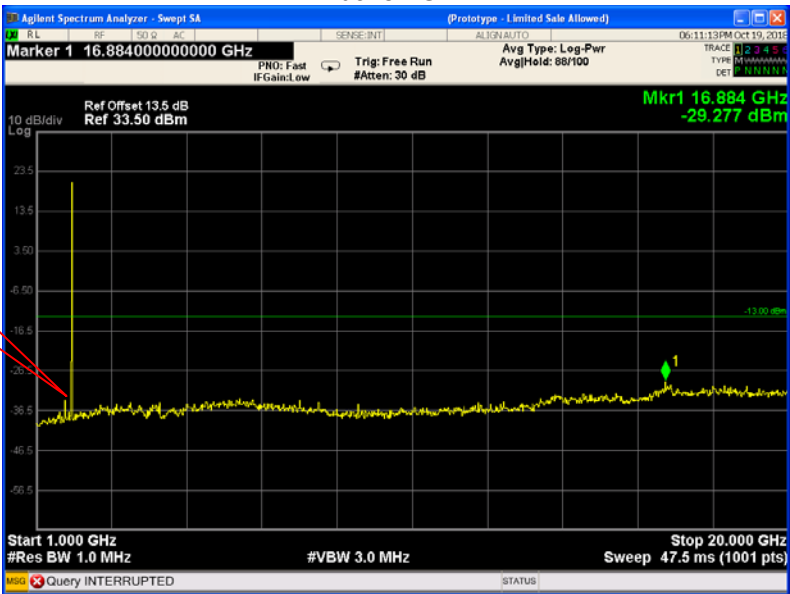
WCDMA band II - channel 9400 (HSDPA)

30MHz-1GHz



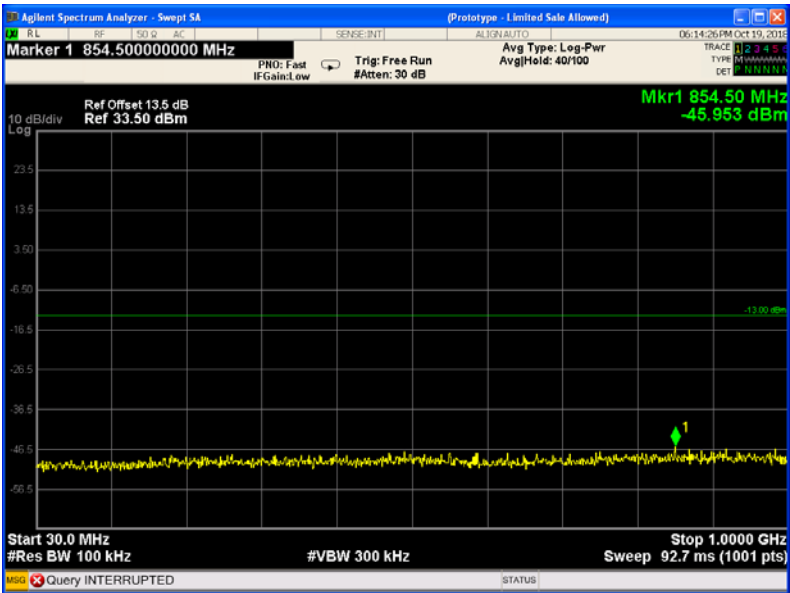
Above 1GHz

Fundamental



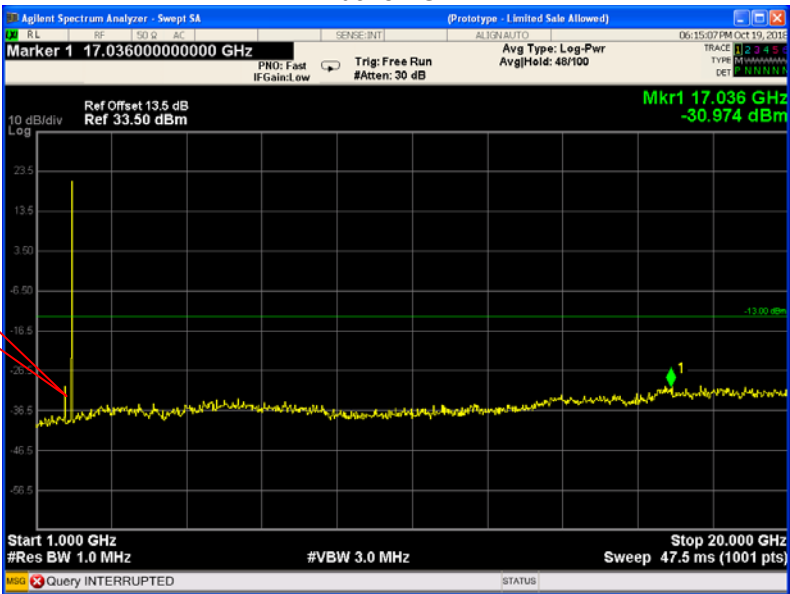
WCDMA band II - channel 9400 (HSUPA)

30MHz-1GHz



Above 1GHz

Fundamental



9 SPURIOUS RADIATED EMISSIONS

Test Requirement:	FCC Part 2.1053, 22.917, 24.238
Test Method:	TIA/EIA-603-D:2010 KDB971168 D01 v03
Test Mode:	TX transmitting

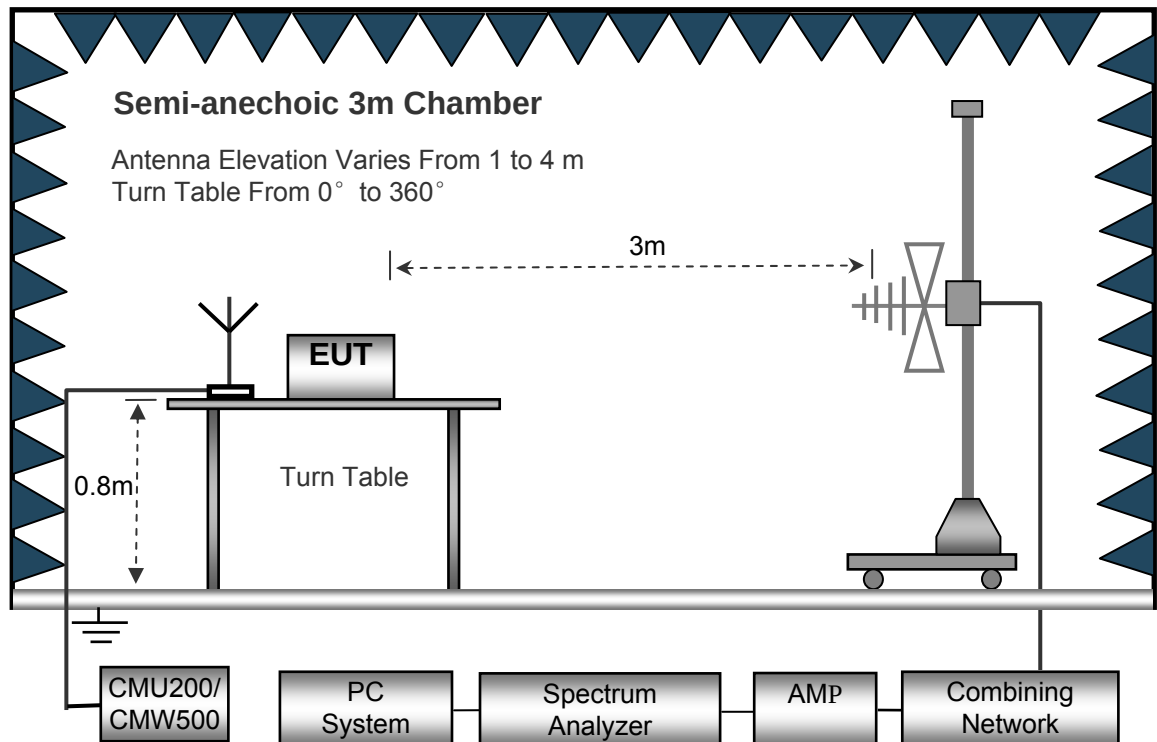
9.1 EUT Operation

Operating Environment :

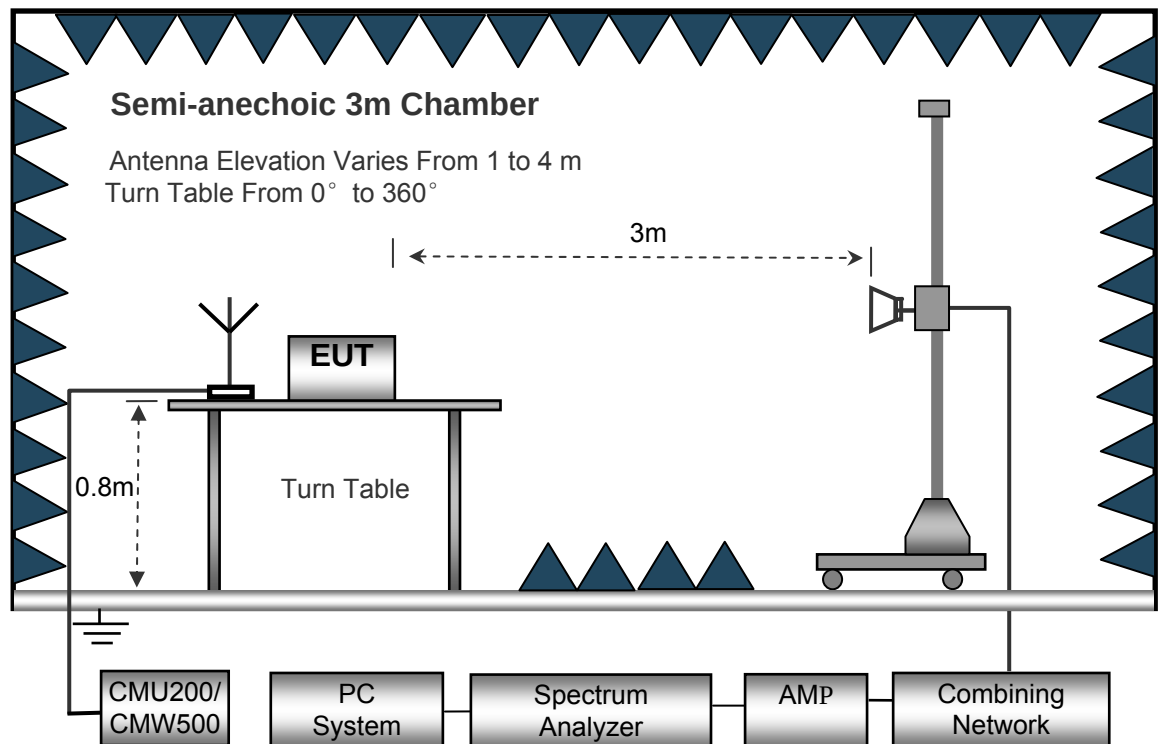
Temperature:	23.5 °C
Humidity:	52.1 % RH
Atmospheric Pressure:	101.2kPa

9.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site.
The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



9.3 Spectrum Analyzer Setup

30MHz ~ 1GHz

Sweep Speed Auto
 Detector PK
 Resolution Bandwidth..... 100kHz
 Video Bandwidth..... 300kHz

Above 1GHz

Sweep Speed Auto
 Detector PK
 Resolution Bandwidth..... 1MHz
 Video Bandwidth..... 3MHz
 Detector Ave.
 Resolution Bandwidth..... 1MHz
 Video Bandwidth..... 10Hz

9.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from 30MHz up to the tenth harmonic of the highest fundamental frequency.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the Z position. So the data shown was the Z position only.
7. Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = $10 \lg (\text{TXpwr in Watts}/0.001)$ – the absolute level

Spurious attenuation limit in dB = $43 + 10 \lg (\text{power out in Watts})$

8. Repeat above procedures until the measurements for all frequencies are completed.

9.5 Summary of Test Results

For 26MHz~30MHz,

The measurements were more than 20 dB below the limit and not reported.

Remark: Test performed from 30MHz to 10th harmonics with low/middle/high channels, only the worst data were recorded.

Cellular Band (Part 22H)

Frequency	Receiver Reading	Turn table Angle	RX Antenna		Substituted			Absolute Level	Result	
			Height	Polar	SG Level	Cable	Antenna Gain		Limit	Margin
(MHz)	(dBμV)	Degree	(m)	(H/V)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)
WCDMA Band V Channel 4233										
223.12	40.37	188	1.1	H	-70.14	0.15	0.00	-70.29	-13.00	-57.29
223.12	46.15	208	2.1	V	-61.44	0.15	0.00	-61.59	-13.00	-48.59
1652.80	61.82	196	1.8	H	-52.15	0.30	9.40	-43.05	-13.00	-30.05
1652.80	51.17	177	1.7	V	-62.36	0.30	9.40	-53.26	-13.00	-40.26
2479.20	51.10	245	1.8	H	-62.90	0.43	10.60	-52.73	-13.00	-39.73
2479.20	41.48	127	1.5	V	-68.80	0.43	10.60	-58.63	-13.00	-45.63

Cellular Band (Part 24E)

Frequency	Receiver Reading	Turn table Angle	RX Antenna		Substituted			Absolute Level	Result	
			Height	Polar	SG Level	Cable	Antenna Gain		Limit	Margin
(MHz)	(dBμV)	Degree	(m)	(H/V)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)
WCDMA Band II Channel 9400										
199.38	47.83	295	2.1	H	-62.68	0.15	0.00	-62.83	-13.00	-49.83
199.38	39.84	198	1.3	V	-67.75	0.15	0.00	-67.90	-13.00	-54.90
3760.00	58.28	60	2.0	H	-53.26	2.37	12.50	-43.13	-13.00	-30.13
3760.00	53.12	206	1.4	V	-56.69	2.37	12.50	-46.56	-13.00	-33.56
5640.00	46.65	281	1.8	H	-62.96	2.86	12.90	-52.92	-13.00	-39.92
5640.00	38.61	104	1.5	V	-70.27	2.86	12.90	-60.23	-13.00	-47.23

Note: 1) Absolute Level = SG Level - Cable loss + Antenna Gain

2) Margin = Limit- Absolute Level

10 RF Exposure

Test Requirement: FCC Part 1.1307

Test Mode: The EUT work in test mode(Tx).

10.1 Requirements

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2m normally can be maintained between the user and the device.

10.2 The procedures / limit

FCC Part 1.1307:

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ;

*Plane-wave equivalent power density

10.3 MPE Calculation Method

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm²)

P = power input to the antenna (in appropriate units, e.g., mW).

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained

FCC Part 1.1307:

Mode	Antenna Gain (dBi)	Antenna Gain (numeric)	Max.Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
WCDMA BAND2	1.71	1.506	23.66	232.27	0.069586	1
WCDMA BAND5	1.86	1.535	23.59	228.56	0.069778	0.550

11 Photographs of test setup and EUT.

Note: Please refer to appendix: WTF18S09122915W_Photo.

===== End of Report =====