

# FCC TEST REPORT

## (PART 96)

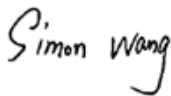
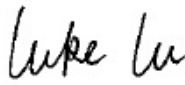
Applicant:	HMD Global Oy
Address:	Bertel Jungin aukio 9,02600 Espoo, Finland

Manufacturer or Supplier:	HMD Global Oy
Address:	Bertel Jungin aukio 9,02600 Espoo, Finland
Product:	Smart phone
Brand Name:	HMD
Model Name:	TA-1600/TA-1688
FCC ID:	2AJOTTA-1600
Date of tests:	Apr. 08, 2024 ~ May. 31, 2024

The tests have been carried out according to the requirements of the following standard:

☒ **47 CFR FCC Part 96**

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

Prepared by Simon Wang Engineer / Mobile Department	Approved by Luke Lu Manager / Mobile Department
	
Date: May. 31, 2024	Date: May. 31, 2024

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**RELEASE CONTROL RECORD**

ISSUE NO.	DESCRIPTION	DATE ISSUED
PSU-NQN2403180115RF11	Original release	May. 31, 2024



# 1 SUMMARY OF TEST RESULTS

47 CFR FCC PART 96			
FCC CLAUSE	TEST ITEM	RESULT	LAB
2.1046 96.41(b)	Maximum Peak Output Power and Maximum EIRP	Compliance	B
2.1046 96.41(e)	Conducted Band Edge	Compliance	A
2.1049	Occupied Bandwidth	Compliance	A
2.1055	Frequency Stability	Compliance	A
2.1051 96.41(e)	Conducted Spurious Emissions	Compliance	A
2.1053 96.41(e)	Radiated Spurious Emissions	Compliance	B
96.41(g)	Peak-to-Average Power Ratio	Compliance	A

Note:

1.Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

**Lab A:**

BV 7Layers Communications Technology (Shenzhen) Co. Ltd

**Lab Address:**

Room B37, Warehouse A5, No.3 Chiwan 4th Road, Zhaoshang Street, Nanshan District  
Shenzhen, Guangdong, People's Republic of China

**Accredited Test Lab Cert 3939.01**

The FCC Site Registration No. is 525120; The Designation No. is CN1171.

**Lab B:**

Huarui 7Layers High Technology (Suzhou) Co., Ltd.

**Lab Address:**

Tower N, Innovation Center, 88 Zhuyi Road, High-tech District, Suzhou City, Anhui Province

**Accredited Test Lab Cert 6613.01**

The FCC Site Registration No. is 434559; The Designation No. is CN1325.



## 1.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

MEASUREMENT	UNCERTAINTY
Effective Radiated Power	±1.48dB
Frequency Stability	±39.27Hz
Radiated emissions (9KHz~30MHz)	±2.68dB
Radiated emissions & Radiated Power (30MHz~1GHz)	±4.98dB
Radiated emissions & Radiated Power (1GHz ~6GHz)	±4.70dB
Radiated emissions (6GHz ~18GHz)	±4.60dB
Radiated emissions (18GHz ~40GHz)	±4.12dB
Conducted emissions	±4.01 dB
Occupied Channel Bandwidth	±21.7KHz
Band Edge Measurements	±1.48dB
Peak to average ratio	±0.76dB

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



## 1.2 TEST SITE AND INSTRUMENT

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
MXE EMI Receiver	KEYSIGHT	N9038A-544	MY54450026	Mar. 28,23	Mar. 27,24
MXE EMI Receiver	KEYSIGHT	N9038A-544	MY54450026	Mar. 27,24	Mar. 26,25
EXA Signal Analyzer	KEYSIGHT	N9010A-544	MY54510355	May. 10,23	May. 09,24
EXA Signal Analyzer	KEYSIGHT	N9010A-544	MY54510355	May. 09,24	May. 08,25
Loop Antenna	Schwarzbeck	FMZB 1519B	00173	Sep. 02,23	Sep. 01,24
Bilog Antenna	ETS-LINDGRE N	3143B	00161965	Feb. 17,24	Feb. 16,25
Horn Antenna	ETS-LINDGRE N	3117	00168692	Feb. 17,24	Feb. 16,25
Horn Antenna (18GHz-40GHz)	N/A	QWH-SL-18-40-K-SG/QMS-00361	15433	Sep. 03,23	Sep. 03,24
Radio Communication Analyzer	ANRITSU	MT8820C	6201465426	Feb. 13,24	Feb. 12,25
Signal Pre-Amplifier	EMSI	EMC 9135	980249	May. 06,23	May. 05,24
Signal Pre-Amplifier	EMSI	EMC 9135	980249	May. 05,24	May. 04,25
Signal Pre-Amplifier	EMSI	EMC 012645B	980257	May. 10,23	May.09,24
Signal Pre-Amplifier	EMSI	EMC 012645B	980257	May. 09,24	May.08,25
Signal Pre-Amplifier	EMSI	EMC 184045B	980259	Feb. 16,24	Feb. 15,25
3m Semi-anechoic Chamber	ETS-LINDGRE N	9m*6m*6m	Euroshieldpn-CT0001143-1216	Nov. 14,23	Nov. 13,26
Test Software	E3	V 9.160323	N/A	N/A	N/A
Test Software	JS1120	3.1.36	N/A	N/A	N/A
10dB Attenuator	JFW/USA	50HF-010-SMA	50HF-010-SMA	May. 06,23	May. 05,24
10dB Attenuator	JFW/USA	50HF-010-SMA	50HF-010-SMA	May. 05,24	May. 04,25
Power Meter	Anritsu	ML2495A	1506002	Feb. 13,24	Feb. 12,25
Power Sensor	Anritsu	MA2411B	1339352	Feb. 13,24	Feb. 12,25
Temperature Chamber	ESPEC	SH-242	93000855	May. 06,23	May. 05,24
Temperature Chamber	ESPEC	SH-242	93000855	May. 05,24	May. 04,25
MXG Analog Microwave Signal Generator	KEYSIGHT	N5183A	MY50143024	Feb. 13,24	Feb. 12,25
Base station R&S CMW500	Rohde&Schwarz	CMW500	153085	May.10,23	May.09,24
Base station R&S CMW500	Rohde&Schwarz	CMW500	153085	May. 09,24	May.08,25
DC Source	Kikusui/JP	PMX18-5A	N/A	Aug. 11,23	Aug. 10,24

**NOTE:** 1. The calibration interval of the above test instruments is 12 months or 36 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

2. The test was performed in 3m Semi-anechoic Chamber and RF Oven Room.

3. The horn antenna is used only for the measurement of emission frequency above 1GHz if tested.

4. The FCC Site Registration No. is 525120; The Designation No. is CN1171.



Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Pre-Amplifier	R&S	SCU18F1	100815	Aug.30,22	Aug.29,24
Pre-Amplifier	R&S	SCU08F1	101028	Sep.16,22	Sep.15,24
Vector Signal Generator	R&S	SMBV100B	102176	Feb.15,24	Feb.14,26
Signal Generator	R&S	SMB100A	182185	Feb.15,24	Feb.14,26
3m Fully-anechoic Chamber	TDK	9m*6m*6m	HRSW-SZ-E MC-01Chamber	Nov.25,22	Nov.24,25
3m Semi-anechoic Chamber	TDK	9m*6m*6m	HRSW-SZ-E MC-02Chamber	Nov.25,22	Nov.24,25
EMI TEST Receiver	R&S	ESR26	101734	Feb.24,24	Feb.23,26
EMI TEST Receiver	R&S	ESW44	101973	Feb.24,24	Feb.23,26
Bilog Antenna	SCHWARZBECK	VULB 9163	1264	Feb.27,24	Feb.26,26
Horn Antenna	ETS-LINDGREN	3117	227836	Aug.22,22	Aug.21,24
Horn Antenna (18GHz-40GHz)	Steatite Q-par Antennas	QMS 00880	23486	Feb.22,24	Feb.21,26
Horn Antenna	Steatite Q-par Antennas	QMS 00208	23485	Aug.22,22	Aug.21,24
Loop Antenna	SCHWARZ	HFH2-Z2/Z2E	100976	Feb.22,24	Feb.21,26
WIDEBANDRADIO COMMUNICATION TESTER	R&S	CMW500	169399	Jun.27,22	Jun.26,24
Test Software	EMC32	EMC32	N/A	N/A	N/A
Test Software	ELEKTRA	ELEKTRA4.32	N/A	N/A	N/A
Open Switch and Control Unit	R&S	OSP220	101964	Oct.01,22	Sep.30,24
DC Source	HYELEC	HY3010B	551016	Aug.31,22	Aug.30,24
Hygrothermograph	DELI	20210528	SZ014	Sep.06,22	Sep.05,24
PC	LENOVO	E14	HRSW0024	N/A	N/A
TMC-AMI18843A(CABLE)	R&S	HF290-NMNM-7.0 OM	N/A	N/A	N/A
TMC-AMI18843A(CABLE)	R&S	HF290-NMNM-4.0 OM	N/A	N/A	N/A
CABLE	R&S	W13.02	N/A	Apr.28,23	Apr.27,24
CABLE	R&S	W13.02	N/A	Apr.27,24	Apr.26,25
CABLE	R&S	W12.14	N/A	Apr.28,23	Apr.27,24
CABLE	R&S	W12.14	N/A	Apr.27,24	Apr.26,25
CABLE	R&S	J12J103539-00-1	SEP-03-20-069	Apr.28,23	Apr.27,24
CABLE	R&S	J12J103539-00-1	SEP-03-20-069	Apr.27,24	Apr.26,25
CABLE	R&S	J12J103539-00-1	SEP-03-20-070	Apr.28,23	Apr.27,24
CABLE	R&S	J12J103539-00-1	SEP-03-20-070	Apr.27,24	Apr.26,25
Temperature Chamber	votsch	VT4002	58566078100050	May.31,22	May.30,24





Temperature Chamber	votsch	VT4002	5856607810 0050	May.30,24	May.29,26
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**NOTE:** 1. The calibration interval of the above test instruments is 12/ 24 / 36 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

2. The test was performed in 3m Semi-anechoic Chamber and RF Oven Room.

3. The horn antenna is used only for the measurement of emission frequency above 1GHz if tested.

4. The FCC Site Registration No. is 434559; The Designation No. is CN1325.



## 2 GENERAL INFORMATION

### 2.1 GENERAL DESCRIPTION OF EUT

PRODUCT*	Smart phone	
BRAND NAME*	HMD	
MODEL NAME*	TA-1600/TA-1688	
NOMINAL VOLTAGE*	5.0Vdc/9.0Vdc /12.0Vdc(adapter) 3.89Vdc (battery)	
MODULATION TECHNOLOGY	5G NR	DFT-s-OFMA(Pi/2 BPSK,QPSK,16QAM,64QAM,256QAM); CP-OFMA(QPSK,16QAM,64QAM,256QAM);
FREQUENCY RANGE	NR Band n48	3555 MHz ~ 3694.98MHz
EMISSION DESIGNATOR	NR Band n48 Channel Bandwidth: 20MHz	QPSK: 17M8G7D 16QAM: 17M9W7D 64QAM: 17M8W7D 256QAM: 17M8W7D Pi/2BPSK: 17M8G7D
	NR Band n48 Channel Bandwidth: 40MHz	QPSK: 35M7G7D 16QAM: 35M8W7D 64QAM: 35M8W7D 256QAM: 35M7W7D Pi/2BPSK: 35M8G7D
MAX. EIRP POWER	NR Band n48 Channel Bandwidth: 20MHz	41.5mW
	NR Band n48 Channel Bandwidth: 40MHz	43.55mW
ANTENNA GAIN*	ANT6: PIFA Antenna with -6.68dBi gain for NR Band n48	
HW VERSION*	V2	
SW VERSION*	00WW_0_340	
I/O PORTS*	Refer to user's manual	
DATA CABLE*	N/A	
EXTREME TEMPERATURE*	-10-55°C	
EXTREME VOLTAGE*	3.5V - 4.48V	

**NOTE:**

- \*Since the above data and/or information is provided by the client relevant results or conclusions of this report are only made for these data and/or information, Test Lab is not responsible for the authenticity, integrity and results of the data and information and/or the validity of the conclusion.



2. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
3. The EUT incorporates a SISO function. Physically, the EUT provides one completed transmitter and four receivers.

MODULATION MODE	TX FUNCTION
NR	1TX/4RX

4. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

##### 5. List of Accessory:

ACCESSORIES	BRAND	MANUFACTURER	MODEL	SPECIFICATION
LCD Panel	BOE	BOE	BF066XMM-TL4-F900	6.55inch, AMOLED;
Back cover	BIEL	BIEL	Panda-X	158 mm*73 mm*0.6 mm
Bezel	BIEL	BIEL	6103HG02-T6	160 mm_76 mm_8.5 mm
Photo Camera 1	AAC	AAC	P50AD01	50MP,AF
Photo Camera 2	AAC	AAC	W13FD02	13MP Ultra Wide, FF
Video Camera 1	AAC	AAC	T50AD01	50MP Tele, AF
Video Camera 2	AAC	AAC	MA8SD01	108MP+OIS, AF
CPU	Qualcomm	Qualcomm	SM-7435-1-PSP1026-TR-00-0-AB	Platform Baseband Chip_PSP_mmW_8 core_SMT
eMMC1 (=ROM1)	Samsung	Samsung	KM8L9001JM-B624T07	uMCP_254-ball FBGA_128GB_LPDD R4X_64Gb_SMT
eMMC2 (=ROM2)	Samsung	Samsung	KM8F9001JM-B813T07	uMCP_254-ball FBGA_256GB_LPDD R4X_64Gb_SMT
eMMC3 (=ROM3)	Samsung	Samsung	KM8F9001MM-B830T07	uMCP_254-ball FBGA_256GB_LPDD R4X_96Gb_SMT
Battery	HMD	Gaoyuan	HBA4633AA	RatedCapacity:4500mAh/17.51Wh

6. The differences between the first and second supply as follows and the specifications and RF parameters are the same.

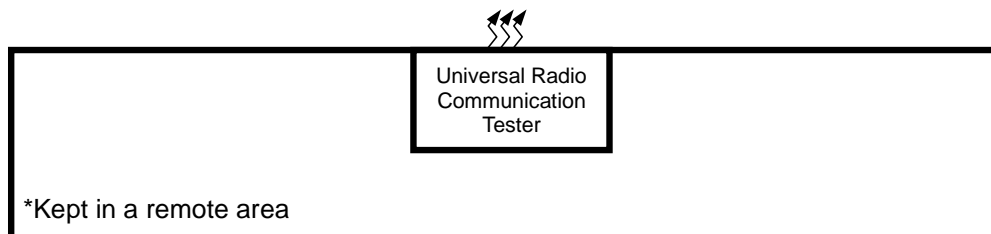
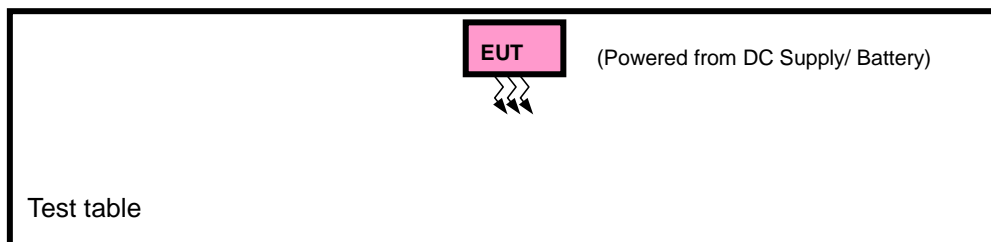
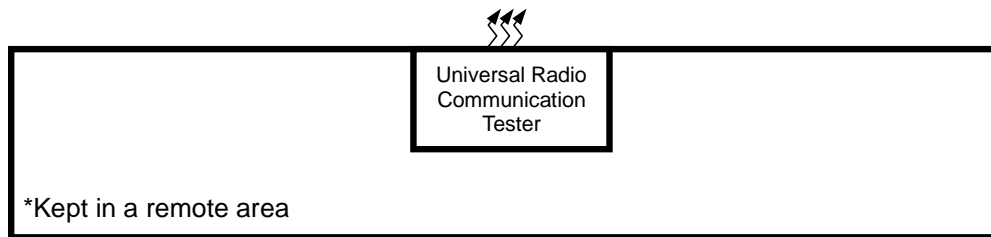
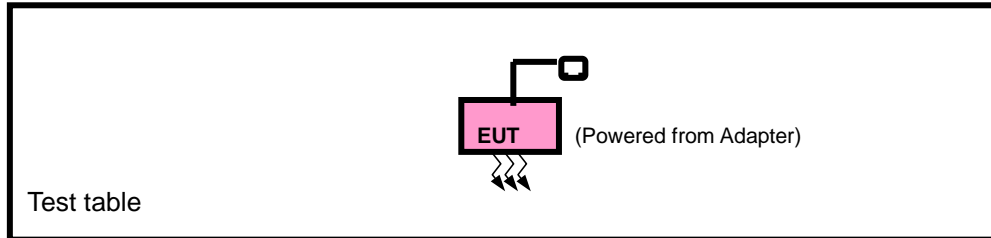
Key Component list						
No.	Component	Description	First supply		Second supply	
			Supplier	Spec	Supplier	Spec
1	USB/ Analog audio headsets	Analog Audio Switch	Dioo	DIO4480WL25 Analog switch & MUX_WLCSP25_2.7-5.5V_3-Channel_1000MHz_SMT	Will	WAS4780C-25/TR Analog switch & MUX_CSP-25L_2.7-5.5V_2-Channel_950MHz_SMT



2	Wireless charge	Load Switch	SGM	SGM2575ADYG/TR Load Switch_34 mΩ_11 W_WLCSP_SGM2575ADY G/TR_SGM	Dioo	DIO7290WL4 Load Switch_85 mΩ_11 W_WLCSP-4
3	Sensor	Barometer	Bosch	BMP580 Baroceptor_LGA-10_±0.05 hPa_48 bit_SMT	Go er mic ro	SPL07-003 Baroceptor_10pin LGA_0.5Pa/°C_24 bit_SMT
4	Sensor	eCOMPASS	VTC	AF6837 Magnetic field sensor_WLCSP_10 LSB/μT_16 bit_I2C_SMT	Memsic	MMC5603NJL Ecompass_MMC56 03NJL_M EMSIC_MCOs
5	RF IC	LNA	Will	WS7916DF-6/TR RF_LNA_6-pin DFN_1150 MHz to 1615_SMT	Awinic	AW5005EDNR RF_LNA_AW5005 EDNR_Awi nic
6	Receiver	SP2T	Will	WS78022D-6/TR DFN-6_0.1GHz - 3.8GHz_SPDT_GPIO_SMT	Champ hill	QX8612GD 0.7 to 2.7GHz_SPDT_2 W_GPIO
7	USB connector	USB type-C connector	LETCON	15-16815-105-M1 USB TYPE C Connector_0.9 mm_16 pin_Female Head (elastic end)_Horizontal_None- waterproof_4.27 mm_Gold_SMT_480M	HRD	UC141-0B100DR0 USB TYPE C Connector_0.9 mm_16 pin_Female Head (elastic end)_Horizontal_No ne- waterproof_4.3 mm_Gold_SMT_48 0M



## 2.2 CONFIGURATION OF SYSTEM UNDER TEST FOR RADIATION EMISSION TEST





## 2.3 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	DC source	Kikusui/JP	PMX18-5A	0000001	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	DC Line: Unshielded, Detachable 1.0m

## 2.4 TEST ITEM AND TEST CONFIGURATION

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports. The worst case was found when positioned on Y-plane for EIRP and X-axis for radiated emission. Following channel(s) was (were) selected for the final test as listed below:

EUT CONFIGURE MODE	DESCRIPTION
A	EUT + Adapter + USB Cable with 5G NR link
B	EUT + DC Supply with 5G NR link

### 5G NR n48 MODE

EUT CONFIGURE MODE	TEST ITEM	AVAILABLE CP-OFDM CHANNEL	AVAILABLE DFT-S-OFDM CHANNEL	TESTED CHANNEL	CHANNEL BANDWIDTH	MODULATION	MODE(DFT-S-OFDM) (INCLUDE CP-OFDM)
A	EIRP	637334 to 646000	637334 to 646000	Low, Middle, High	20MHz	QPSK,	1RB/ 0RB Offset
		638000 to 645332	638000 to 645332	Low, Middle, High	40MHz	Pi/2BPSK, QPSK, 16QAM, 64QAM, 256QAM	1RB/ 0RB Offset
B	FREQUENCY STABILITY	637334 to 646000	637334 to 646000	Low, Middle, High	20MHz	QPSK	Outer_ Full
A	PEAK TO AVERAGE RATIO	637334 to 646000	637334 to 646000	Low, Middle, High	20MHz	QPSK	Outer_ Full
A	OCCUPIED BANDWIDTH	637334 to 646000	637334 to 646000	Middle	20MHz	Pi/2BPSK, QPSK, 16QAM, 64QAM, 256QAM	Outer_ Full
		638000 to 645332	638000 to 645332	Middle	40MHz	Pi/2BPSK, QPSK, 16QAM, 64QAM, 256QAM	Outer_ Full
A	BAND EDGE	637334 to 646000	637334 to 646000	Low	20MHz	QPSK	637334 to 646000
				High	20MHz	QPSK	1RB/ max Offset
		638000 to 645332	638000 to 645332	Low	40MHz	QPSK	Outer_ Full



							Outer_ Full
				High	40MHz	QPSK	1RB/ max Offset
							Outer_ Full
		638000 to 645332	638000 to 645332	Low	40MHz	QPSK	1RB/ 0RB Offset
							Outer_ Full
				High	40MHz	QPSK	1RB/ max Offset
Outer_ Full							
A	CONDUCTED EMISSION	637334 to 646000	637334 to 646000	Low, Middle, High	20MHz	QPSK	1RB/ 0RB Offset
		638000 to 645332	638000 to 645332	Low, Middle, High	40MHz	QPSK	1RB/ 0RB Offset
A	RADIATED EMISSION	637334 to 646000	637334 to 646000	Low, Middle, High	20MHz	QPSK	1RB/ 0RB Offset
		638000 to 645332	638000 to 645332	Middle	40MHz	QPSK	1RB/ 0RB Offset
A	ACLR	637334 to 646000	637334 to 646000	Low	20MHz	QPSK	1RB/ 0RB Offset
							Outer_ Full
				High	20MHz	QPSK	1RB/ max Offset
							Outer_ Full
		638000 to 645332	638000 to 645332	Low	40MHz	QPSK	1RB/ 0RB Offset
							Outer_ Full
				High	40MHz	QPSK	1RB/ max Offset
							Outer_ Full
Outer_ Full							

**Note:** 1. This device was tested under all bandwidths, RB configurations and modulations. The worst case was found in QPSK modulation.

2. The test data presented in the report from worst SA\_n48



**TEST CONDITION:**

TEST ITEM	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
ERP&EIRP	23deg. C, 70%RH	DC 9V By Adapter	Hanwen Xu
FREQUENCY STABILITY	23deg. C, 70%RH	DC 3.5V/3.89V/4.48V By DC Supply	Hanwen Xu
OCCUPIED BANDWIDTH	23deg. C, 70%RH	DC 9V By Adapter	Hanwen Xu
BAND EDGE	23deg. C, 70%RH	DC 9V By Adapter	Hanwen Xu
CONDCUDETED EMISSION	23deg. C, 70%RH	DC 9V By Adapter	Hanwen Xu
RADIATED EMISSION	23deg. C, 70%RH	DC 9V By Adapter	Hanwen Xu
PEAK TO AVERAGE RATIO	23deg. C, 70%RH	DC 9V By Adapter	Hanwen Xu





## **2.5 GENERAL DESCRIPTION OF APPLIED STANDARDS**

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**FCC 47 CFR Part 2**

**FCC 47 CFR Part 96**

**KDB 971168 D02 Power Meas License Digital Systems v02r02**

**ANSI/TIA/EIA-603-E 2016**

**ANSI 63.26-2015**

**NOTE:** All test items have been performed and recorded as per the above standards.



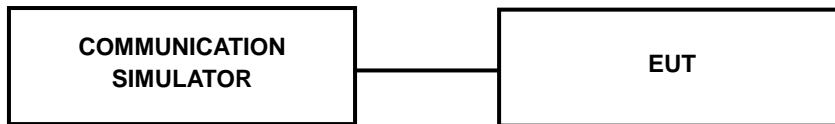
### 3 TEST TYPES AND RESULTS

#### 3.1 MAXIMUM EIRP MEASUREMENT

##### 3.1.1 LIMITS OF MAXIMUM EIRP MEASUREMENT

Device	Maximum EIRP (dBm/10 MHz)
End User Device	23
Category A CBSD	30
Category B CBSD	47

##### 3.1.2 TEST SETUP



For the actual test configuration, please refer to the attached file (Test Setup Photo).

### 3.1.3 TEST PROCEDURES

#### EIRP MEASUREMENT:

Per KDB 971168 D01 Power Meas License Digital Systems v03r01 or subclause 5.2.5.5 of ANSI C63.26-2015, the relevant equation for determining the ERP or EIRP from the conducted RF output power measured using the guidance provided above is:

$$\text{ERP or EIRP} = P_{\text{Meas}} + G_T - L_C$$

Where:

ERP or EIRP = effective radiated power or equivalent isotropically radiated power, respectively  
(expressed in the same units as  $P_{\text{Meas}}$ , typically dBW or dBm);

$P_{\text{Meas}}$  = measured transmitter output power or PSD, in dBm or dBW;

$G_T$  = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);

$L_C$  = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

#### CONDUCTED POWER MEASUREMENT:

- The EUT was set up for the maximum power with LTE link data modulation and link up with simulator.
- Set the EUT to transmit under low, middle, and high channel and record the power level shown on simulator.

Note: The worst case EIRP shown in this section is found with SA operating only using 1RB. As such, the EIRP/10MHz and full channel EIRP values will be identical since 1RB is fully contained within all available channel bandwidths (i.e., 10, 15, 20, 40MHz).

### 3.1.4 DEVIATION FROM TEST STANDARD

No deviation.

### 3.1.5 TEST RESULTS

#### 5G SA N48

n48 (SCS 30 kHz) (Ant6)						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		638000	641666	645332
		Frequency (MHz)		3570	3624.99	3679.98
40M	DFT-s-OFDM Pi/2 BPSK	1	1	22.97	22.91	22.98
		1	52	22.95	22.92	22.95
		1	104	22.97	22.96	22.91
		50	0	22.26	22.47	22.20
		50	28	22.29	22.43	22.19
		50	56	22.31	22.35	22.07
		100	0	22.27	22.36	22.18
	DFT-s-OFDM QPSK	1	1	22.95	23.07	22.87
		1	52	22.92	22.91	22.85
		1	104	22.79	22.97	22.78
		50	0	21.79	21.89	21.71
		50	28	22.27	22.34	22.09
		50	56	21.83	21.85	21.59
		100	0	21.81	21.87	21.60
	DFT-s-OFDM 16QAM	1	1	21.97	22.06	21.84
	DFT-s-OFDM 64QAM	1	1	20.56	20.63	20.65
	DFT-s-OFDM 256QAM	1	1	17.98	18.14	17.93
BW	MCS Index	Channel		637334	641666	646000
		Frequency (MHz)		3560.01	3624.99	3690
20M	DFT-s-OFDM QPSK	1	1	22.84	22.86	22.85

**EIRP****N48 (ANT5)(PC3)****CHANNEL BANDWIDTH: 40M DFT-s-OFDM Pi/2 BPSK**

Channel	Frequency (MHz)	Conducted Power (dBm)	G <sub>T</sub> -L <sub>C</sub> (dB)	EIRP (dBm)	EIRP (mW)	Limit (dBm/10MHz)
638000	3570	22.97	-6.68	16.29	42.56	23
641666	3624.99	22.96	-6.68	16.28	42.46	23
645332	3679.98	22.98	-6.68	16.3	42.66	23

**CHANNEL BANDWIDTH: 40M DFT-s-OFDM QPSK**

Channel	Frequency (MHz)	Conducted Power (dBm)	G <sub>T</sub> -L <sub>C</sub> (dB)	EIRP (dBm)	EIRP (mW)	Limit (dBm/10MHz)
638000	3570	22.95	-6.68	16.27	42.36	23
641666	3624.99	23.07	-6.68	16.39	43.55	23
645332	3679.98	22.87	-6.68	16.19	41.59	23

**CHANNEL BANDWIDTH: 40M DFT-s-OFDM 16QAM**

Channel	Frequency (MHz)	Conducted Power (dBm)	G <sub>T</sub> -L <sub>C</sub> (dB)	EIRP (dBm)	EIRP (mW)	Limit (dBm/10MHz)
638000	3570	21.97	-6.68	15.29	33.81	23
641666	3624.99	22.06	-6.68	15.38	34.51	23
645332	3679.98	21.84	-6.68	15.16	32.81	23

**CHANNEL BANDWIDTH: 40M DFT-s-OFDM 64QAM**

Channel	Frequency (MHz)	Conducted Power (dBm)	G <sub>T</sub> -L <sub>C</sub> (dB)	EIRP (dBm)	EIRP (mW)	Limit (dBm/10MHz)
638000	3570	20.56	-6.68	13.88	24.43	23
641666	3624.99	20.63	-6.68	13.95	24.83	23
645332	3679.98	20.65	-6.68	13.97	24.95	23

**CHANNEL BANDWIDTH: 40M DFT-s-OFDM 256QAM**

Channel	Frequency (MHz)	Conducted Power (dBm)	G <sub>T</sub> -L <sub>C</sub> (dB)	EIRP (dBm)	EIRP (mW)	Limit (dBm/10MHz)
638000	3570	17.98	-6.68	11.3	13.49	23
641666	3624.99	18.14	-6.68	11.46	14	23
645332	3679.98	17.93	-6.68	11.25	13.34	23



CHANNEL BANDWIDTH: 20M DFT-s-OFDM QPSK

Channel	Frequency (MHz)	Conducted Power (dBm)	G <sub>T</sub> -L <sub>C</sub> (dB)	EIRP (dBm)	EIRP (mW)	Limit (dBm/10MHz)
637334	3560.01	22.84	-6.68	16.16	41.3	23
641666	3624.99	22.86	-6.68	16.18	41.5	23
646000	3690	22.85	-6.68	16.17	41.4	23

**REMARKS:** ERP Output Power (dBm) = EIRP (dBm) -2.15(dB).

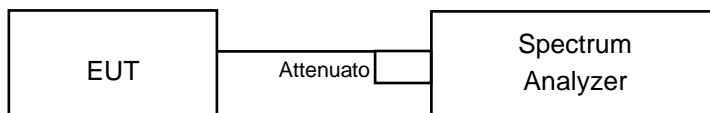
**Note:** The worst case EIRP shown in this section is found with NR operating only using 1RB. As such, the EIRP/10MHz and full channel EIRP values will be identical since 1RB is fully contained within all available channel bandwidths (i.e., 10, 15, 20,40MHz).

## 3.2 CONDUCTED BAND EDGE

### 3.2.1 LIMITS OF CONDUCTED BAND EDGE MEASUREMENT

The conducted power of any End User Device emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed -13 dBm/MHz within 0 to B megahertz (where B is the bandwidth in megahertz of the assigned channel or multiple contiguous channels of the End User Device) above the upper CBSD-assigned channel edge and within 0 to B megahertz below the lower CBSD-assigned channel edge. At all frequencies greater than B megahertz above the upper CBSD assigned channel edge and less than B megahertz below the lower CBSD-assigned channel edge, the conducted power of any End User Device emission shall not exceed -25 dBm/MHz. Notwithstanding the emission limits in this paragraph, the Adjacent Channel Leakage Ratio for End User Devices shall be at least 30 dB.

### 3.2.2 TEST SETUP



### 3.2.3 TEST INSTRUMENTS

Refer to section 1.2 to get information about the above instrument.



### 3.2.4 TEST PROCEDURE

#### For the Conducted Band Edge:

- a. Connect the transmitter to the spectrum analyzer via coaxial cable while ensuring proper impedance matching.
- b. Tune the analyzer to the nominal center frequency of the emission bandwidth (EBW).
- c. Set the resolution bandwidth (RBW)  $\geq 1\%$  EBW in the 1MHz band immediately outside and adjacent to the band edge.
- d. Beyond the 1MHz band from the band edge, RBW=1MHz was used.
- e. Set the video bandwidth (VBW) to  $\geq 3 \times$  RBW.
- f. Select the average power (RMS) display detector.
- g. Set the number of measurement points to  $\geq 1001$ .
- h. Use auto-coupled sweep time.
- i. Perform the measurement over an interval of time when the transmission is continuous and at its maximum power level.
- j. The RF fundamental frequency should be excluded against the limit line in the operating frequency band and use RBW is 10KHz or 100KHz.
- k. Record the max trace plot into the test report.

#### For Adjacent Channel Leakage Ratio (ACLR) measurement:

1. The Adjacent Channel Leakage Ratio (ACLR) is the ratio of the average power in the assigned aggregated channel bandwidth to the average power over the equivalent adjacent channel bandwidth.
2. The option ACLR of spectrum analyzer is used and measures the ACLR ratio by setting equivalent channel bandwidth.
3. The measured ACLR ratio shall be at least 30 dB.

### 3.2.5 DEVIATION FROM TEST STANDARD

No deviation.



### 3.2.6 TEST RESULTS

Please Refer to Appendix K Of this test report.



### 3.3 FREQUENCY STABILITY MEASUREMENT

#### 3.3.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT

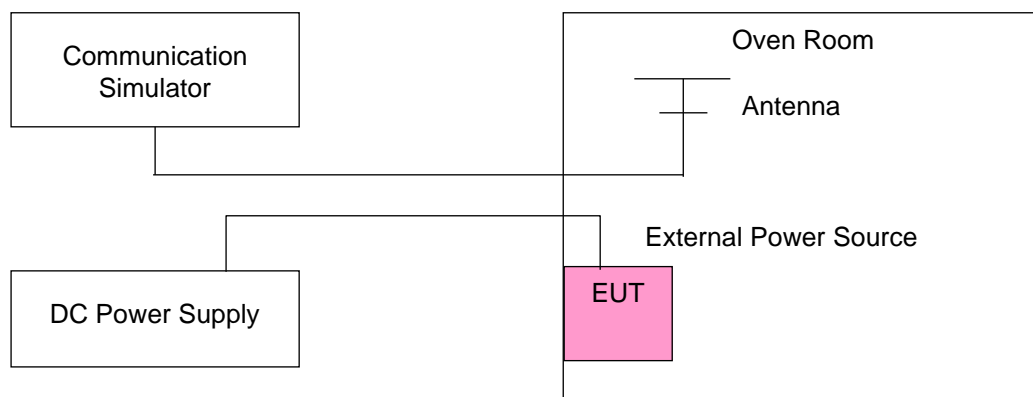
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency band.

#### 3.3.2 TEST PROCEDURE

- Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
- EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
- The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the  $\pm 0.5^{\circ}\text{C}$  during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.

**NOTE:** The frequency error was recorded frequency error from the communication simulator.

#### 3.3.3 TEST SETUP



### 3.3.4 TEST RESULTS

Please Refer to Appendix K Of this test report.

Note: VL = Low voltage(3.5V); VN/NV = Normal voltage(3.89V); VH = High voltage(4.48V);  
NT = Normal temperature (25°C)

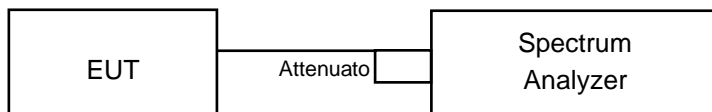


### 3.4 OCCUPIED BANDWIDTH MEASUREMENT

#### 3.4.1 OCCUPIED BANDWIDTH MEASUREMENT

The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

#### 3.4.2 TEST SETUP



#### 3.4.3 TEST INSTRUMENTS

Refer to section 1.2 to get information of above instrument.

#### 3.4.4 TEST PROCEDURE

- The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.
- Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth.

#### 3.4.5 DEVIATION FROM TEST STANDARD

No deviation.

### 3.4.6 TEST RESULT

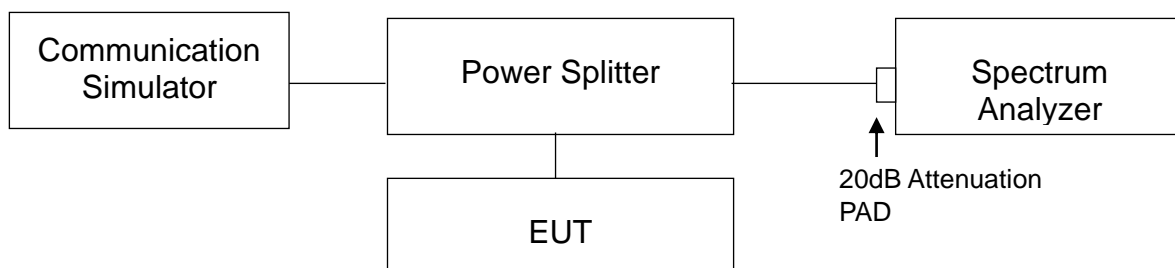
Please Refer to Appendix K Of this test report.

### 3.5 CONDUCTED SPURIOUS EMISSIONS

#### 3.5.1 LIMITS OF CONDUCTED SPURIOUS EMISSIONS MEASUREMENT

The power of any emissions below 3530 MHz or above 3720 MHz shall not exceed -40dBm/MHz.

#### 3.5.2 TEST SETUP



#### 3.5.3 TEST PROCEDURE

- The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range.
- Measuring frequency range is from 9 kHz to 40 GHz. 20dB attenuation pad is connected with spectrum. RBW=1MHz and VBW=3MHz is used for conducted emission measurement.

### 3.5.4 TEST RESULTS

Please Refer to Appendix K Of this test report.



### 3.6 RADIATED EMISSION MEASUREMENT

#### 3.6.1 LIMITS OF RADIATED EMISSION MEASUREMENT

The power of any emissions below 3530 MHz or above 3720 MHz shall not exceed -40dBm/MHz.

#### 3.6.2 TEST PROCEDURES

- a. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8m(below or equal 1GHz) and/or 1.5m(above 1GHz) height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- b. The substitution antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a tx cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to "Read Value " of step a. Record the power level of S.G
- c.  $EIRP = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}.$
- d. E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole,  
 $E.R.P \text{ power} = E.I.P.R \text{ power} - 2.15dBi.$

**Note:** The resolution bandwidth of spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz.

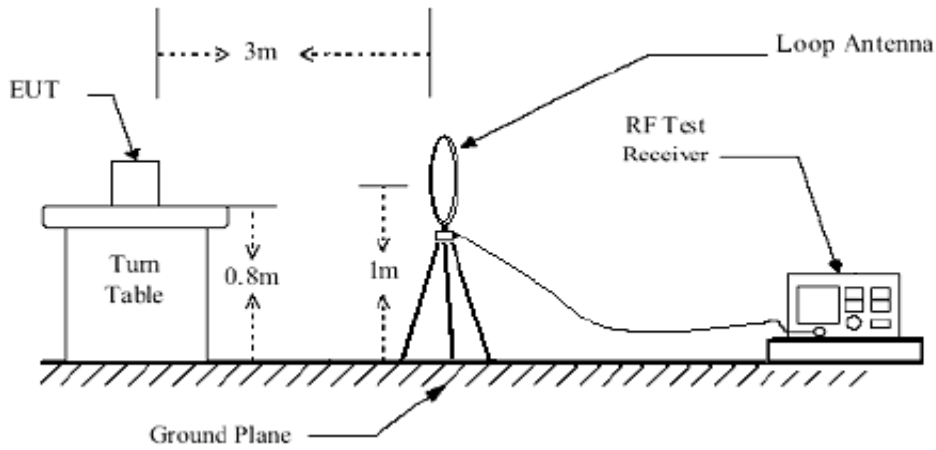
#### 3.6.3 DEVIATION FROM TEST STANDARD

No deviation.

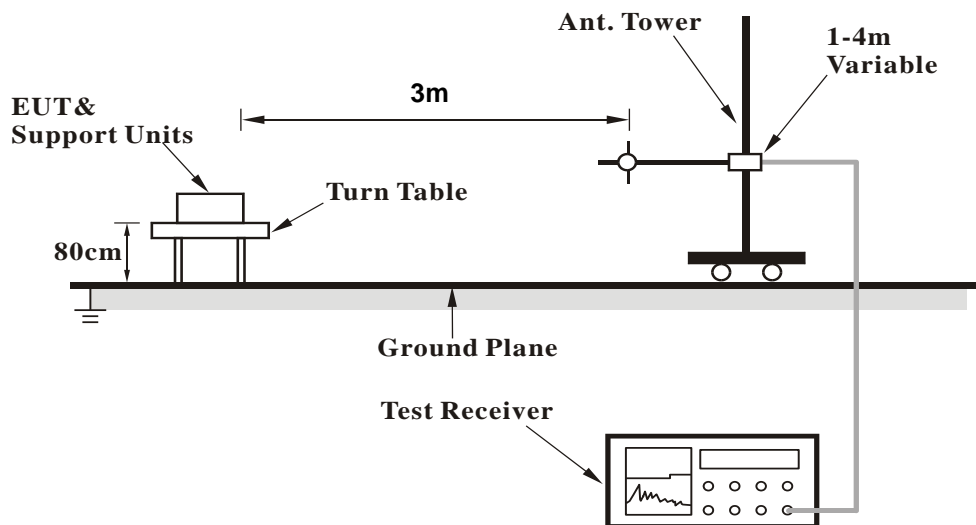


### 3.6.4 TEST SET UP

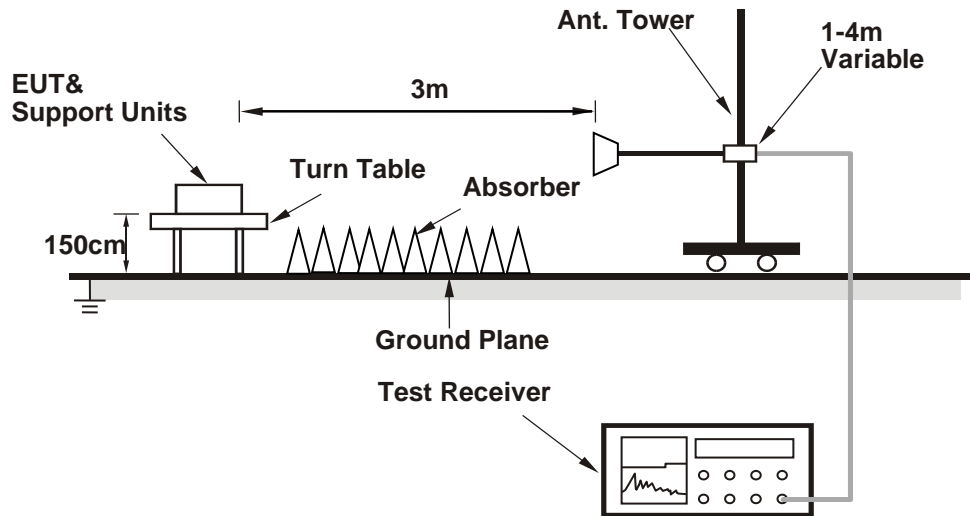
#### < Frequency Range below 30MHz >



#### <Frequency Range below 1GHz>



#### <Frequency Range above 1GHz>



For the actual test configuration, please refer to the attached file (Test Setup Photo).



## 3.6.5 TEST RESULTS

NOTE : The 9K~30MHz amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required in the report.

## 5G SA BELOW 1GHz WORST-CASE DATA

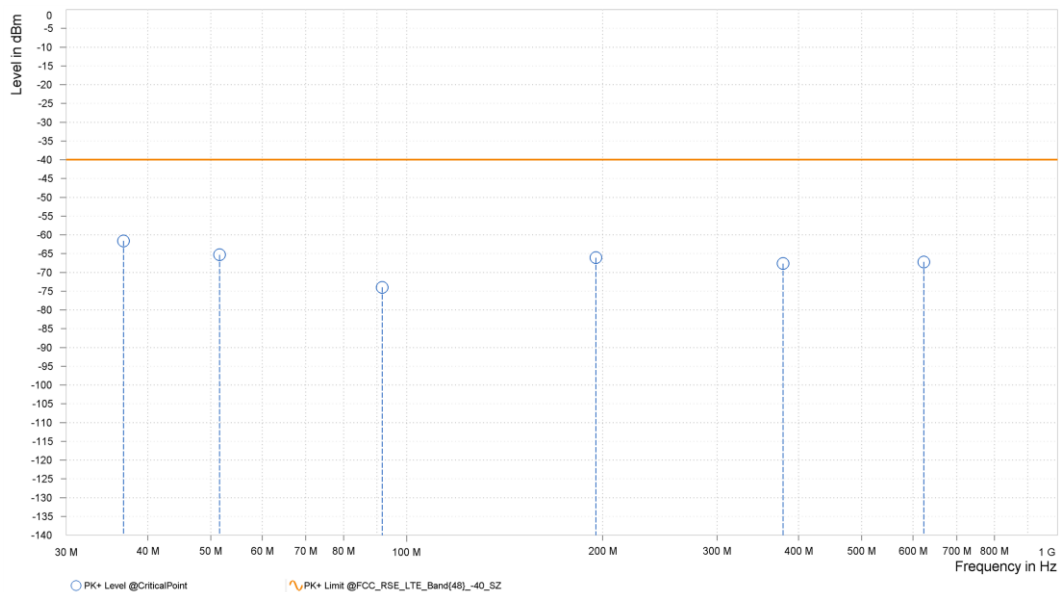
30 MHz – 1GHz data:

N48

CHANNEL BANDWIDTH: 20MHz / QPSK

MODE	TX channel 641666	FREQUENCY RANGE	Below 1000MHz
ENVIRONMENTAL CONDITIONS	23deg. C, 70%RH	INPUT POWER	AC 120V 60HZ
TESTED BY	Hanwen Xu		
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M			

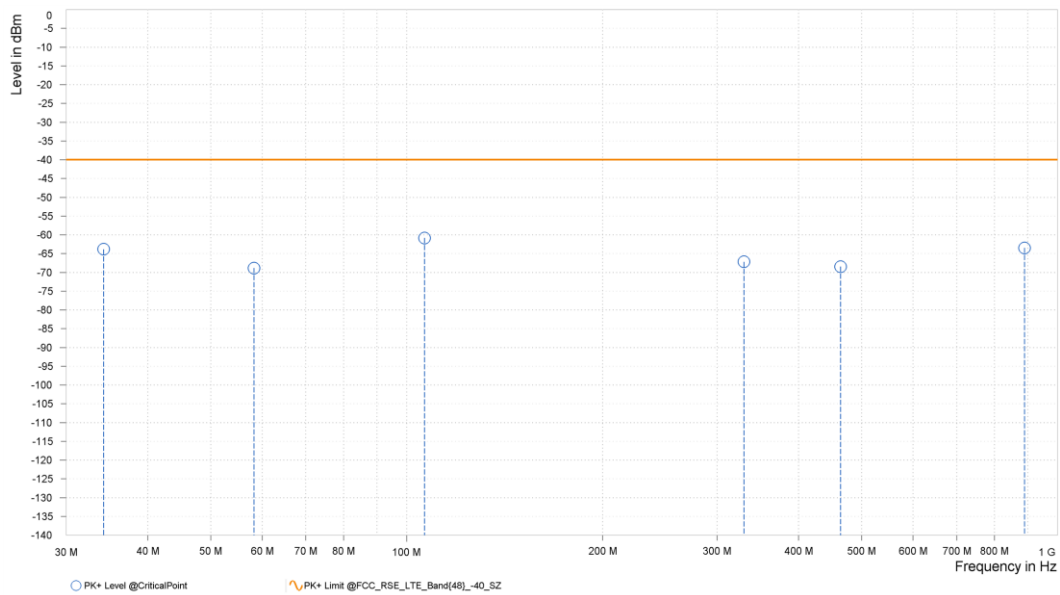
Rg	Frequency [MHz]	PK+ Level [dBm]	PK+ Limit [dBm]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	36.750	-61.61	-40.00	21.61	5.03	H	1	2.00
1	51.600	-65.31	-40.00	25.31	2.49	H	359	1.00
1	91.700	-73.99	-40.00	33.99	-5.77	H	198.1	2.00
1	195.400	-66.09	-40.00	26.09	0.07	H	181	1.00
1	378.750	-67.66	-40.00	27.66	5.05	H	4.9	1.00
2	623.250	-67.22	-40.00	27.22	5.16	H	195.3	1.00





MODE	TX channel 641666	FREQUENCY RANGE	Below 1000MHz
ENVIRONMENTAL CONDITIONS	23deg. C, 70%RH	INPUT POWER	AC 120V 60HZ
TESTED BY	Hanwen Xu		
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M			

Rg	Frequency [MHz]	PK+ Level [dBm]	PK+ Limit [dBm]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	34.250	-63.84	-40.00	23.84	-4.77	V	219.3	1.00
1	58.300	-68.86	-40.00	28.86	1.76	V	253.9	1.00
1	106.500	-60.82	-40.00	20.82	8.84	V	1	1.00
1	329.700	-67.17	-40.00	27.17	3.87	V	219.3	1.00
2	464.117	-68.47	-40.00	28.47	3.84	V	158.2	1.00
2	889.863	-63.48	-40.00	23.48	9.24	V	308	2.00





## ABOVE 1GHz

**Note:** For higher frequency, the emission is too low to be detected.

### N48(HUPE)

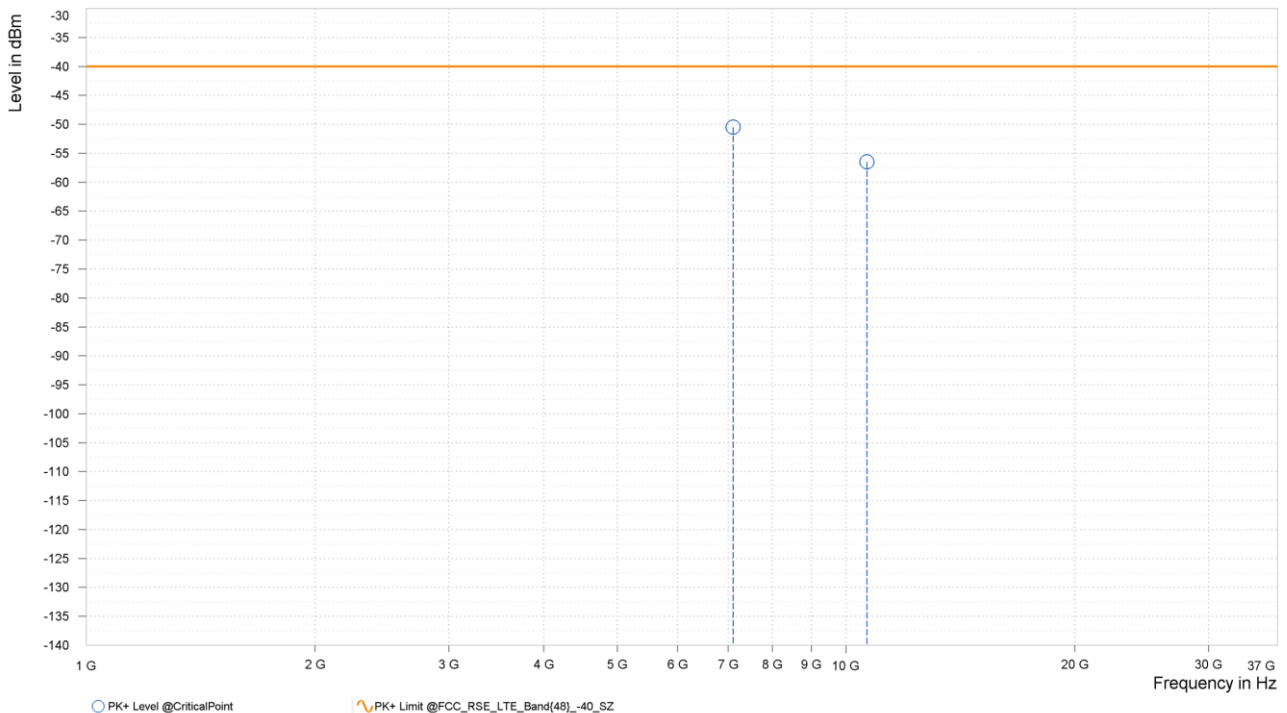
**Note:** For frequency above 18GHz, the emission was tested 20db below the limit so the data not recorded in the sheet.

**CHANNEL BANDWIDTH: 20MHz / QPSK**

**637334**

MODE	TX channel 637334	FREQUENCY RANGE	Above 1000MHz
ENVIRONMENTAL CONDITIONS	23deg. C, 70%RH	INPUT POWER	AC 120V 60HZ
TESTED BY	Hanwen Xu		
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M			

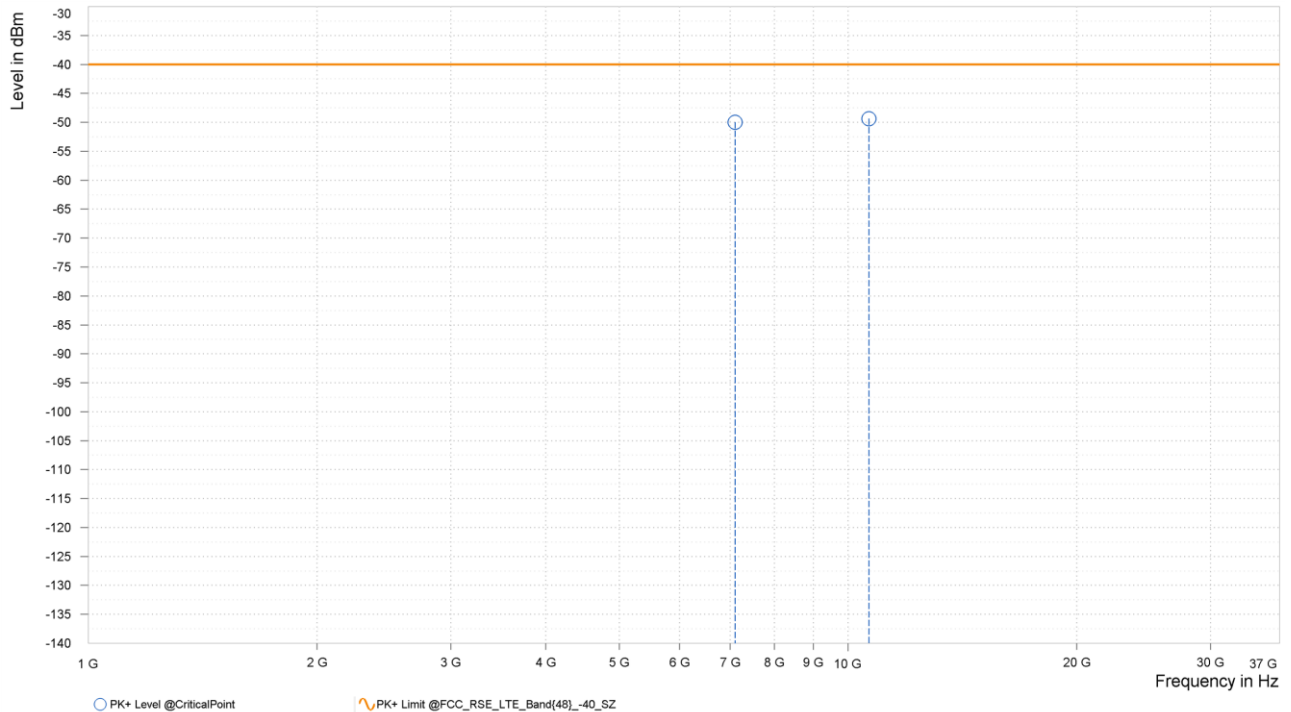
Rg	Frequency [MHz]	PK+ Level [dBm]	PK+ Limit [dBm]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
5	7,102.020	-50.50	-40.00	10.50	22.50	H	359	1.00
6	10,653.030	-56.48	-40.00	16.48	10.04	H	359	1.00





MODE	TX channel 637334	FREQUENCY RANGE	Above 1000MHz
ENVIRONMENTAL CONDITIONS	23deg. C, 70%RH	INPUT POWER	AC 120V 60HZ
TESTED BY	Hanwen Xu		
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M			

Rg	Frequency [MHz]	PK+ Level [dBm]	PK+ Limit [dBm]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
5	7,102.020	-49.97	-40.00	9.97	22.50	V	179	2.00
6	10,652.500	-49.36	-40.00	9.36	10.04	V	359	2.00

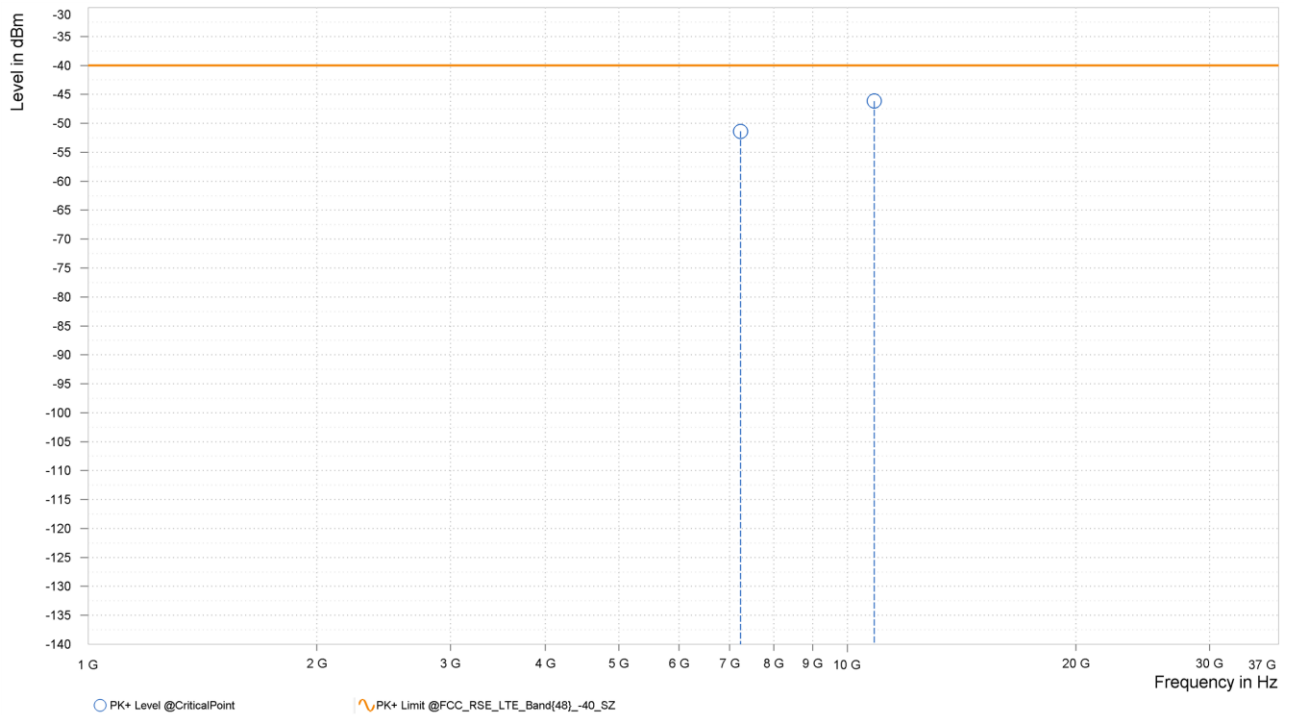




CH641666

MODE	TX channel 641666	FREQUENCY RANGE	Above 1000MHz
ENVIRONMENTAL CONDITIONS	23deg. C, 70%RH	INPUT POWER	AC 120V 60HZ
TESTED BY	Hanwen Xu		
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M			

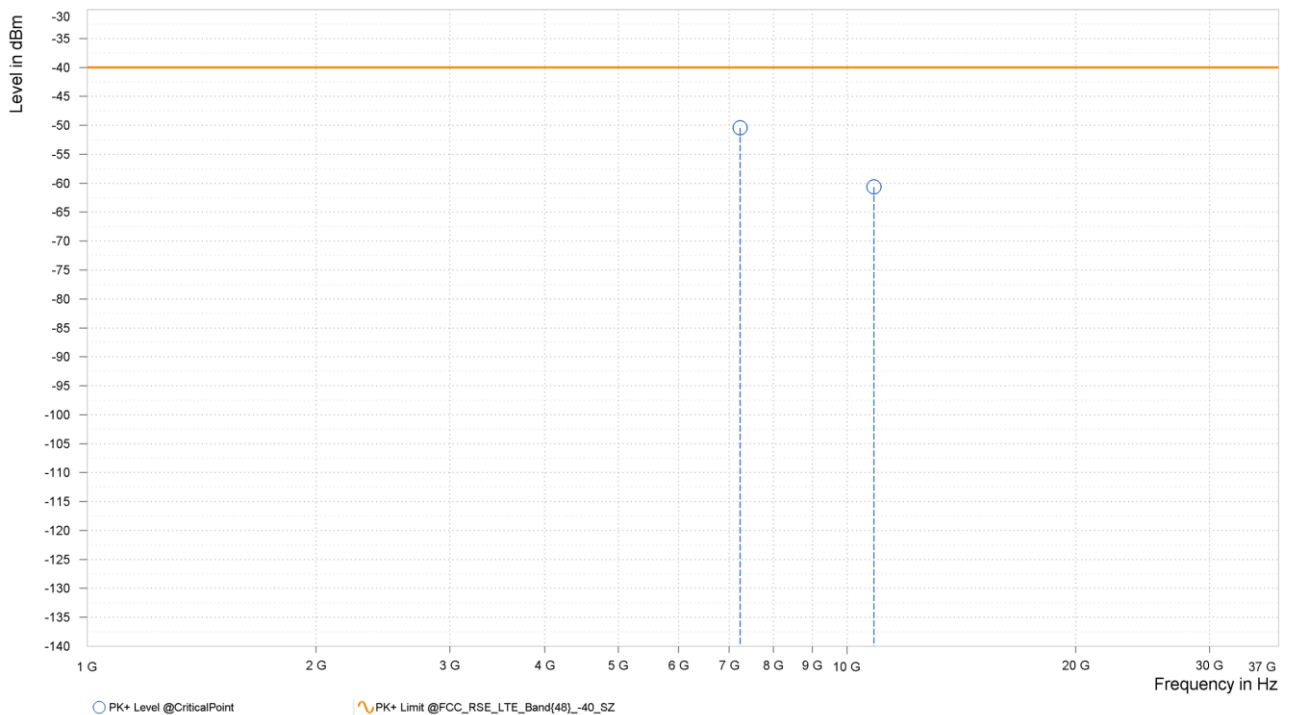
Rg	Frequency [MHz]	PK+ Level [dBm]	PK+ Limit [dBm]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
5	7,231.980	-51.39	-40.00	11.39	22.47	H	1	1.00
6	10,848.000	-46.17	-40.00	6.17	9.63	H	274.2	1.00





MODE	TX channel 641666	FREQUENCY RANGE	Above 1000MHz
ENVIRONMENTAL CONDITIONS	23deg. C, 70%RH	INPUT POWER	AC 120V 60HZ
TESTED BY	Hanwen Xu		
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M			

Rg	Frequency [MHz]	PK+ Level [dBm]	PK+ Limit [dBm]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
5	7,231.980	-50.45	-40.00	10.45	22.47	V	359	2.00
6	10,847.970	-60.64	-40.00	20.64	9.63	V	359.1	1.00



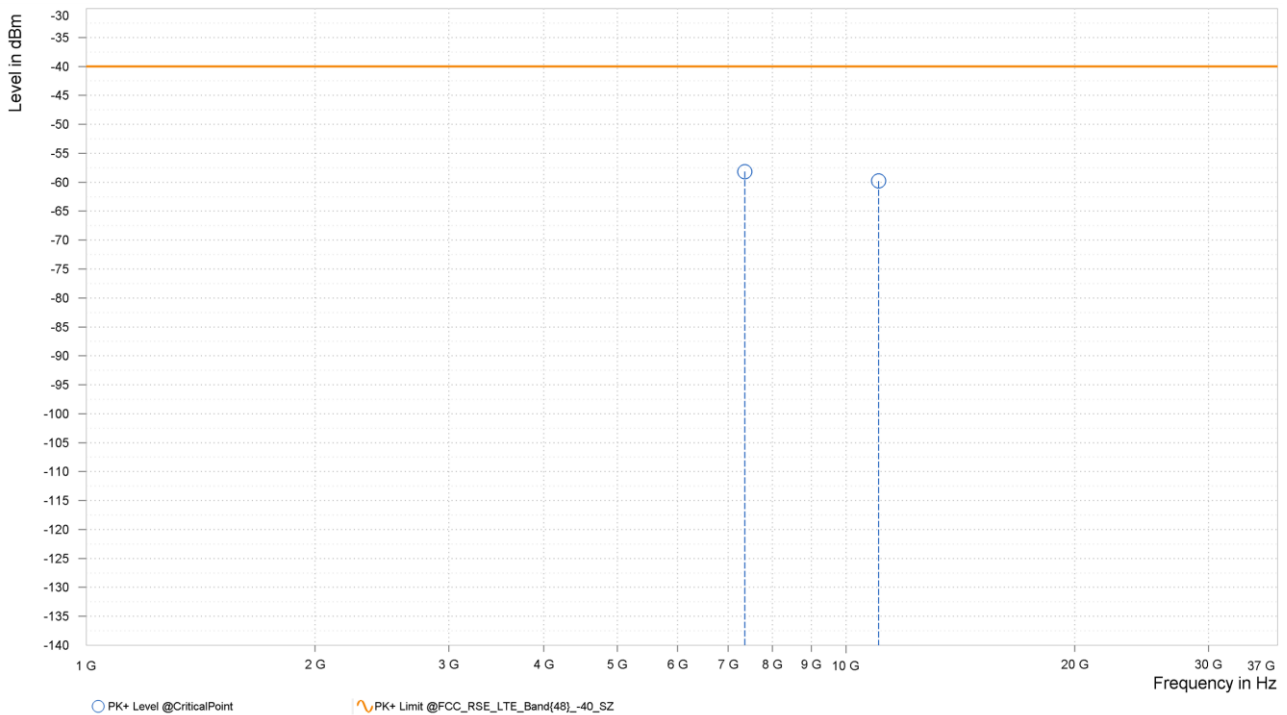




CH646000

MODE	TX channel 646000	FREQUENCY RANGE	Above 1000MHz
ENVIRONMENTAL CONDITIONS	23deg. C, 70%RH	INPUT POWER	AC 120V 60HZ
TESTED BY	Hanwen Xu		
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M			

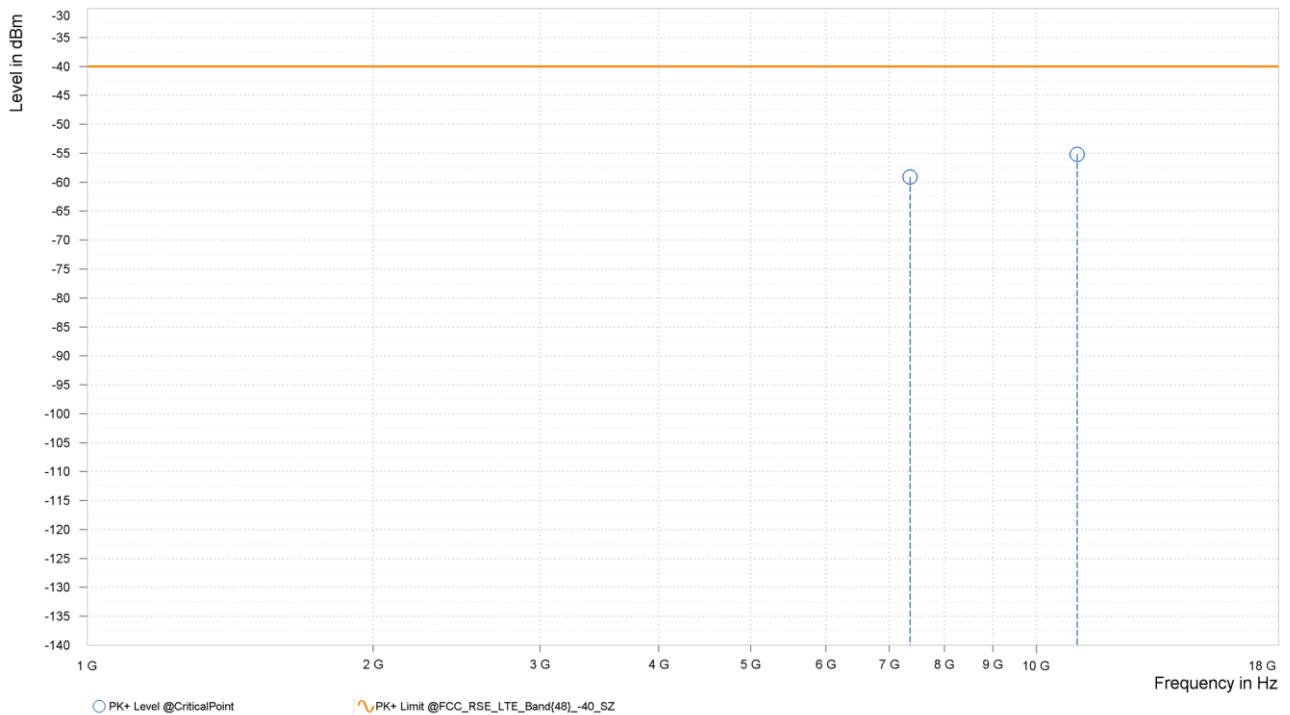
Rg	Frequency [MHz]	PK+ Level [dBm]	PK+ Limit [dBm]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
5	7,362.000	-58.18	-40.00	18.18	14.90	H	0.9	2.00
6	11,043.000	-59.80	-40.00	19.80	9.68	H	0.9	2.00





MODE	TX channel 646000	FREQUENCY RANGE	Above 1000MHz
ENVIRONMENTAL CONDITIONS	23deg. C, 70%RH	INPUT POWER	AC 120V 60HZ
TESTED BY	Hanwen Xu		
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M			

Rg	Frequency [MHz]	PK+ Level [dBm]	PK+ Limit [dBm]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
5	7,362.000	-59.11	-40.00	19.11	14.90	V	359	2.00
6	11,043.000	-55.18	-40.00	15.18	9.68	V	110.8	2.00

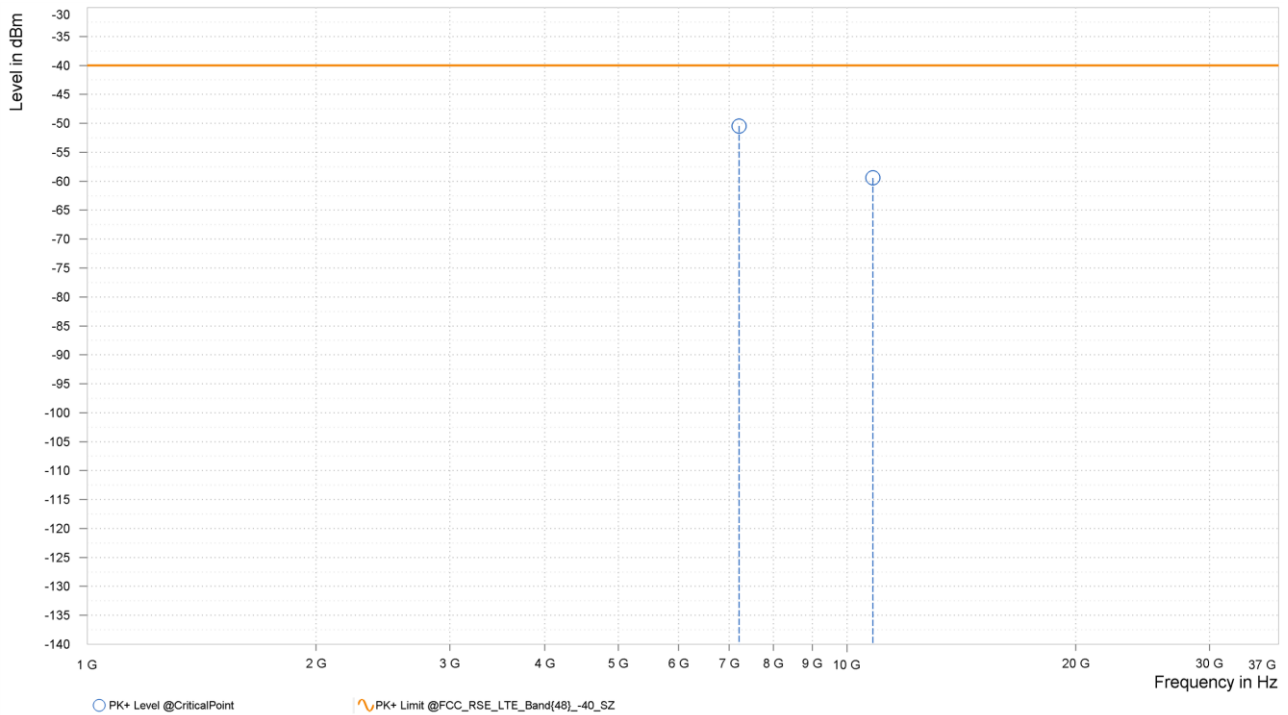




CHANNEL BANDWIDTH: 40MHz / QPSK

MODE	TX channel 641666	FREQUENCY RANGE	Above 1000MHz
ENVIRONMENTAL CONDITIONS	23deg. C, 70%RH	INPUT POWER	AC 120V 60HZ
TESTED BY	Hanwen Xu		
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M			

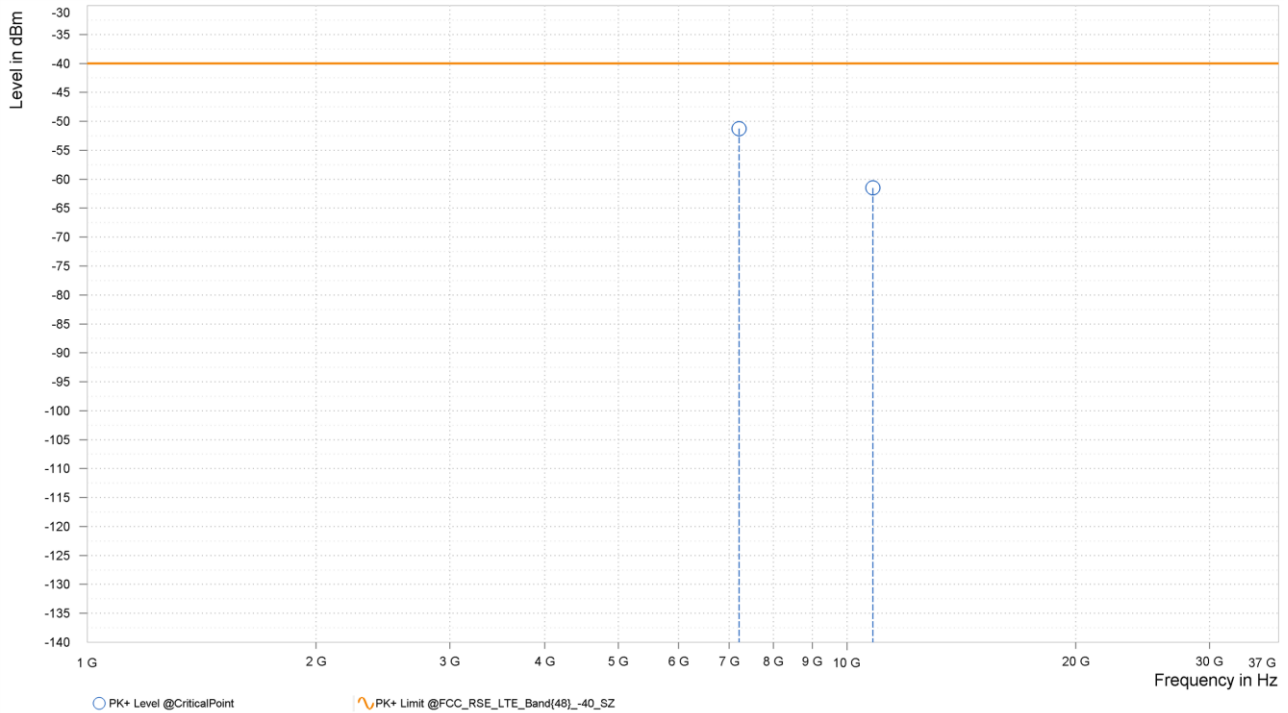
Rg	Frequency [MHz]	PK+ Level [dBm]	PK+ Limit [dBm]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
5	7,213.980	-50.48	-40.00	10.48	22.44	H	0.9	2.00
6	10,820.970	-59.41	-40.00	19.41	9.80	H	268.2	1.00





MODE	TX channel 641666	FREQUENCY RANGE	Above 1000MHz
ENVIRONMENTAL CONDITIONS	23deg. C, 70%RH	INPUT POWER	AC 120V 60HZ
TESTED BY	Hanwen Xu		
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M			

Rg	Frequency [MHz]	PK+ Level [dBm]	PK+ Limit [dBm]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
5	7,213.980	-51.26	-40.00	11.26	22.44	V	1	1.00
6	10,820.970	-61.51	-40.00	21.51	9.80	V	0.9	2.00

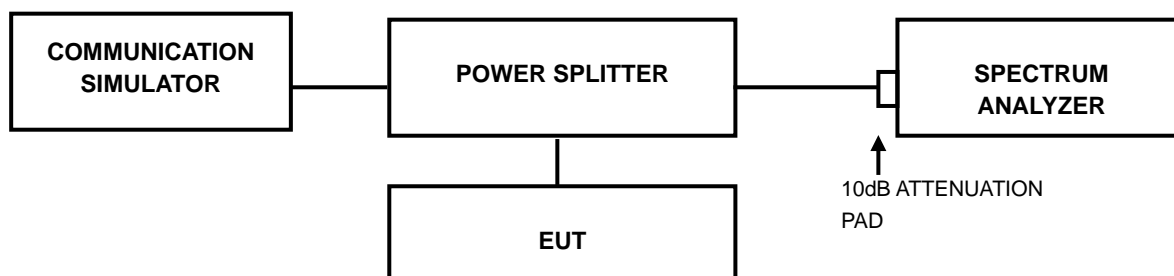


### 3.7 PEAK TO AVERAGE RATIO

#### 3.6.1 LIMITS OF PEAK TO AVERAGE RATIO MEASUREMENT

In measuring transmissions in this band using an average power technique, the peak to-average ratio (PAR) of the transmission may not exceed 13 dB

#### 3.6.2 TEST SETUP



#### 3.6.3 TEST PROCEDURES

1. Set resolution/measurement bandwidth  $\geq$  signal's occupied bandwidth;
2. Set the number of counts to a value that stabilizes the measured CCDF curve;
3. Record the maximum PAPR level associated with a probability of 0.1%.



**Test Report No.: PSU-NQN2403180115RF11**

#### 3.6.4 TEST RESULTS

Please Refer to Appendix K Of this test report.



## 4 INFORMATION ON THE TESTING LABORATORIES

We, BV 7LAYERS COMMUNICATIONS TECHNOLOGY (SHENZHEN) CO. LTD., were founded in 2015 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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Web Site: [www.adt.com.tw](http://www.adt.com.tw)

5 The address and road map of all our labs can be found in our web site also.



## **6 MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB**

No any modifications are made to the EUT by the lab during the test.

**--END--**