Shenzhen Global Test Service Co.,Ltd.
No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

FCC TEST REPORT

FCC Part 22H/27

Report Reference No......:	**GTS20200303005-1-9**
FCC ID..... **:**	**2AWAB-C1N1**
Compiled by (position+printed name+signature)..:	File administrators Tracy Hu
Supervised by (position+printed name+signature)..:	Test Engineer Moon Tan
Approved by (position+printed name+signature)..:	Manager Simon Hu
Date of issue.....:	May. 21, 2020

Representative Laboratory Name .:	**Shenzhen Global Test Service Co.,Ltd.**
Address.....**:**	No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

Applicant's name.....:	**Hanvo Aviation Technology Co., Ltd.**
Address .....:	Middle Section of Longteng Road, Jiulong District, Gaoxin Zone, Yu xi City, Yunnan Province, China

Test specification .....**:**	
Standard .....:	**FCC CFR Title 47 Part 2, Part 22H,Part 27** **EIA/TIA 603-D: 2010** **KDB 971168 D01**
TRF Originator.....:	Shenzhen Global Test Service Co.,Ltd..

Test item description .....:	**Control and Navigation System**
Trade Mark .....:	HANVO
Manufacturer .....:	**Hanvo Aviation Technology Co., Ltd.**
Model/Type reference.....:	C1/N1
Listed Models .....:	N/A
Modulation Type .....:	QPSK, 16QAM
Rating .....:	Input:11V-54V—8A
Hardware version .....:	V1.0
Software version .....:	V1.0
Result.....:	**PASS**

T E S T R E P O R T

Test Report No. :	**GTS20200303005-1-9**	May. 21, 2020 Date of issue

Equipment under Test	:	Control and Navigation System
Model /Type	:	C1/N1
Listed model	:	N/A
Applicant	:	**Hanvo Aviation Technology Co., Ltd.**
Address	:	Middle Section of Longteng Road, Jiulong District, Gaoxin Zone, Yuxi City, Yunnan Province, China
Manufacturer	:	**Hanvo Aviation Technology Co., Ltd.**
Address	:	Middle Section of Longteng Road, Jiulong District, Gaoxin Zone, Yuxi City, Yunnan Province, China

Test result	**Pass ***

* In the configuration tested, the EUT complied with the standards specified page 4.

Contents

1 SUMMARY

1.1 TEST STANDARDS

The tests were performed according to following standards:
FCC Part 22 : PUBLIC MOBILE SERVICES
FCC Part 27 : MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES

TIA/EIA 603 D June 2010:Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.
47 CFR FCC Part 15 Subpart B: - Unintentional Radiators
FCC Part 2: FREQUENCY ALLOCA-TIONS AND RADIO TREATY MAT-TERS; GENERAL RULES AND REG-ULATIONS
KDB971168 D01: v02r02 MEASUREMENT GUIDANCE FOR CERTIFICATION OF LICENSED DIGITAL TRANSMITTERS
ANSI C63.26:2015: American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

1.2 Test Description

Test Item	Section in CFR 47	Test Sample	Result
RF Output Power	Part 2.1046 Part 22.913(a) Part 27.50	GTS20200303005-1-1#	Pass
Peak-to-Average Ratio	N/A	GTS20200303005-1-1#	Pass
99% & -26 dB Occupied Bandwidth	Part 2.1049	GTS20200303005-1-1#	Pass
Spurious Emissions at Antenna Terminal	Part 2.1051 Part 22.917 Part 27.53	GTS20200303005-1-1#	Pass
Field Strength of Spurious Radiation	Part 2.1053 Part 22.917(b) Part 27.53	GTS20200303005-1-1#	Pass
Out of band emission, Band Edge	Part 2.1051 Part 22.917(b) Part 27.53	GTS20200303005-1-1#	Pass
Frequency stability	Part 2.1055 Part 22.355 Part 27.54	GTS20200303005-1-1#	Pass

1.3 Test Facility

1.3.1 Address of the test laboratory

Shenzhen Global Test Service Co.,Ltd.
No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

1.3.2 Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

CNAS (No. CNAS L8169)
Shenzhen Global Test Service Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2019 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA (Certificate No. 4758.01)
Shenzhen Global Test Service Co., Ltd. has been assessed by the American Association for Laboratory Accreditation (A2LA). Certificate No. 4758.01.

1.4 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen Global Test Service Co.,Ltd.. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen Global Test Service Co.,Ltd. is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.10dB	(1)
Radiated Emission	Above 1GHz	4.32dB	(1)
Conducted Disturbance	0.15~30MHz	3.20dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

2 GENERAL INFORMATION

2.1 General Remarks

Date of receipt of test sample	:	Apr. 27, 2020
Testing commenced on	:	Apr. 27, 2020
Testing concluded on	:	May. 21, 2020

2.2 Product Description

Product Name	Control and Navigation System
Trade Mark	HWMO
Model/Type reference	C1/N1
List Model	N/A
Model Declaration	N/A
Power supply:	Input:11V-54V—8A
Sample ID	GTS20200303005-1-1#
3G	
UMTS Operation Frequency Band	UMTS FDD Band V
WCDMA Release Version	R6
HSDPA Release Version	Release 6
HSUPA Release Version	Release 6
Modulation Type	QPSK for UMTS
Antenna Description	External Antenna; 0.8dBi (max.) For WCDMA Band V
LTE	
LTE Operation Frequency Band	LTE Band 5, 41
LTE Release Version	R9
Type Of Modulation	QPSK/16QAM
Antenna Description	External Antenna; 0.8dBi (max.)
Bluetooth	
Frequency Range	2402MHz ~ 2480MHz
Channel Number	79 channels for Bluetooth V4.0 (BDR/EDR)
Channel Spacing	1MHz for Bluetooth V4.0 (BDR/EDR)
Modulation Type	GFSK, π/4-DQPSK, 8-DPSK for Bluetooth V4.0 (BDR/EDR)
Bluetooth Version	V4.0
Antenna Description	PCB Antenna, 0.0dBi (Max.)
GPS Receiver	Support and only RX

2.3 Equipment Under Test

Power supply system utilised

Power supply voltage	:	○	230V / 50 Hz	○	120V / 60Hz
		○	12 V DC	●	24 V DC
		○	Other (specified in blank below)		

2.4 Short description of the Equipment under Test (EUT)

This is a WCDMA+LTE Control and Navigation System.For more details, refer to the user's manual of the EUT.

2.5 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature:	25°C
Relative Humidity:	55 %
Air Pressure:	101 kPa

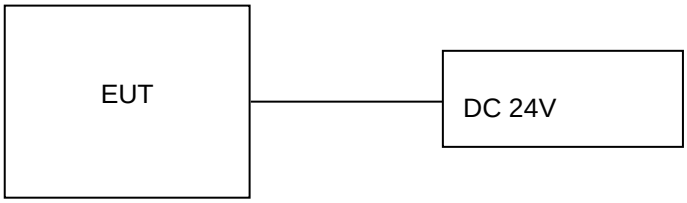
2.6 Description of Test Modes

The EUT has been tested under typical operating condition. The CMW500 used to control the EUT staying in continuous transmitting and receiving mode for testing. Regards to the frequency band operation: the lowest、middle and highest frequency of channel were selected to perform the test, then shown on this report.

Note:

1. For the ERP/EIRP and radiated emission test, every axis (X, Y, Z) was verified, and show the worst resulton this report.
2. Test method and refer to 3GPP TS136521.

2.7 Block Diagram of Test Setup



2.8 Special Accessories

Manufacturer	Description	Model	Serial Number	Certificate
/	/	/	/	/

1.1. External I/O Cable

I/O Port Description	Quantity	Cable
PMU Port	1	0.2M, Unscreened Cable
IIBS Port	1	0.2M, Unscreened Cable
USB MINI	1	0.2M, Unscreened Cable
SIM Card	1	N/A
SD Card	1	N/A

2.9 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is filing to comply with of the FCC Part 22,Part 27 Rules.

2.10 Modifications

No modifications were implemented to meet testing criteria.

2.11 Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	3560.6550.08	2019/09/20	2020/09/19
LISN	R&S	ESH2-Z5	893606/008	2019/09/20	2020/09/19
EMI Test Receiver	R&S	ESPI3	101841-cd	2019/09/20	2020/09/19
EMI Test Receiver	R&S	ESCI7	101102	2019/09/20	2020/09/19
Spectrum Analyzer	Agilent	N9020A	MY48010425	2019/09/20	2020/09/19
Spectrum Analyzer	R&S	FSV40	100019	2019/09/20	2020/09/19
Vector Signal generator	Agilent	N5181A	MY49060502	2019/09/20	2020/09/19
Signal generator	Agilent	E4421B	3610AO1069	2019/09/20	2020/09/19
Climate Chamber	ESPEC	EL-10KA	A20120523	2019/09/20	2020/09/19
Controller	EM Electronics	Controller EM 1000	N/A	N/A	N/A
Horn Antenna	Schwarzbeck	BBHA 9120D	01622	2019/09/23	2020/09/22
Active Loop Antenna	Beijing Da Ze Technology Co.,Ltd.	ZN30900C	15006	2019/10/12	2020/10/11
Bilog Antenna	Schwarzbeck	VULB9163	000976	2019/05/26	2020/05/25
Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	791	2019/09/20	2020/09/19
Amplifier	Schwarzbeck	BBV 9743	#202	2019/09/20	2020/09/19
Amplifier	Schwarzbeck	BBV9179	9719-025	2019/09/20	2020/09/19
Amplifier	EMCI	EMC051845B	980355	2019/09/20	2020/09/19
Temperature/Humidity Meter	Gangxing	CTH-608	02	2019/09/20	2020/09/19
High-Pass Filter	K&L	9SH10-2700/X12750-O/O	KL142031	2019/09/20	2020/09/19
High-Pass Filter	K&L	41H10-1375/U12750-O/O	KL142032	2019/09/20	2020/09/19
RF Cable(below 1GHz)	HUBER+SUHNER	RG214	RE01	2019/09/20	2020/09/19
RF Cable(above 1GHz)	HUBER+SUHNER	RG214	RE02	2019/09/20	2020/09/19
Data acquisition card	Agilent	U2531A	TW53323507	2019/09/20	2020/09/19
Power Sensor	Agilent	U2021XA	MY5365004	2019/09/20	2020/09/19
Test Control Unit	Tonscend	JS0806-1	178060067	2019/06/20	2020/06/19
Automated filter bank	Tonscend	JS0806-F	19F8060177	2019/06/20	2020/06/19
Universal Radio Communication	R&S	CMU200	114353	2019/09/20	2020/09/19
Wireless Commnunication Tester	R&S	CMW500	125408	2019/09/20	2020/09/19
EMI Test Software	Tonscend	JS1120-1	Ver 2.6.8.0518	/	/
EMI Test Software	Tonscend	JS1120-3	Ver 2.5.77.0418	/	/
EMI Test Software	Tonscend	JS32-CE	Ver 2.5	/	/
EMI Test Software	Tonscend	JS32-RE	Ver 2.5.1.8	/	/

3 TEST CONDITIONS AND RESULTS

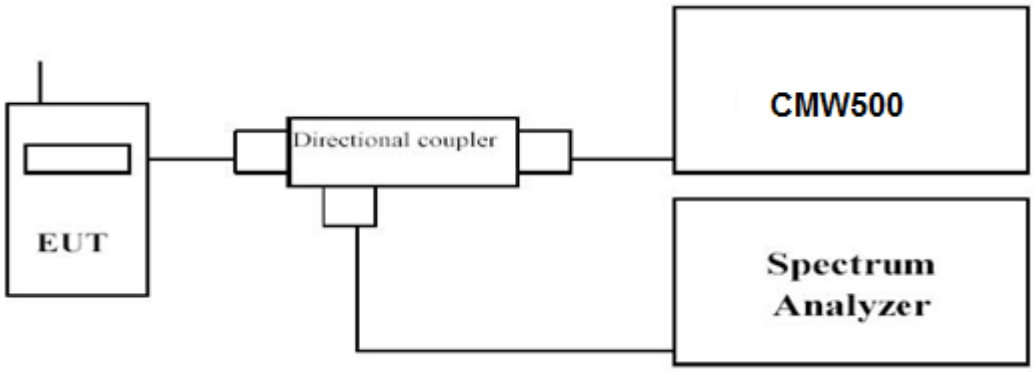
3.1 Output Power

LIMIT

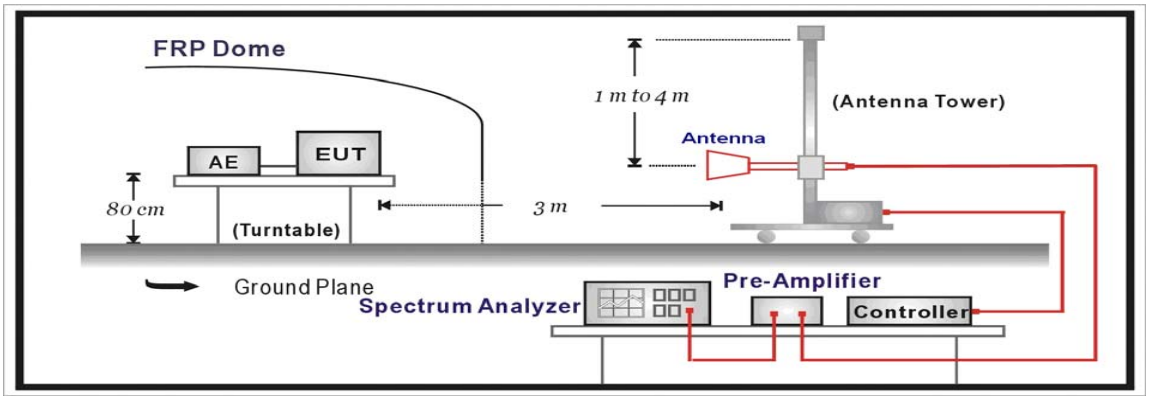
According to § 22.913(a) specifies ” The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.”
The ERP of mobile transmitters must not exceed 7 Watts for LTE Band 5.
The EIRP of mobile transmitters must not exceed 2 Watts for Band 41.

TEST CONFIGURATION

Conducted Power Measurement



Radiated Power Measurement:



TEST PROCEDURE

The EUT was setup according to EIA/TIA 603D

Conducted Power Measurement:

a) Place the EUT on a bench and set it in transmitting mode.
b) Connect a low loss RF cable from the antenna port to a spectrum analyzer and CMW500 by a Directional Couple.
c) EUT Communicate with CMW500, then select a channel for testing.
d) Add a correction factor to the display of spectrum, and then test.

Radiated Power Measurement:

a. The EUT shall be placed at the specified height on a support, and in the position closest to normal use as declared by provider.
b. The test antenna shall be oriented initially for vertical polarization and shall be chosen to correspond to thefrequency of the transmitter
c. The output of the test antenna shall be connected to the measuring receiver.
d. The transmitter shall be switched on and the measuring receiver shall be tuned to the frequency of the transmitter under test.
e. The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.

f. The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
g. The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
h. The maximum signal level detected by the measuring receiver shall be noted.
i. The transmitter shall be replaced by a substitution antenna.
j. The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
k. The substitution antenna shall be connected to a calibrated signal generator.
l. If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
m. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
n. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that 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.
o. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.
p. The measure of the effective radiated power is the larger of the two levels recorded at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.
q. Test site anechoic chamber refer to ANSI C63.26.

TEST RESULTS

Temperature	24.5℃	Humidity	53.7%
Test Engineer	Moon Tan	Configurations	WCDMA/LTE

Conducted Measurement:

WCDMA Band V

Mode	3GPP Sub Test	Low Channel	Middle Channel	High Channel
		Ave.Power (dBm)	Ave. Power (dBm)	Ave. Power (dBm)
Rel 99	1	**22.93**	22.88	22.79
HSDPA	1	21.74	20.98	21.29
	2	20.68	21.80	21.92
	3	20.76	22.18	20.83
	4	20.79	21.31	21.79
HSUPA	1	21.58	21.00	21.36
	2	20.59	22.11	21.03
	3	20.36	21.77	22.35
	4	20.55	21.58	22.44
	5	20.61	21.83	22.31
HSPA+	1	20.64	21.54	21.44

LTE FDD Band 5				
TX Channel Bandwidth	RB Size/Offset	Frequency (MHz)	Average Power [dBm]	
			QPSK	16QAM
1.4 MHz	1 RB low	824.7	21.98	21.69
		836.5	22.28	21.22
		848.3	21.95	21.56
	1 RB high	824.7	21.66	20.84
		836.5	21.81	21.64
		848.3	21.38	21.43
	50% RB mid	824.7	21.73	**22.61**
		836.5	21.89	21.19
		848.3	22.55	22.53
	100% RB	824.7	21.91	21.41
		836.5	21.60	22.06
		848.3	21.63	21.24
3 MHz	1 RB low	825.5	21.91	21.26
		836.5	22.05	21.55
		847.5	22.18	21.03
	1 RB high	825.5	20.87	22.55
		836.5	21.58	22.03
		847.5	22.34	21.80
	50% RB mid	825.5	21.78	20.71
		836.5	21.41	21.41
		847.5	21.04	22.20
	100% RB	825.5	21.32	21.04
		836.5	22.24	22.39
		847.5	22.34	21.19
5 MHz	1 RB low	826.5	20.71	22.56
		836.5	22.19	20.90
		846.5	20.62	22.10
	1 RB high	826.5	22.12	21.30
		836.5	22.25	21.48
		846.5	21.63	20.77
	50% RB mid	826.5	22.02	22.00
		836.5	21.45	21.40
		846.5	21.65	21.69
	100% RB	826.5	21.14	22.55
		836.5	21.32	22.09
		846.5	22.27	21.90
10 MHz	1 RB low	829	22.25	21.41
		836.5	21.43	22.02
		844	22.06	22.03
	1 RB high	829	22.47	20.78
		836.5	22.39	21.45
		844	20.84	22.09
	50% RB mid	829	22.40	20.70
		836.5	21.24	22.17
		844	22.12	22.02
	100% RB	829	21.20	20.93
		836.5	21.37	21.52
		844	21.44	21.54

LTE FDD Band 41				
TX Channel Bandwidth	RB Size/Offset	Frequency (MHz)	Average Power [dBm]	
			QPSK	16QAM
5 MHz	1 RB low	2552.5	22.38	21.97
		2605	22.17	22.45
		2652.5	21.89	20.88
	1 RB high	2552.5	21.95	21.46
		2605	22.20	21.09
		2652.5	21.01	21.86
	50% RB mid	2552.5	21.18	21.40
		2605	22.03	21.07
		2652.5	21.05	22.20
	100% RB	2552.5	22.08	21.00
		2605	22.32	21.06
		2652.5	21.98	22.00
10 MHz	1 RB low	2560	21.54	21.50
		2605	22.29	21.65
		2650	21.69	21.29
	1 RB high	2560	21.13	**22.82**
		2605	21.11	21.86
		2650	21.15	20.81
	50% RB mid	2560	20.79	21.62
		2605	21.37	21.19
		2650	22.10	22.73
	100% RB	2560	21.82	20.95
		2605	21.78	21.35
		2650	21.80	21.92
15 MHz	1 RB low	2562.5	21.64	21.91
		2605	22.67	21.11
		2647.5	21.77	21.59
	1 RB high	2562.5	22.17	21.03
		2605	22.16	22.04
		2647.5	21.25	21.90
	50% RB mid	2562.5	21.57	21.38
		2605	21.86	21.49
		2647.5	21.30	21.75
	100% RB	2562.5	21.86	21.72
		2605	20.67	22.08
		2647.5	20.92	21.35
20 MHz	1 RB low	2565	21.69	22.31
		2605	21.19	22.04
		2645	22.43	22.00
	1 RB high	2565	22.05	22.08
		2605	20.74	21.26
		2645	22.59	20.93
	50% RB mid	2565	21.52	21.19
		2605	22.77	21.36
		2645	22.55	21.99
	100% RB	2565	22.23	21.33
		2605	21.47	22.02
		2645	21.91	21.72

Radiated Measurement:

Remark:

1. We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 5; recorded worst case for each Channel Bandwidth of LTE FDD Band 5.
2. ERP = EIRP – 2.15dBi as EIRP by subtracting the gain of the dipole.

nnelFrequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss(dB)			
WCDMA Band V Middle Channel								
836.60	H	81.34	20.41	0	0.97	19.44	38.45	19.01
836.60	V	94.47	22.69	0	0.97	21.72	38.45	16.73

LTE Band 5

Frequency (MHz)	BW (MHz)	Modulation	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
					Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
836.50	1.4	QPSK	H	80.22	19.29	0	0.97	18.32	38.45	20.13
836.50			V	90.24	18.46	0	0.97	17.49	38.45	20.96
836.50	3		H	79.5	18.57	0	0.97	17.6	38.45	20.85
836.50			V	93.81	22.03	0	0.97	21.06	38.45	17.39
836.50	5		H	79.34	18.41	0	0.97	17.44	38.45	21.01
836.50			V	93.17	21.39	0	0.97	20.42	38.45	18.03
836.50	10		H	79.97	19.04	0	0.97	18.07	38.45	20.38
836.50			V	93.24	21.46	0	0.97	20.49	38.45	17.96
836.50	1.4	16QAM	H	79.42	18.49	0	0.97	17.52	38.45	20.93
836.50			V	91.45	19.67	0	0.97	18.7	38.45	19.75
836.50	3		H	79.98	19.05	0	0.97	18.08	38.45	20.37
836.50			V	93.4	21.62	0	0.97	20.65	38.45	17.8
836.50	5		H	80.5	19.57	0	0.97	18.6	38.45	19.85
836.50			V	91.57	19.79	0	0.97	18.82	38.45	19.63
836.50	10		H	80.63	19.7	0	0.97	18.73	38.45	19.72
836.50			V	89.88	18.1	0	0.97	17.13	38.45	21.32

LTE Band 41

Frequency (MHz)	BW (MHz)	Modulation	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
					Substituted Level (dBm)	Antenna Gain (dBd/ dBi)	Cable Loss (dB)			
2605.00	5	QPSK	H	88.18	15.95	13.2	3.1	26.05	33	6.95
2605.00			V	82.16	11.69	13.2	3.1	21.79	33	11.21
2605.00	10		H	87.76	15.53	13.2	3.1	25.63	33	7.37
2605.00			V	81.28	10.81	13.2	3.1	20.91	33	12.09
2605.00	15		H	88.95	16.72	13.2	3.1	26.82	33	6.18
2605.00			V	82.25	11.78	13.2	3.1	21.88	33	11.12
2605.00	20		H	87.82	15.59	13.2	3.1	25.69	33	7.31
2605.00			V	82.28	11.81	13.2	3.1	21.91	33	11.09
2605.00	5	16QAM	H	88.44	16.21	13.2	3.1	26.31	33	6.69
2605.00			V	81.72	11.25	13.2	3.1	21.35	33	11.65
2605.00	10		H	87.56	15.33	13.2	3.1	25.43	33	7.57
2605.00			V	82.45	11.98	13.2	3.1	22.08	33	10.92
2605.00	15		H	87.85	15.62	13.2	3.1	25.72	33	7.28
2605.00			V	82.22	11.75	13.2	3.1	21.85	33	11.15
2605.00	20		H	88.58	16.35	13.2	3.1	26.45	33	6.55
2605.00			V	81.47	11	13.2	3.1	21.1	33	11.9

Note:
(1) The unit of Antenna Gain is dBd for frequency below 1GHz, and the unit of Antenna Gain is dBi for frequency above 1GHz.

(2) Absolute Level = Substituted Level - Cable loss + Antenna Gain

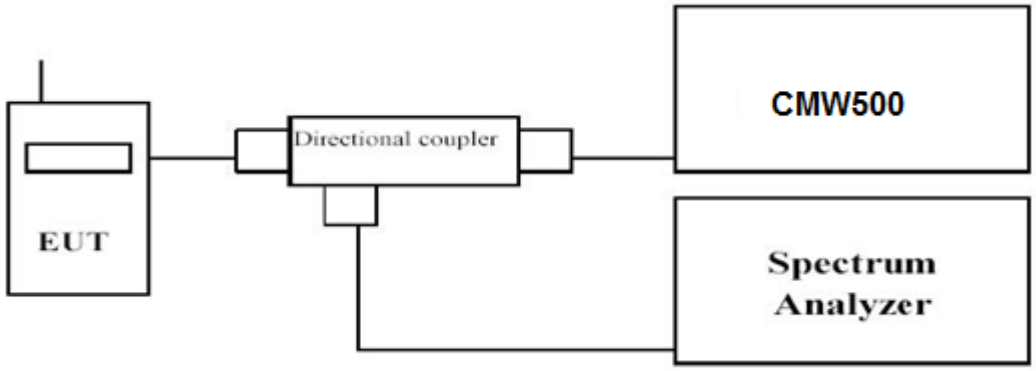
(3) Margin = Limit-Absolute Level

3.2 Peak-to-Average Ratio (PAR)

LIMIT

The Peak-to-Average Ratio (PAR) of the transmission may not exceed 13 dB.

TEST CONFIGURATION



TEST PROCEDURE

1. Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;
2. Set resolution/measurement bandwidth ≥ signal's occupied bandwidth;
3. Set the number of counts to a value that stabilizes the measured CCDF curve;
4. Set the measurement interval as follows:
   1). for continuous transmissions, set to 1 ms,
   2). for burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize and set the measurement interval to a time that is less than or equal to the burst duration.
5. Record the maximum PAPR level associated with a probability of 0.1%.

TEST RESULTS

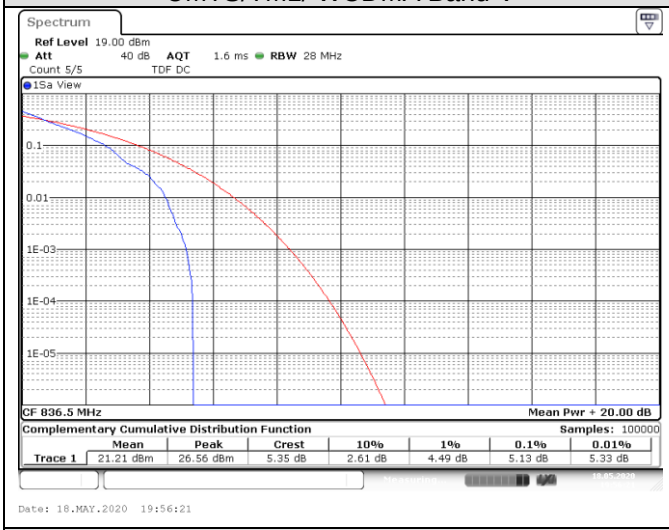
Temperature	24.5℃	Humidity	53.7%
Test Engineer	Moon Tan	Configurations	WCDMA/LTE

Remark:
We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of WCDMA Band V ,LTE FDD Band 5, LTE TDD Band 41; recorded worst case for each Channel Bandwidth of WCDMA Band V , LTE FDD Band 5,LTE TDD Band 41.

1.For E-UTRA Band 5, please refer to Appendix Band 5: Section A;
2.For E-UTRA Band 7, please refer to Appendix Band 41: Section A;

WCDMA :

Test Mode	Channel	Frequency (MHz)	PAPR Value (dB)	Limits (dB)	Verdict
UMTS/TM1/ WCDMA Band V	4183	836.60	5.13	13.0	PASS

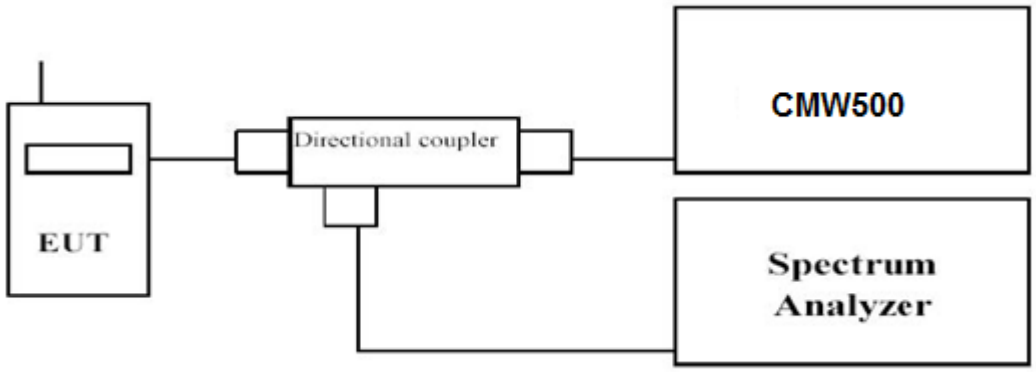
Peak-to-Average Ratio (PAR)	
UMTS/TM1/ WCDMA Band V	
	
Channel 4182 / 836.4 MHz	

3.3 Occupied Bandwidth and Emission Bandwidth

LIMIT

FCC §2.1049, §22.917, §22.905, §27.53.

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at low, middle and high channel in each band. The -26dBc Emission bandwidth was also measured and recorded.
Set RBW was set to about 1% of emission BW, VBW≥3 times RBW.
-26dBc display line was placed on the screen (or 99% bandwidth), the occupied bandwidth is the delta frequency between the two points where the display line intersects the signal trace.

TEST RESULTS

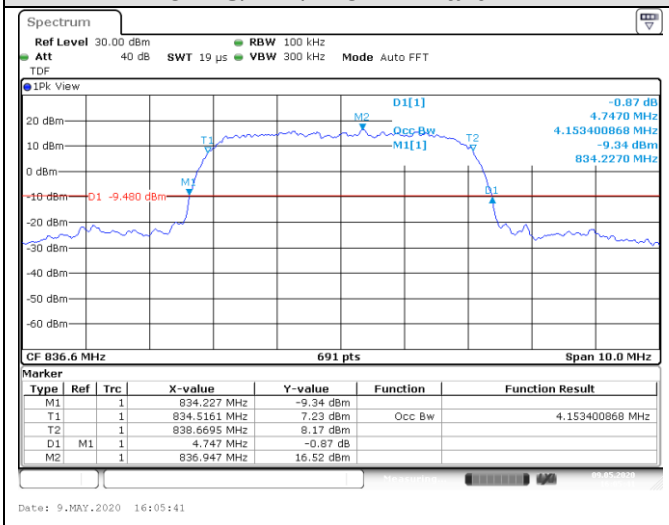
Remark:
We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of WCDMA Band V ,LTE FDD Band 5, LTE TDD Band 41; recorded worst case for each Channel Bandwidth of WCDMA Band V , LTE FDD Band 5,LTE TDD Band 41.

1.For E-UTRA Band 5, please refer to Appendix Band 5: Section B;
2.For E-UTRA Band 7, please refer to Appendix Band 41: Section B;

Temperature	24.5℃	Humidity	53.7%
Test Engineer	Moon Tan	Configurations	WCDMA/LTE

Test Mode	Channel	Frequency (MHz)	Occupied Bandwidth (99% BW) (MHz)	Emission Bandwidth (-26 dBc BW) (MHz)	Verdict
UMTS/TM1/ WCDMA Band V	4183	836.60	4.153	4.747	PASS

Remark:
1. Test results including cable loss;
2. Please refer to following plots;

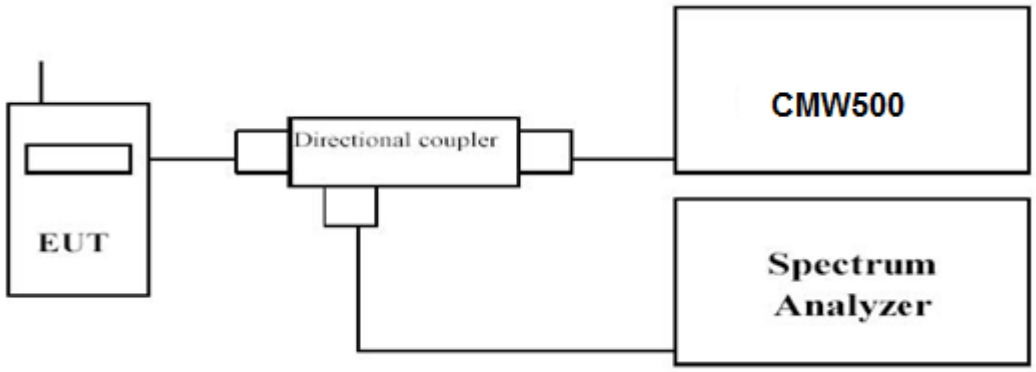
Occupied Bandwidth and Emission Bandwidth	
UMTS/TM1/ WCDMA Band V	
	
Channel 4182 / 836.4 MHz	

3.4 Band Edge compliance

LIMIT

FCC § 2.1053, §22.917, and § 27.53.

TEST CONFIGURATION



TEST PROCEDURE

1. The transmitter output port was connected to base station.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator, the path loss was compensated to the results for each measurement.
3. Set EUT at maximum power through base station.
4. Select lowest and highest channels for each band and different modulation.
5. Measure Band edge using RMS (Average) detector by spectrum

TEST RESULTS

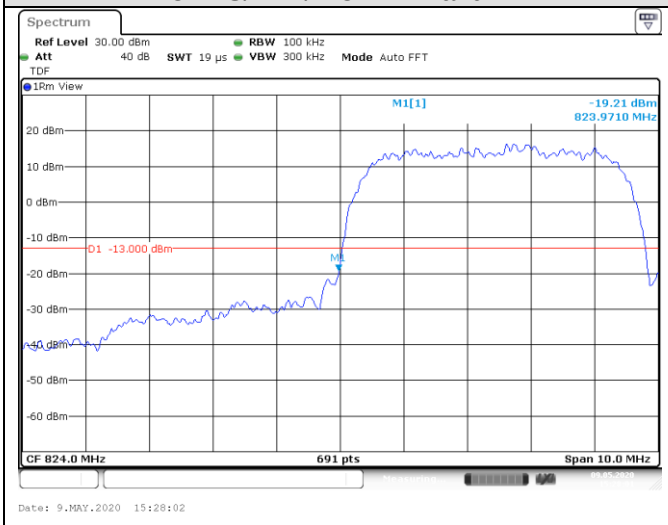
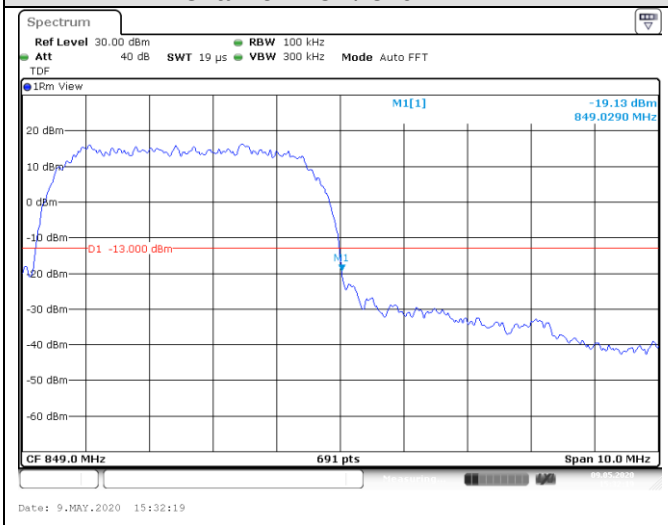
Temperature	24.5℃	Humidity	53.7%
Test Engineer	Moon Tan	Configurations	WCDMA/LTE

Remark:
We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of WCDMA Band V ,LTE FDD Band 5, LTE TDD Band 41; recorded worst case for each Channel Bandwidth of WCDMA Band V , LTE FDD Band 5,LTE TDD Band 41.

1.For E-UTRA Band 5, please refer to Appendix Band 5: Section C;
2.For E-UTRA Band 41, please refer to Appendix Band 41: Section C;

UMTS/TM1/WCDMA Band V					
Test Mode	Channel	Frequency (MHz)	Band Edg Compliance (dBm)	Limits (dBm)	Verdict
UMTS/TM1/WCDMA Band V	4132	826.40	-19.21dBm	-13dBm	PASS
	4233	846.60	-19.13dBm	-13dBm	

Remark:
1. Test results including cable loss;
2. Please refer to following plots;

Band-edge Compliance	
UMTS/TM1/WCDMA Band V	
	
Channel 4132 / 826.4 MHz	
	
Channel 4233 / 846.6 MHz	

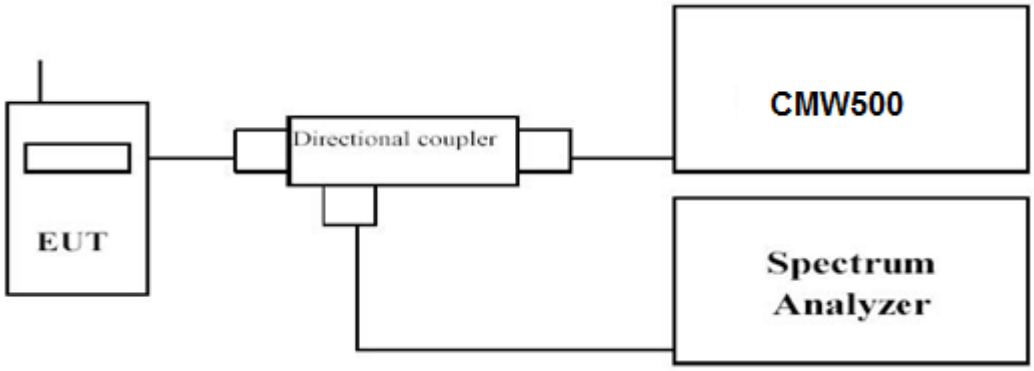
3.5 Spurious Emission

LIMIT

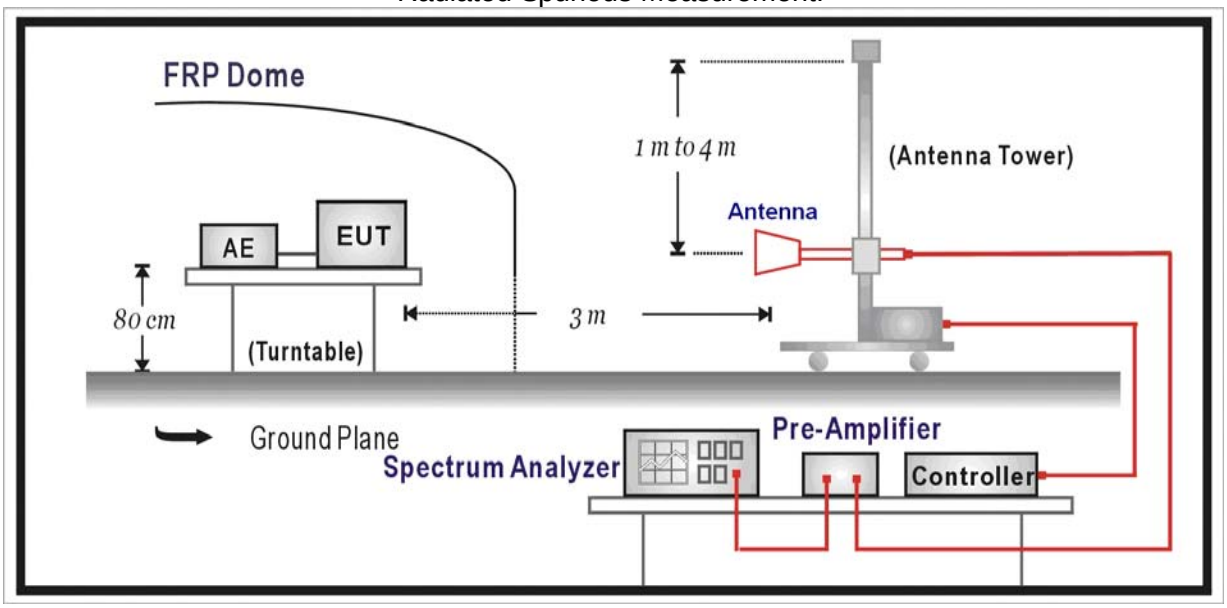
FCC § 2.1053, §22.917, and § 27.53.

TEST CONFIGURATION

Conducted Spurious Measurement:



Radiated Spurious Measurement:



TEST PROCEDURE

The EUT was setup according to EIA/TIA 603D

Conducted Spurious Measurement:

a. Place the EUT on a bench and set it in transmitting mode.
b. Connect a low loss RF cable from the antenna port to a spectrum analyzer and CMW500 by a Directional Couple.
c. EUT Communicate with CMW500, then select a channel for testing.
d. Add a correction factor to the display of spectrum, and then test.
e. The resolution bandwidth of the spectrum analyzer was set sufficient scans were taken to show the out of band Emission if any up to10^{th} harmonic.
f. Please refer to following tables for test antenna conducted emissions.

Working Frequency	Sub range (GHz)	RBW	VBW	Sweep time (s)
LTE FDD Band 5	0.000009~0.000015	1KHz	3KHz	Auto
	0.000015~0.03	10KHz	30KHz	Auto
	0.03~26.5	1 MHz	3 MHz	Auto

Radiated Spurious Measurement:

a. The EUT shall be placed at the specified height on a support, and in the position closest to normal use as declared by provider.
b. The test antenna shall be oriented initially for vertical polarization and shall be chosen to correspond to the frequency of the transmitter
c. The output of the test antenna shall be connected to the measuring receiver.
d. The transmitter shall be switched on and the measuring receiver shall be tuned to the frequency of the transmitter under test.
e. The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
f. The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
g. The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
h. The maximum signal level detected by the measuring receiver shall be noted.
i. The transmitter shall be replaced by a substitution antenna.
j. The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
k. The substitution antenna shall be connected to a calibrated signal generator.
l. If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
m. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
n. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that 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.
o. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.
p. The measure of the effective radiated power is the larger of the two levels recorded at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.
q. The resolution bandwidth of the spectrum analyzer was set at 100 kHz for Part 22 and 1MHz for Part 24. The frequency range was checked up to 10th harmonic.
r. Test site anechoic chamber refer to ANSI C63.

TEST RESULTS

Conducted Measurement:

Temperature	24.5℃	Humidity	53.7%
Test Engineer	Moon Tan	Configurations	WCDMA/LTE

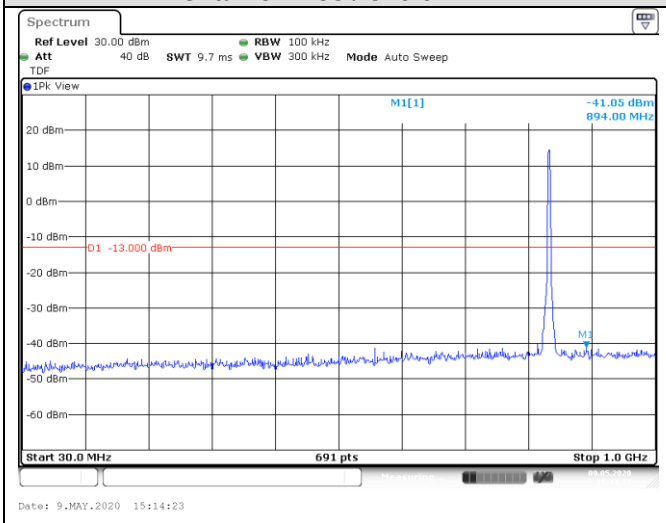
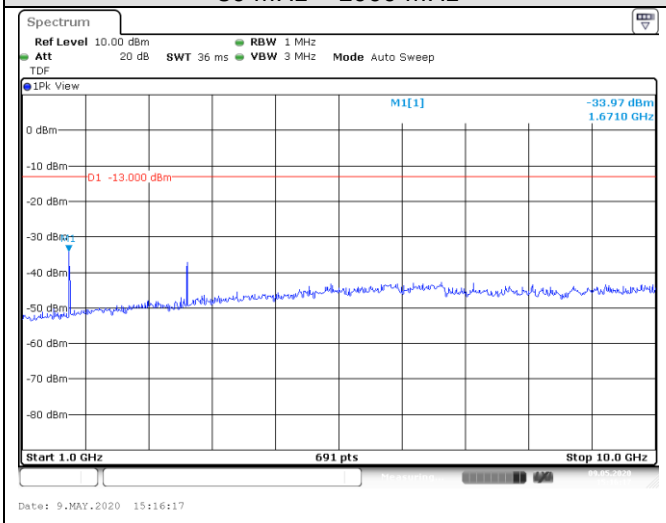
Remark:
We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of WCDMA Band V ,LTE FDD Band 5, LTE TDD Band 41; recorded worst case for each Channel Bandwidth of WCDMA Band V , LTE FDD Band 5,LTE TDD Band 41.

1.For E-UTRA Band 5, please refer to Appendix Band 5: Section D;
2.For E-UTRA Band 7, please refer to Appendix Band 41: Section D;

WCDMA:

Test Mode	Channel	Frequency (MHz)	Spurious RF Conducted Emission (dBm)	Limits (dBm)	Verdict
UMTS/TM1/WCDMA Band V	4182	836.40	<-13dBm	-13dBm	PASS

Remark:
1. Test results including cable loss;
2. Please refer to following plots;

Spurious Emssion on Antenna Port	
UMTS/TM1/WCDMA Band V	
Channel 4233 / 846.6 MHz	
	
30 MHz – 1000 MHz	
	
1 GHz – 10 GHz	

Radiated Measurement:

30-10G:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
WCDMA Band V R99,Frequency:836.600 MHz								
1673.2	H	44.39	-62.61	10.6	0.73	-52.74	-13	39.74
1673.2	V	44.16	-60.84	10.6	0.73	-50.97	-13	37.97
2509.8	H	46.45	-66.55	13.1	1.25	-54.7	-13	41.7
2509.8	V	46.77	-66.23	13.1	1.25	-54.38	-13	41.38
3346.4	H	42.66	-67.34	13.8	1.61	-55.15	-13	42.15
3346.4	V	46.2	-63.8	13.8	1.61	-51.61	-13	38.61
356	H	47.23	-60.27	0	0.55	-60.82	-13	47.82
356	V	45.55	-61.95	0	0.55	-62.5	-13	49.5

LTE Band 5 (30MHz-10GHz):

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/ dBi)	Cable Loss (dB)			
QPSK,Frequency: 836.500 MHz								
1673	H	45.73	-61.27	10.6	0.73	-51.4	-13	38.4
1673	V	44.91	-60.09	10.6	0.73	-50.22	-13	37.22
2510	H	48.92	-64.08	13.1	1.25	-52.23	-13	39.23
2510	V	46.52	-66.48	13.1	1.25	-54.63	-13	41.63
3346.4	H	42.57	-67.43	13.8	1.61	-55.24	-13	42.24
3346.4	V	45.48	-64.52	13.8	1.61	-52.33	-13	39.33
289.4	H	46.37	-61.13	0	0.55	-61.68	-13	48.68
289.4	V	44.53	-62.97	0	0.55	-63.52	-13	50.52

LTE Band 41 (30MHz-26.5GHz):

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/ dBi)	Cable Loss (dB)			
QPSK,Frequency:2605.000 MHz								
5210	H	49.14	-58.86	13.99	1.5	-46.37	-25	21.37
5210	V	50.49	-55.51	13.99	1.5	-43.02	-25	18.02
7820	H	50.41	-61.59	13.32	1.53	-49.8	-25	24.8
7820	V	50.63	-61.37	13.32	1.53	-49.58	-25	24.58
305.2	H	47.24	-60.26	0	0.55	-60.81	-25	35.81
305.2	V	44.76	-62.74	0	0.55	-63.29	-25	38.29

Note:

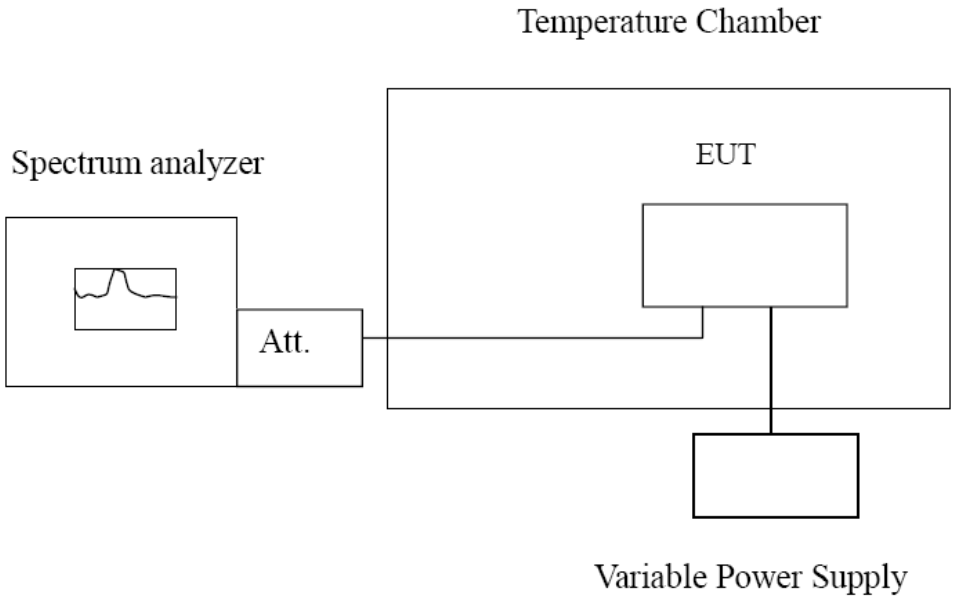
1) The unit of Antenna Gain is dBd for frequency below 1GHz, and the unit of Antenna Gain is dBi for frequency above 1GHz.
2) Absolute Level = Substituted Level - Cable loss + Antenna Gain
3) Margin = Limit-Absolute Level

3.6 Frequency Stability under Temperature & Voltage Variations

LIMIT

FCC § 2.1055 (a), § 2.1055 (d), §22.355,§27.54.

TEST CONFIGURATION



TEST PROCEDURE

The EUT was setup according to EIA/TIA 603D

Frequency Stability Under Temperature Variations:
In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a “call mode”. This is accomplished with the use of R&S CMW500 DIGITAL RADIO COMMUNICATION TESTER.
1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30℃.
3. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on middle channel for LTE band 5, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
4. Repeat the above measurements at 10℃ increments from -30℃ to +50℃. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1.5 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50℃.
7. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10 ℃ increments from +50℃ to -30℃. Allow at least 1.5 hours at each temperature, unpowered, before making measurements
9. At all temperature levels hold the temperature to +/- 0.5℃ during the measurement procedure.
Frequency Stability Under Voltage Variations:
Set chamber temperature to 20℃. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.
Reduce the input voltage to specify extreme voltage variation (±15%) and endpoint, record the maximum frequency change.

TEST RESULTS

Temperature	24.5℃	Humidity	53.7%
Test Engineer	Moon Tan	Configurations	WCDMA/LTE

WCDMA Band V: R99

Middle Channel, fc = 836.6 MHz				
Temperature	**Voltage**	**Frequency Error**	**Frequency Error**	**Limit**
℃	**VDC**	**Hz**	**ppm**	**ppm**
-30	24	13	0.015539	2.5
-20		5	0.005977	
-10		4	0.004781	
0		9	0.010758	
10		-7	-0.008367	
20		2	0.002391	
30		-5	-0.005977	
40		-12	-0.014344	
45		-10	-0.011953	
25	11	-4	-0.004781	
25	54	5	0.005977	

LTE Band 5:

QPSK, Channel Bandwidth:10MHz Middle Channel, fc = 836.5 MHz				
Temperature	**Voltage**	**Frequency Error**	**Frequency Error**	**Limit**
℃	**VDC**	**Hz**	**ppm**	**ppm**
-30	24	-7.55	-0.009026	2.5
-20		-4.76	-0.005690	
-10		-19.13	-0.022869	
0		3.30	0.003945	
10		-18.96	-0.022666	
20		8.09	0.009671	
30		-5.14	-0.006145	
40		2.05	0.002451	
50		-3.75	-0.004483	
20	11	-6.32	-0.007555	
20	54	-13.50	-0.016139	

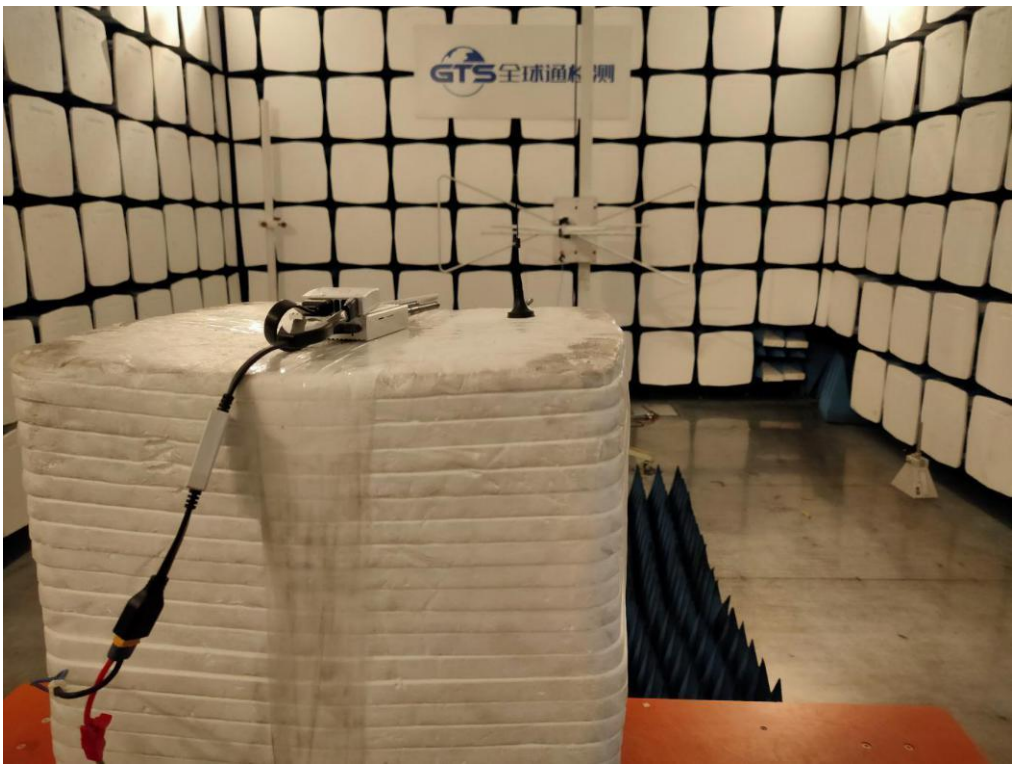
16QAM, Channel Bandwidth:10MHz Middle Channel, fc =836.5 MHz				
Temperature	**Voltage**	**Frequency Error**	**Frequency Error**	**Limit**
℃	**VDC**	**Hz**	**ppm**	**ppm**
-30	24	-9.64	-0.011524	2.5
-20		1.58	0.001889	
-10		-2.26	-0.002702	
0		15.70	0.018769	
10		-8.13	-0.009719	
20		10.34	0.012361	
30		-7.35	-0.008787	
40		-5.48	-0.006551	
50		-0.83	-0.000992	
20	11	1.99	0.002379	
20	54	-7.13	-0.008524	

LTE Band 41:

QPSK, Channel Bandwidth:10MHz Middle Channel, fc =2605MHz				
Temperature	**Voltage**	**Frequency Error**	**Frequency Error**	**Result**
℃	**VDC**	**Hz**	**ppm**	
-30	24	19.05	0.007313	Pass
-20		1.91	0.000733	
-10		6.44	0.002472	
0		6.06	0.002326	
10		11.74	0.004507	
20		11.09	0.004257	
30		-3.63	-0.001393	
40		-1.56	-0.000599	
50		12.87	0.004940	
20	11	-16.74	-0.006426	
20	54	-19.14	-0.007347	

16QAM, Channel Bandwidth:10MHz Middle Channel, f_C =2605 MHz				
Temperature	**Voltage**	**Frequency Error**	**Frequency Error**	**Result**
℃	**VDC**	**Hz**	**ppm**	
-30	24	18.27	0.007013	Pass
-20		6.00	0.002303	
-10		13.25	0.005086	
0		-1.99	-0.000764	
10		-11.53	-0.004426	
20		1.83	0.000702	
30		14.04	0.005390	
40		7.21	0.002768	
50		0.58	0.000223	
20	11	-16.37	-0.006284	
20	54	-12.20	-0.004683	

4 TEST SETUP PHOTOS OF THE EUT



5 EXTERNAL AND INTERNAL PHOTOS OF THE EUT

Reference to the test report No. **GTS20200303005-1-8**

.....End of Report.....