FCC Test Report

Report No.: AGC14559220601FE02

FCC ID	:	2AX4Y-X97PRO
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	Smart Phone
BRAND NAME	:	DOOGEE
MODEL NAME	:	X97Pro, X97
APPLICANT	:	Shenzhen DOOGEE Hengtong Technology CO., LTD
DATE OF ISSUE	:	Jul. 21, 2022
STANDARD(S)	:	FCC Part 22H & 24E& 27L Rules
REPORT VERSION	:	V1.0

*A*ttestation of *G*lobal *C*ompliance (Shenzhen) Co., Ltd.

REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Jul. 21, 2022	Valid	Initial Release

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1. GENERAL INFORMATION

Applicant	Shenzhen DOOGEE Hengtong Technology CO., LTD
Address	B, 2F, Silicon Valley Power Digital Industrial Park, Dafu Industrial Zone, Guanlan Aobei Community, Shenzhen China
Manufacturer	Shenzhen DOOGEE Hengtong Technology CO., LTD
Address	B, 2F, Silicon Valley Power Digital Industrial Park, Dafu Industrial Zone, Guanlan Aobei Community, Shenzhen China
Factory	Shenzhen DOOGEE Hengtong Technology CO., LTD
Address	B, 2F, Silicon Valley Power Digital Industrial Park, Dafu Industrial Zone, Guanlan Aobei Community, Shenzhen China
Product Designation	Smart Phone
Brand Name	DOOGEE
Test Model	X97Pro
Series Model	X97
Declaration of Difference	All the same except the model name
Date of test	Jun. 30, 2022~Jul. 21, 2022
Deviation	No any deviation from the test method.
Condition of Test Sample	Normal

WE HEREBY CERTIFY THAT:

The above equipment was tested by Attestation of Global Compliance(Shenzhen) Co., Ltd. The data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI/TIA-603-E-2016. The sample tested as described in this report is in compliance with the FCC Rules Part 22H, 24E and 27L.The test results of this report relate only to the tested sample identified in this report.

Prepared By — Eder Zhan (Project Engineer) — Jul. 21, 2022

Reviewed By — Calvin Liu (Reviewer) — Jul. 21, 2022

Approved By — Max Zhang (Authorized Officer) — Jul. 21, 2022

2. PRODUCT INFORMATION

2.1 PRODUCT TECHNICAL DESCRIPTION

A major technical description of EUT is described as following:

Product Designation:	Smart Phone		
Hardware Version:	E2T_01		
Software Version:	DOOGEE-X97Pro-EEA-Android12.0-20220616		
Support Networks:	GSM, GPRS, EDGE, WCDMA, HSDPA, HSUPA		
Frequency Bands:	☒GPRS 850 ☒PCS1900 (U.S. Bands) ☐GSM 900 ☐DCS 1800 (Non-U.S. Bands) ☒UMTS FDD Band II ☒UMTS FDD Band IV ☒UMTS FDD Band V (U.S. Bands) ☐UMTS FDD Band I ☐UMTS FDD Band VIII (Non-U.S. Bands)		
Type of Modulation:	GMSK,8PSK Modulation For GSM/GPRS/EDGE		
	BPSK,QPSK Modulation For WCDMA/HSDPA/HSUPA		
Frequency Range:	GSM/GPRS/EDGE 850: 824.2MHz-848.8 MHz		
	GSM/GPRS/EDGE 1900: 1850.2MHz-1909.8 MHz		
	WCDMA Band II: 1852.4MHz-1907.6 MHz		
	WCDMA Band IV: 1712.4-1752.6 MHz		
	WCDMA Band V: 826.4-846.6 MHz		
Emission Designator:	GSM/GPRS 850:	247KGXW	
	EDGE 850:	254KG7W	
	GSM/GPRS 1900:	247KGXW	
	EDGE 1900:	251KG7W	
	WCDMA Band II:	4M18F9W	
	WCDMA Band IV:	4M17F9W	
	WCDMA Band V:	4M18F9W	
Antenna Type:	PIFA Antenna		
Antenna gain:	GSM850:2.0dBi	PCS1900: 1.25dBi	
	WCDMA850:2.0dBi	WCDMA1700:1.36dBi	WCDMA1900:1.25dBi
Power Supply:	DC 3.87V by battery		
Battery parameter:	DC 3.87V 4000mAh		
Dual Card:	GSM /WCDMA/LTE Card Slot		
Extreme Vol. Limits:	DC3.29V to 4.45V (Normal: 3.87V)		
Extreme Temp. Tolerance	-30 °C to +50 °C		

GSM/WCDMA SLOT 1:

	Maximum ERP/EIRP (dBm)	Max. Average Burst Power (dBm)
GSM 850	30.69	32.75
PCS 1900	27.88	29.20
UMTS BAND V	22.01	23.03
UMTS BAND II	19.96	21.86
UMTS BAND IV	20.22	22.21

GSM/WCDMA SLOT 2:

	Maximum ERP/EIRP (dBm)	Max. Average Burst Power (dBm)
GSM 850	31.49	32.06
PCS 1900	27.11	28.45
UMTS BAND V	21.88	22.39
UMTS BAND II	19.94	21.01
UMTS BAND IV	19.87	21.46

2.2 RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID: 2AX4Y-X97PRO** , filing to comply with the FCC Part 22H&24E&27L requirements.

2.3 TEST METHODOLOGY

The tests were performed according to following standards:

No.	Identity	Document Title
1	47 CFR FCC Part 2	Frequency allocations and radio treaty matters, general rules and regulations.
2	47 CFR FCC Part 22	Public Mobile Services.
3	47 CFR FCC Part 24	Personal Communications Services.
4	47 CFR FCC Part 27	Miscellaneous Wireless Communications Services.
5	ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
6	ANSI/TIA-603-E-2016	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
7	KDB 971168	D01 v03r01 Measurement Guidance For Certification Of Licensed Digital Transmitters.

2.4 DEVICE CAPABILITIES

850/1900 GSM/GPRS/EGPRS,850/1700/1900 WCDMA/HSPA, Multi-Band LTE,802.11 b/g/n for WLAN,802.11 a/n/ac for UNII,Bluetooth (1X,EDR,LE).

For emissions from 1GHz – 18GHz, low, mid, and high channels were tested with highest power and worst case configuration.

The emissions below 1GHz and above 18GHz were tested with the highest transmitting power channel and the worst case configuration.

The EUT was manipulated through three orthogonal planes of X-orientation (flatbed), Y-orientation (landscape),and Z-orientation (portrait) during the testing. Only the worst case emissions were reported in this test report.

2.5 SPECIAL ACCESSORIES

The battery was supplied by the applicant were used as accessories and being tested with EUT intended for FCC grant together.

2.6 EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

2.7 EMISSION DESIGNATOR

GSM Emission Designator

Emission Designator = 249KGXW

GSM BW = 249 kHz

G = Phase Modulation

X = Cases not otherwise covered

W = Combination (Audio/Data)

EDGE Emission Designator

Emission Designator = 249KG7W

GSM BW = 249 kHz

G = Phase Modulation

7 = Quantized/Digital Info

W = Combination (Audio/Data)

WCDMA Emission Designator

Emission Designator = 4M17F9W

WCDMA BW = 4.17 MHz

F = Frequency Modulation

9 = Composite Digital Info

W = Combination (Audio/Data)

QPSK Modulation

Emission Designator = 4M48G7D

LTE BW = 4.48 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

QAM Modulation

Emission Designator = 4M48W7D

LTE BW = 4.48 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

3. TEST ENVIRONMENT

3.1 ADDRESS OF THE TEST LABORATORY

Laboratory: Attestation of Global Compliance (Shenzhen) Co., Ltd

Address: 1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

3.2 TEST FACILITY

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

CNAS-Lab Code: L5488

Attestation of Global Compliance (Shenzhen) Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2017 General Requirements) for the Competence of Testing and Calibration Laboratories

A2LA-Lab Cert. No.: 5054.02

Attestation of Global Compliance (Shenzhen) Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC-Registration No.: 975832

Attestation of Global Compliance (Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files with Registration 975832.

IC-Registration No.: 24842

Attestation of Global Compliance (Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the Certification and Engineering Bureau of Industry Canada. The acceptance letter from the IC is maintained in our files with Registration 24842

3.3 ENVIRONMENTAL CONDITIONS

	NORMAL CONDITIONS	EXTREME CONDITIONS
Temperature range	15~35℃	-30℃~50℃
Humidty range	20 % to 75 %.	20 % to 75 %.
Pressure range	86-106kPa	86-106kPa
Power supply	DC 3.87V	DC 3.29V or DC 4.45V
Note: The Extreme Temperature and Extreme Voltages declared by the manufacturer.		

3.4 MEASUREMENT UNCERTAINTY

Test	Measurement Uncertainty	Notes
Transmitter power conducted	±0.57 dB	(1)
Transmitter power Radiated	±2.20 dB	(1)
Conducted spurious emission 9KHz-40 GHz	±2.20 dB	(1)
Occupied Bandwidth	±0.01ppm	(1)
Radiated Emission 30~1000MHz	±4.10dB	(1)
Radiated Emission Above 1GHz	±4.32dB	(1)
Conducted Disturbance0.15~30MHz	±3.20dB	(1)
Radio Frequency	± 6.5 x 10-8	(1)
RF Power, Conducted	± 0.9 dB	(1)

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

3.5 LIST OF TEST EQUIPMENT

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESPI	101206	Mar. 28, 2022	Mar. 27, 2023
LISN	R&S	ESH2-Z5	100086	Jun. 07, 2022	Jun. 06, 2023
TEST RECEIVER	R&S	ESCI	10096	Mar. 28, 2022	Mar. 27, 2023
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Nov. 17, 2021	Nov. 16, 2022
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Sep. 19, 2021	Sep. 18, 2023
preamplifier	ChengYi	EMC184045SE	980508	Sep. 19, 2021	Sep. 18, 2022
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	Apr. 23, 2021	Apr. 22, 2023
Broadband Preamplifier	SCHWARZBECK	BBV 9718	9718-205	Jun.06, 2022	Jun.05, 2023
ANTENNA	SCHWARZBECK	VULB9168	D69250	Apr. 28, 2021	Apr. 27, 2023
SIGNAL ANALYZER	Agilent	N9020A	MY52090123	Sep. 06, 2021	Sep. 05, 2022
USB Wideband Power Sensor	Agilent	U2021XA	MY54110007	May 11, 2021	May 10, 2025
Universal Radio Communication Tester	R&S	CMU200	120237	Jun. 07, 2022	Jun. 06, 2023
Universal Radio Communication Tester	Agilent	8960	GB46200384	Aug. 18, 2021	Aug. 17, 2022
Power Splitter	Agilent	11636A	34	Jun.06, 2022	Jun.05, 2023
Attenuator	JFW	50FHC-006-50	N/A	Jun.06, 2022	Jun.05, 2023
Horn Ant (18G-40GHz)	Schwarzbeck	BBHA 9170		Sep. 19, 2021	Sep. 18, 2022
Horn Ant (18G-40GHz)	ETS	QWH_SL_18_40_K_SG		Sep. 19, 2021	Sep. 18, 2022
Power Splitter	Agilent	11636A	/	Sep.14, 2021	Sep.13, 2022
CMU200	R&S	120237	/	Jun. 07, 2022	Jun. 06, 2023
Artificial Mains	R&S	101242	/	Jun. 07, 2022	Jun. 06, 2023

Network ENV216					
Filter Bank Notch 1(880-915MHz)	MICRO-TRONICS	010	/	Feb. 21, 2022	Feb. 20, 2023
Filter Bank Notch 2 (1710-1785MHz)	MICRO-TRONICS	009	/	Feb. 21, 2022	Feb. 20, 2023
Filter Bank Notch 3 (1920-1980MHz)	MICRO-TRONICS	008	/	Feb. 21, 2022	Feb. 20, 2023

4. SYSTEM TEST CONFIGURATION

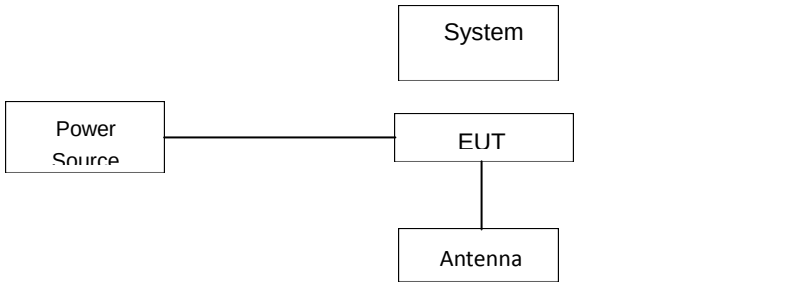
4.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commission's requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

4.2 EUT EXERCISE

The Transmitter was operated in the maximum output power mode through Communication Tester. The TX frequency was fixed which was for the purpose of the measurements.

4.3 CONFIGURATION OF EUT SYSTEM



This example is connection diagram of EUT test configurations.

Table 2-1 Equipment Used in EUT System

4.4 EQUIPMENT USED IN TESTED SYSTEM

The Following Peripheral Devices And Interface Cables Were Connected During The Measurement:

☐ Test Accessories Come From The Laboratory

☒ Test Accessories Come From The Manufacturer

Item	Equipment	Model No.	ID or Specification	Remark
1	Smart Phone	X97Pro	2AX4Y-X97PRO	EUT
2	Adapter	PS10UA050K2000UU	Input:100-240V, 50/60, 0.35A Output: DC 5.0V 2A	AE
3	Battery	BAT2219174000	DC 3.87V 4000mAh	AE
4	USB Cable	N/A	N/A	AE

5. SUMMARY OF TEST RESULTS

5.1 TEST CONDITION : CONDUCTED TEST

Item	Test Description	FCC Rules	Result
1	Occupied Bandwidth	§2.1049	Pass
2	Band Edge / Spurious and Harmonic Emissions at Antenna Terminal	§2.1051, §22.917(a), §24.238(a),§27.53(h)	Pass
5	Conducted Output Power	§2.1046	Pass
6	Frequency stability / variation of ambient temperature	§2.1055, § 22.355, §24.235, §27.54	Pass
7	Peak- to- Average Ratio	§24.232(d), §27.50(d)(5),	Pass

5.2 TEST CONDITION : RADIATED TEST

Item	Test Description	FCC Rules	Result
1	Effective Radiated Power	§22.913(a)(5)	Pass
2	Equivalent Isotropic Radiated Power	§24.232(c), §27.50(d)(4)	Pass
3	Radiated Spurious and Harmonic Emissions	§2.1053, §22.917(a), §24.238(a), §27.53(h)	Pass

6. DESCRIPTION OF TEST MODES

Bands	Tx/Rx Frequency	RF Channel		
		Low(L)	Middle(M)	High(H)
GSM/GPRS/ EDGE850	TX (824 MHz ~ 849 MHz)	Channel 128	Channel 190	Channel 251
		824.2 MHz	836.6 MHz	848.8 MHz
WCDMA band V	TX (824 MHz ~ 849 MHz)	Channel 4132	Channel 4182	Channel 4233
		826.4 MHz	836.4 MHz	846.6 MHz

Bands	Tx/Rx Frequency	RF Channel		
		Low(L)	Middle(M)	High(H)
GSM/GPRS/ EDGE1900	TX (1850 MHz-1910 MHz)	Channel 512	Channel 661	Channel 810
		1850.2 MHz	1880.0 MHz	1909.8 MHz
WCDMA Band II	TX (1850 MHz-1910 MHz)	Channel 9262	Channel 9400	Channel 9538
		1852.4 MHz	1880.0 MHz	1907.6 MHz

Bands	Tx/Rx Frequency	RF Channel		
		Low(L)	Middle(M)	High(H)
WCDMA Band IV	TX (1710 MHz-1755 MHz)	Channel 1312	Channel 1412	Channel 1513
		1712.4 MHz	1732.4 MHz	1752.6 MHz

Pre-scan all bandwidth and RB, find worse case mode are chosen to the report, the worse mode applicability and tested channel detail as below:

Band	Radiated	Conducted
GSM/GPRS/ EDGE 850/1900	GSM (GMSK, 1Tx-slot) Link GPRS (GMSK, 1Tx-slot) Link EDGE (8PSK, 1Tx-slot) Link	GSM (GMSK,1Tx-slot) Link GPRS (GMSK, 1Tx-slot) Link EDGE (8PSK, 1Tx-slot) Link
WCDMA Band II/IV/V	RMC 12.2kbps Link	RMC 12.2kbps Link

ACCORDING TO 3GPP 25.101 SUB-CLAUSE 6.2.2 , THE MAXIMUM OUTPUT POWER IS ALLOWED TO BE REDUCED BY FOLLOWING THE TABLE.

Table 6.1aA: UE maximum output power with HS-DPCCH and E-DCH

UE Transmit Channel Configuration	CM(db)	MPR(db)
For all combinations of ,DPDCH,DPCCH HS-DPDCH,E-DPDCH and E-DPCCH	0≤ CM≤3.5	MAX(CM-1,0)
Note: CM=1 for β_c/β_d=12/15,β_{hs}/β_c=24/15.For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.		

The device supports MPR to solve linearity issues (ACLR or SEM) due to the higher peak-to average ratios (PAR) of the HSUPA signal. This prevents saturating the full range of the TX DAC inside of device and provides a reduced power output to the RF transceiver chip according to the Cubic Metric (a function of the combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH).

When E-DPDCH channels are present the beta gains on those channels are reduced firsts to try to get the power under the allowed limit. If the beta gains are lowered as far as possible, then a hard limiting is applied at the maximum allowed level.

The SW currently recalculates the cubic metric every time the beta gains on the E-DPDCH are reduced. The cubic metric will likely get lower each time this is done .However, there is no reported reduction of maximum output power in the HSUPA mode since the device also provides a compensate for the power back-off by increasing the gain of TX_AGC in the transceiver (PA) device.

The end effect is that the DUT output power is identical to the case where there is no MPR in the device.

7. CONDUCTED OUTPUT POWER

7.1 PROVISIONS APPLICABLE

The conduction test is carried out in a shielded room.

According to the test, connect the device under test to the antenna port on the non-conductive platform directly to the test device for evaluation and measurement (ANSI-C63.26-2015 Clause 5.4)

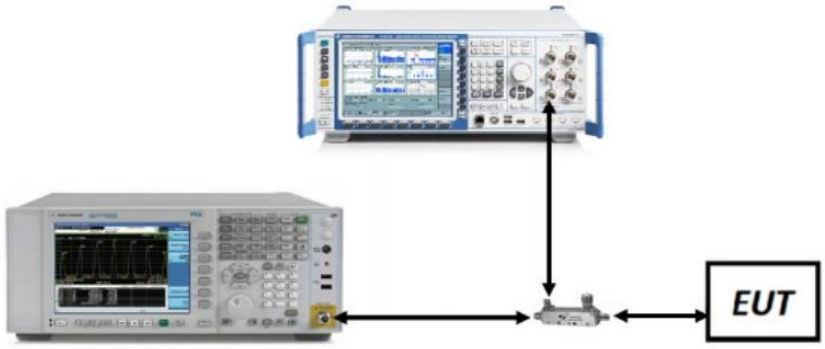
7.2 MEASUREMENT METHOD

- The transmitter output port was connected to base station.
- The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.
- The path loss was compensated to the results for each measurement.

Measure the maximum burst average power and average power for other modulation signal.

The EUT was setup for the max output power with pseudo random data modulation. Power was measured with Spectrum Analyzer. The measurements were performed on all mode (GSM/EGPRS 850, GSM/EGPRS 1900, WCDMA/HSPA band II, WCDMA/HSPA band IV ,WCDMA/HSPA band V)at 3 typical channels(the Top Channel, the Middle Channel and the Bottom Channel) for each band.

7.3 MEASUREMENT SETUP



7.4 MEASUREMENT RESULT

GSM 850 Maximum Average Power (dBm)			
Channel	**128**	**190**	**251**
Frequency(MHz)	**824.2 MHz**	**836.6 MHz**	**848.8 MHz**
GSM (GMSK, 1Tx-slot)	32.74	**32.75**	32.60
GPRS (GMSK, 1Tx-slot)	32.74	32.69	32.51
GPRS (GMSK, 2Tx-slot)	30.56	30.42	30.66
GPRS (GMSK, 3Tx-slot)	28.56	28.49	28.43
GPRS (GMSK, 4Tx-slot)	26.42	26.36	26.57
EDGE (8PSK, 1Tx-slot)	27.24	27.01	27.05
EDGE (8PSK, 2Tx-slot)	24.24	24.43	24.34
EDGE (8PSK, 3Tx-slot)	22.51	22.28	22.34
EDGE (8PSK, 4Tx-slot)	20.93	20.13	20.03

PCS 1900 Maximum Average Power (dBm)			
Channel	**512**	**661**	**810**
Frequency(MHz)	**1850.2 MHz**	**1880.0 MHz**	**1909.8 MHz**
GSM (GMSK, 1Tx-slot)	**29.20**	29.05	28.67
GPRS (GMSK, 1Tx-slot)	29.20	29.00	28.65
GPRS (GMSK, 2Tx-slot)	27.81	27.48	27.66
GPRS (GMSK, 3Tx-slot)	26.35	26.24	25.41
GPRS (GMSK, 4Tx-slot)	24.12	24.20	24.19
EDGE (8PSK, 1Tx-slot)	23.74	24.13	24.98
EDGE (8PSK, 2Tx-slot)	23.52	23.41	23.55
EDGE (8PSK, 3Tx-slot)	22.09	22.11	22.36
EDGE (8PSK, 4Tx-slot)	20.24	20.44	20.19

WCDMA Band II Maximum Average Power (dBm)			
Channel	**9262**	**9400**	**9538**
Frequency(MHz)	**1852.4 MHz**	**1880.0 MHz**	**1907.6 MHz**
RMC 12.2kbps	21.60	21.78	**21.86**
HSDPA Subtest-1	20.68	21.01	21.13
HSDPA Subtest-2	19.96	20.29	20.32
HSDPA Subtest-3	20.09	20.17	20.39
HSDPA Subtest-4	20.12	20.29	20.35
HSUPA Subtest-1	18.45	18.52	18.65
HSUPA Subtest-2	18.55	18.55	18.76
HSUPA Subtest-3	19.32	19.57	19.60
HSUPA Subtest-4	18.36	18.22	18.23
HSUPA Subtest-5	17.33	17.40	17.58

WCDMA Band IV Maximum Average Power (dBm)			
Channel	**1312**	**1412**	**1513**
Frequency(MHz)	**1712.4 MHz**	**1732.4 MHz**	**1752.6 MHz**
RMC 12.2kbps	**22.21**	21.95	21.77
HSDPA Subtest-1	21.20	21.07	20.87
HSDPA Subtest-2	20.43	20.28	20.13
HSDPA Subtest-3	20.38	20.29	20.11
HSDPA Subtest-4	20.31	20.30	20.06
HSUPA Subtest-1	18.98	18.74	18.61
HSUPA Subtest-2	19.12	18.81	18.68
HSUPA Subtest-3	20.00	19.76	19.57
HSUPA Subtest-4	18.63	18.90	18.19
HSUPA Subtest-5	18.03	17.86	17.46

WCDMA Band V Maximum Average Power (dBm)			
Channel	**4132**	**4182**	**4233**
Frequency(MHz)	**826.4 MHz**	**836.4 MHz**	**846.6 MHz**
RMC 12.2kbps	**23.03**	22.84	22.83
HSDPA Subtest-1	22.04	21.89	21.81
HSDPA Subtest-2	21.24	21.13	21.05
HSDPA Subtest-3	21.18	21.04	21.02
HSDPA Subtest-4	21.10	21.07	20.93
HSUPA Subtest-1	19.94	19.82	19.72
HSUPA Subtest-2	19.91	19.77	19.68
HSUPA Subtest-3	20.86	20.66	20.60
HSUPA Subtest-4	19.38	19.26	19.30
HSUPA Subtest-5	19.00	19.03	19.01

8. RADIATED OUTPUT POWER

8.1 PROVISIONS APPLICABLE

The radiation test is carried out in a semi-anechoic chamber.

According to the test, put the device under test on a non-conductive platform 3 meters away from the receiving antenna (ANSI/TIA-603-E-2016 Article 2.2.17).

The following rules are for the maximum radiated power limit requirements of the product:

Mode	Nominal Peak Power
GSM 850	< 7 Watts max. ERP (38.45dBm)
PCS 1900	< 2 Watts max. EIRP (33dBm)
WCDMA Band II	< 2 Watts max. EIRP (33dBm)
WCDMA Band IV	< 1 Watts max. EIRP (30dBm)
WCDMA Band V	< 7 Watts max. ERP (38.45dBm)

8.2 MEASUREMENT METHOD

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
3. VBW ≥ 3 x RBW
4. Span = 1.5 times the OBW
5. No. of sweep points > 2 x span / RBW
6. Detector = RMS
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto".
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize.

Radiation Construction Method：

1. The turntable is rotated through 360 degrees, and the receiving antenna scans in order to determine the level of the maximized emission.
2. A half wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator and the previously recorded signal was duplicated.

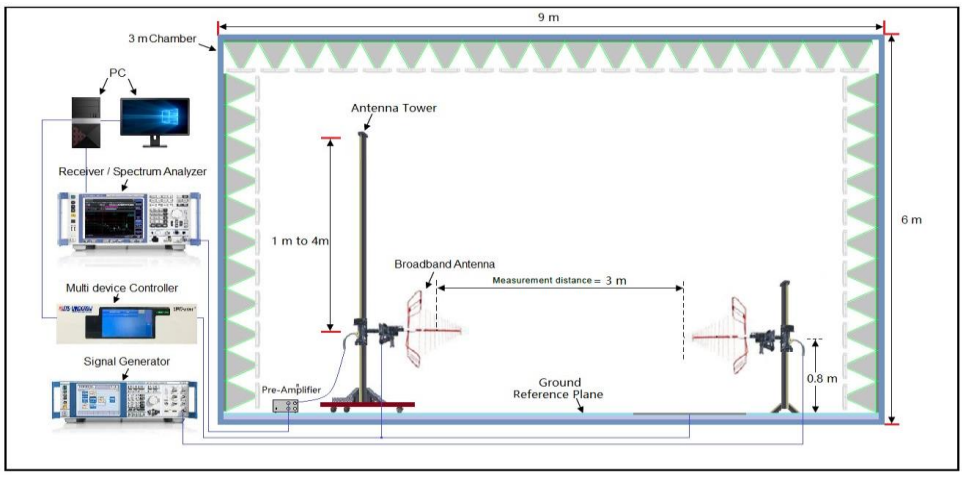
   The power is calculated by the following formula：

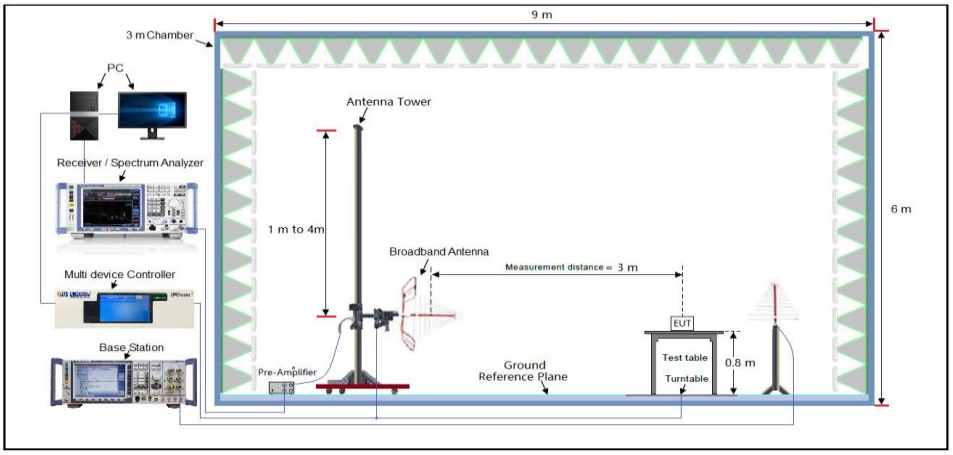
   Pd(dBm) = Pg(dBm) – cable loss (dB) + antenna gain (dB)

   Where: Pd is the dipole equivalent power and Pg is the generator output power into the substitution antenna.
3. The maximum value is calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps are repeated with the receiving antenna in both vertical and horizontal polarization. the difference between the gain of the horn and an isotropic antenna are taken into consideration
4. The EUT was tested in three orthogonal planes (X, Y, Z) and in all possible test configurations and positioning.
5. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

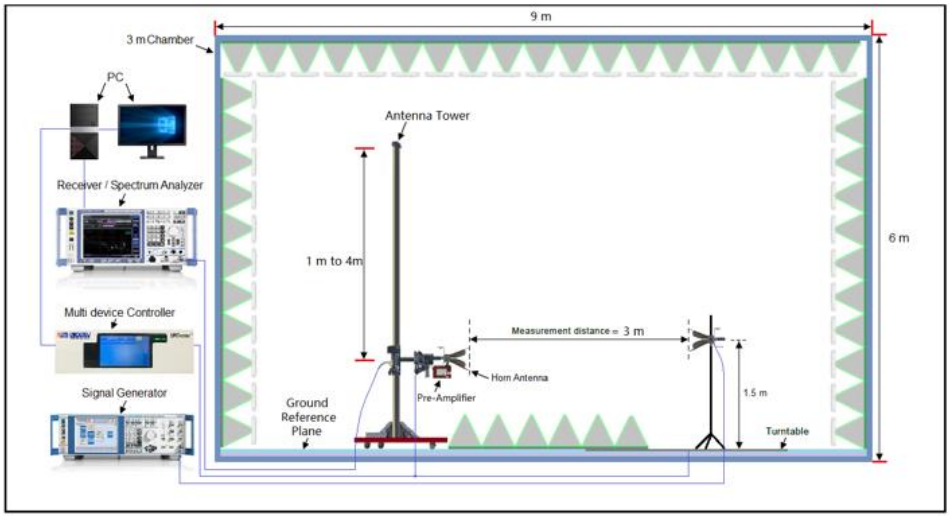
8.3 MEASUREMENT SETUP

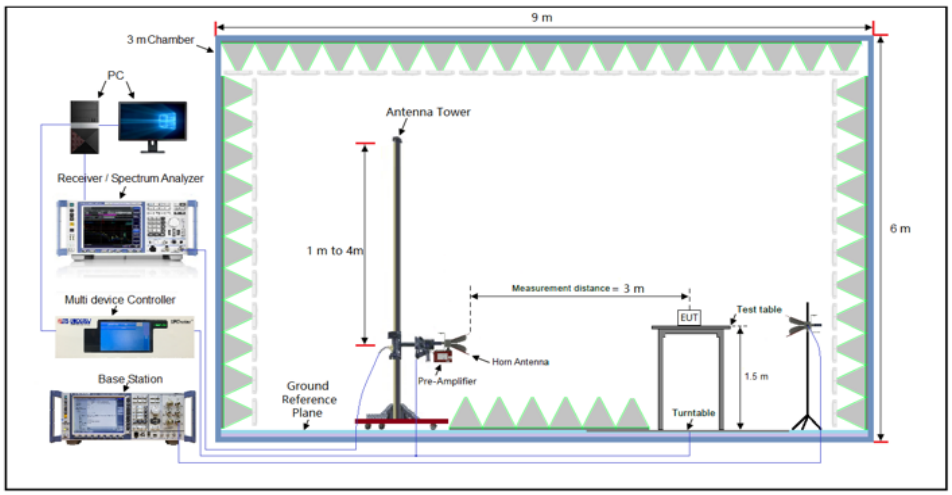
Radiated Power 30MHz to 1GHz Test setup





Radiated Power Above 1GHz Test setup





8.4 MEASUREMENT RESULT

Mode	Ch./ Freq.		Substitute	Ant.	C.L	Pol.	Limit	ERP	
	channel	Freq. (MHz)	LEVEL (dBm)	Gain (dBd)			W	W	dBm
GSM850	128	824.2	35.17	5.90	1.21	H	< 7.00	1.117	30.48
	190	836.6	35.37	5.90	1.22	H		1.172	**30.69**
	251	848.8	35.22	5.90	1.25	H		1.140	30.57
EDGE	128	824.2	29.80	5.90	1.21	H		0.324	25.11
	190	836.6	29.91	5.90	1.22	H		0.333	25.23
	251	848.8	29.79	5.90	1.25	H		0.327	25.14
WCDMA850	4132	826.4	26.53	5.90	1.21	H		0.153	21.84
	4183	836.6	26.42	5.90	1.25	H		0.150	21.77
	4233	846.6	26.67	5.90	1.24	H		0.159	**22.01**
HSPA	4132	826.4	25.31	5.90	1.21	H		0.115	20.62
	4183	836.6	24.88	5.90	1.25	H		0.105	20.23
	4233	846.6	25.18	5.90	1.24	H		0.113	20.52

Mode	Ch./ Freq.		Substitute	Ant.	C.L	Pol.	Limit	EIRP	
	channel	Freq. (MHz)	LEVEL (dBm)	Gain (dBi)			W	W	dBm
PCS1900	512	1850.2	34.37	8.6	2.11	H	< 2.00	0.614	**27.88**
	661	1880.0	33.99	8.6	2.15	H		0.568	27.54
	810	1909.8	33.84	8.6	2.15	H		0.548	27.39
EDGE	512	1850.2	29.09	8.6	2.11	H		0.182	22.60
	661	1880.0	29.32	8.6	2.15	H		0.194	22.87
	810	1909.8	28.69	8.6	2.15	H		0.167	22.24
WCDMA 1900	9262	1852.4	26.36	8.6	2.11	H		0.097	19.87
	9400	1880.0	26.41	8.6	2.15	H		0.099	**19.96**
	9538	1907.6	26.22	8.6	2.15	H		0.095	19.77
HSPA	9262	1852.4	24.24	8.6	2.11	H		0.060	17.75
	9400	1880.0	24.05	8.6	2.15	H		0.058	17.60
	9538	1907.6	24.32	8.6	2.15	H		0.061	17.87
WCDMA 1700	1312	1712.4	26.39	8.3	2.05	H	< 1.00	0.103	20.14
	1412	1732.4	26.47	8.3	2.05	H		0.105	**20.22**
	1513	1752.6	26.32	8.3	2.06	H		0.102	20.08
HSPA	1312	1712.4	24.49	8.3	2.05	H		0.067	18.24
	1412	1732.4	25.00	8.3	2.05	H		0.075	18.75
	1513	1752.6	24.84	8.3	2.06	H		0.072	18.60

Note:1. EIRP/ERP = Substitute LEVEL (dBm) + Ant. Gain – C.L (Cable Loss)

2. All polarizations and modes have been tested, only the worst mode is recorded in the report

9. PEAK-TO-AVERAGE RATIO

9.1 PROVISIONS APPLICABLE

This is the test for the Peak-to-Average Ratio from the EUT.

Power Complementary Cumulative Distribution Function (CCDF) curves provide a means for characterizing the power peaks of a digitally modulated signal on a statistical basis. A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth. 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.

9.2 MEASUREMENT METHOD

① CCDF Procedure for PAPR :

1. Set resolution/measurement bandwidth ≥ signal's occupied bandwidth;
2. Set the number of counts to a value that stabilizes the measured CCDF curve;
3. Set the measurement interval as follows:

-for continuous transmissions, set to 1 ms,

-or 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.

4. Record the maximum PAPR level associated with a probability of 0.1%.

② Alternate Procedure for PAPR:

Use one of the procedures presented in 5.2(ANSI C63.26-2015) to measure the total peak power and record as P_{Pk}. Use one of the applicable procedures presented 5.2(ANSI C63.26-2015) to measure the total average power and recordas PAvg. Determine the P.A.R. from:

P.A.R(dB) = PPk (dBm) – PAvg (dBm) (PAvg = Average Power + Duty cycle Factor)

Allow trace to fully stabilize.

Use the peak marker function to determine the peak amplitude level.

Test Settings(Peak Power):

The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW ≥ 3 × RBW.

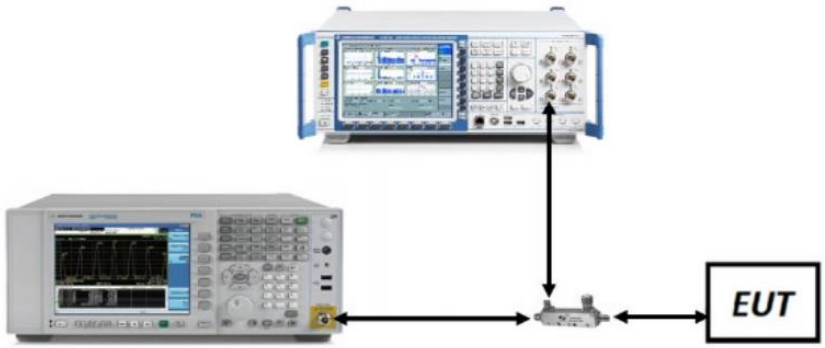
1. Set the RBW ≥ OBW.
2. Set VBW ≥ 3 × RBW.
3. Set span ≥ 2 × OBW.

4. Sweep time ≥ 10 × (number of points in sweep) × (transmission symbol period).
5. Detector = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the peak amplitude level.

Test Settings(Average Power)

1. Set span to 2 × to 3 × the OBW.
2. Set RBW ≥ OBW.
3. Set VBW ≥ 3 × RBW.
4. Set number of measurement points in sweep ≥ 2 × span / RBW.
5. Sweep time: Set ≥ [10 × (number of points in sweep) × (transmission period)] for single sweep (automation-compatible) measurement. The transmission period is the (on + off) time.
6. Detector = power averaging (rms).
7. Set sweep trigger to “free run.”
8. Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. (To accurately determine the average power over the on and off period of the transmitter, it can be necessary to increase the number of traces to be averaged above 100 or, if using a manually configured sweep time, increase the sweep time.)
9. Use the peak marker function to determine the maximum amplitude level.
10. Add [10 log (1/duty cycle)] to the measured maximum power level to compute the average power during continuous transmission. For example, add [10 log (1/0.25)] = 6 dB if the duty cycle is a constant 25%.

9.3 MEASUREMENT SETUP



9.4 MEASUREMENT RESULT

Bands	Modulation	Peak-to-average ratio (dB)			Limit	Result
		Lowest	Middle	Highest	(dB)	
GSM 850	GSM	2.64	2.67	2.64	13	Pass
	EDGE	5.42	5.43	5.48	13	Pass
PCS 1900	GSM	2.65	2.65	2.65	13	Pass
	EDGE	5.57	5.55	5.52	13	Pass
WCDMA Band II	RMC 12.2kbps	3.07	3.05	3.01	13	Pass
WCDMA Band II	HSUPA	3.15	3.15	4.24	13	Pass
WCDMA Band II	HSDPA	4.56	3.36	4.93	13	Pass
WCDMA Band IV	RMC 12.2kbps	4.11	4.56	4.52	13	Pass
WCDMA Band IV	HSUPA	3.56	3.44	3.26	13	Pass
WCDMA Band IV	HSDPA	4.25	4.11	4.09	13	Pass
WCDMA Band V	RMC 12.2kbps	3.19	3.04	3.02	13	Pass
WCDMA Band V	HSUPA	2.81	5.14	2.97	13	Pass
WCDMA Band V	HSDPA	4.25	4.33	4.31	13	Pass

10. OCCUPIED BANDWIDTH

10.1 PROVISIONS APPLICABLE

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.

The EUT makes a call to the communication simulator.

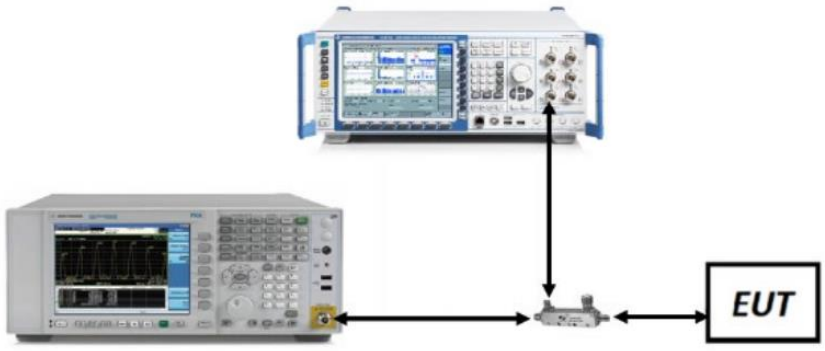
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth

10.2 MEASUREMENT METHOD

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

10.3 MEASUREMENT SETUP



10.4 MEASUREMENT RESULT

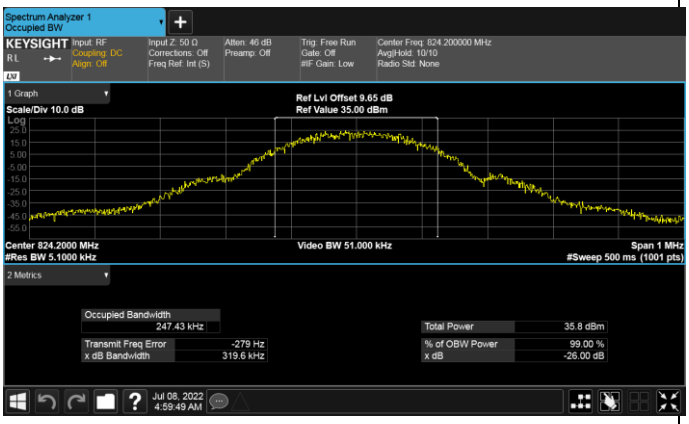
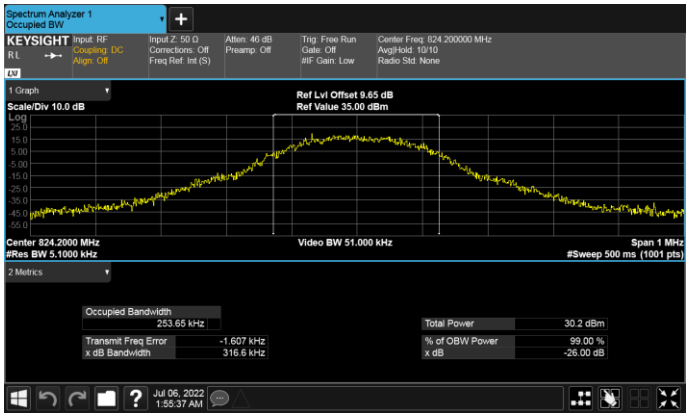
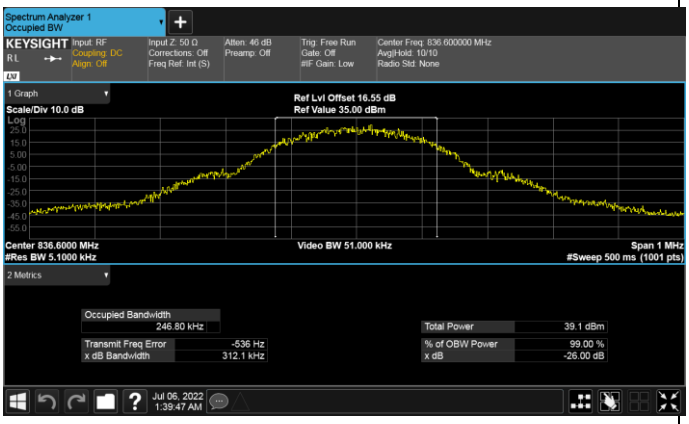
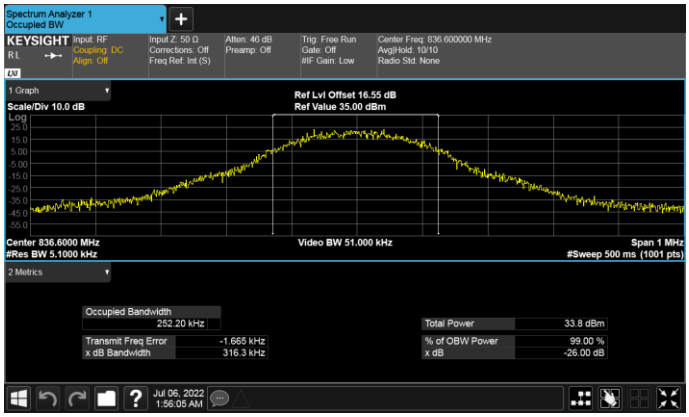
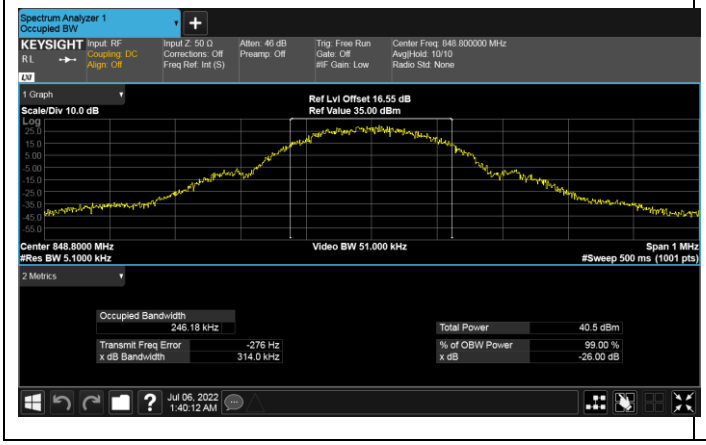
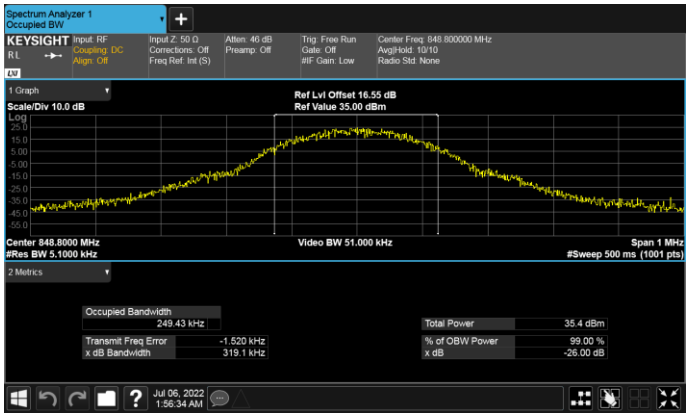
Test Band	Test Mode	Test Channel	Occupied Bandwidth (KHz)	Emission Bandwidth (KHz)	Verdict
GSM 850	GSM	LCH	247.4	320	PASS
		MCH	246.8	312	PASS
		HCH	246.2	314	PASS
	EDGE	LCH	253.6	317	PASS
		MCH	252.2	316	PASS
		HCH	249.4	319	PASS

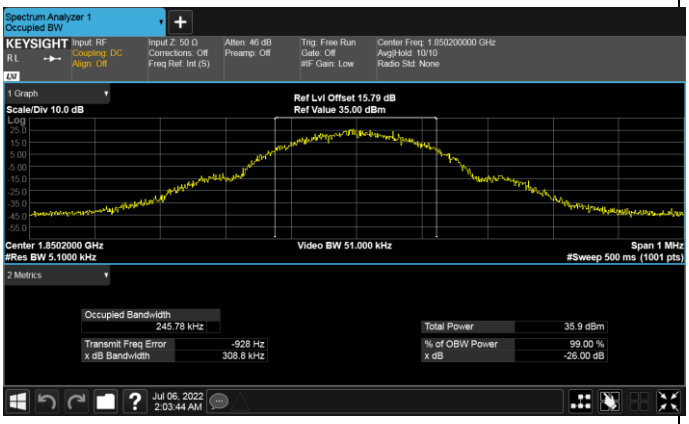
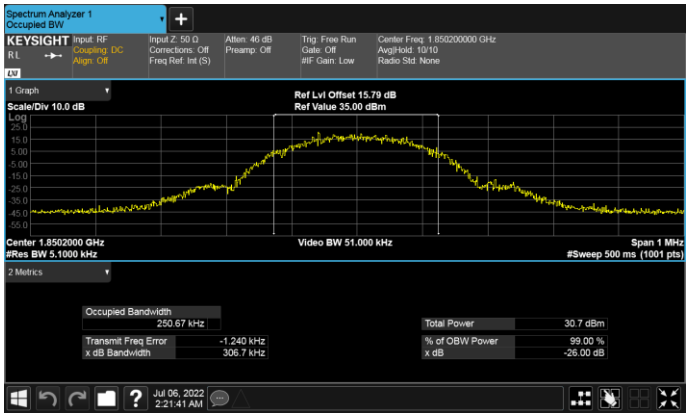
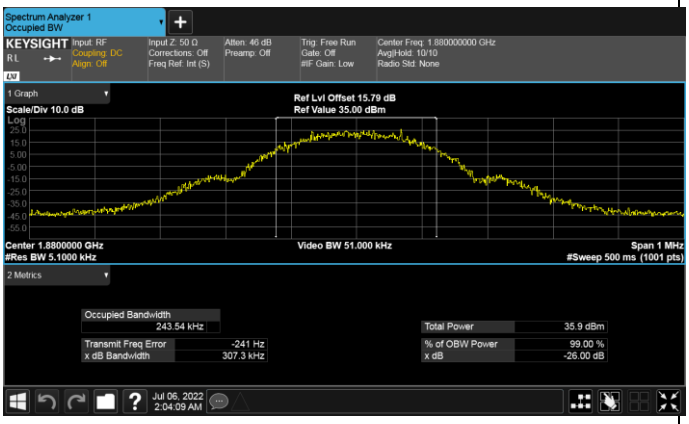
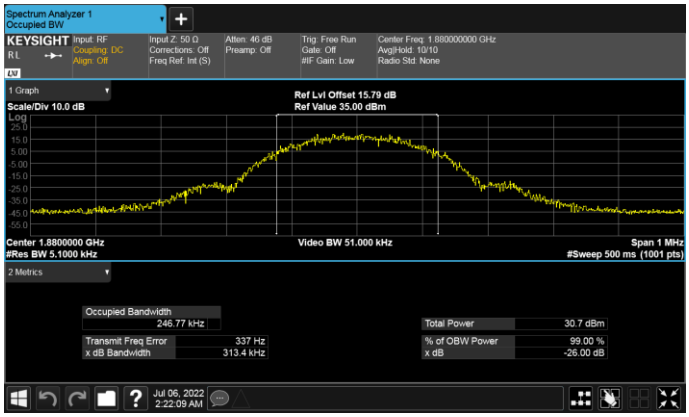
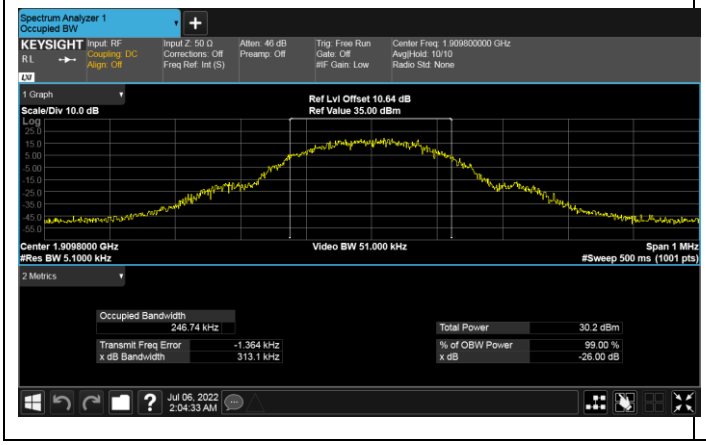
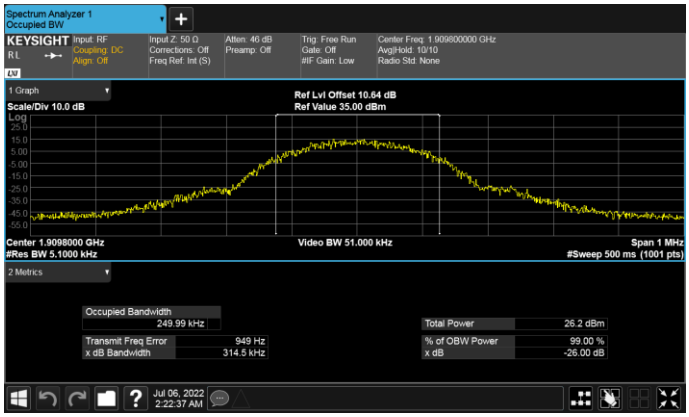
Test Band	Test Mode	Test Channel	Occupied Bandwidth (KHz)	Emission Bandwidth (KHz)	Verdict
PCS 1900	GSM	LCH	245.8	309	PASS
		MCH	243.5	307	PASS
		HCH	246.7	313	PASS
	EDGE	LCH	250.7	307	PASS
		MCH	246.8	313	PASS
		HCH	250.0	314	PASS

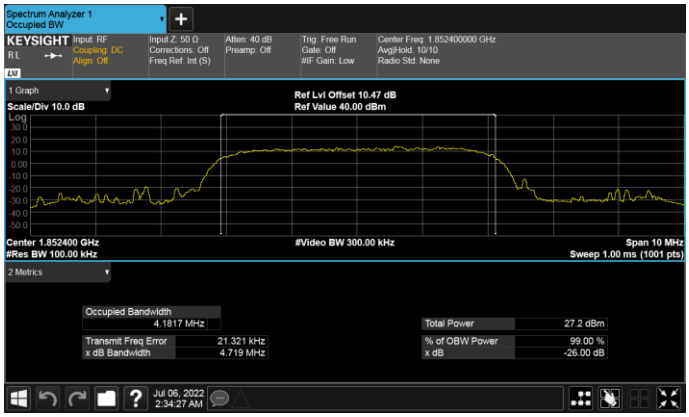
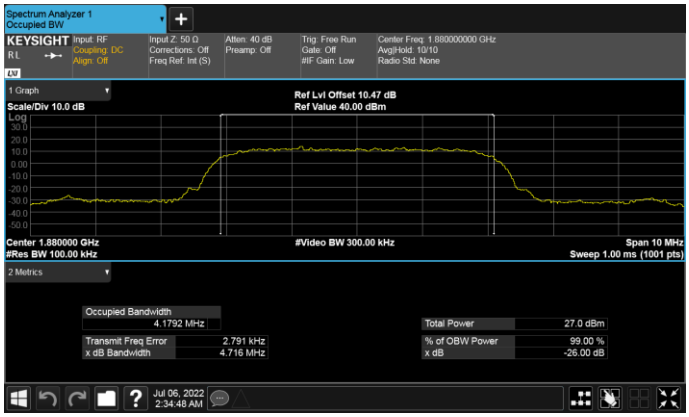
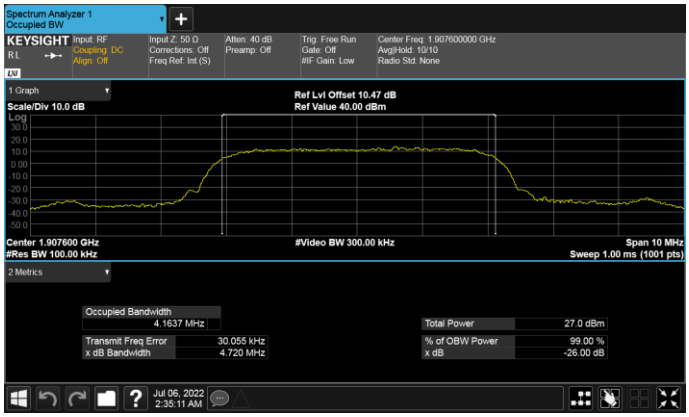
Test Band	Test Mode	Test Channel	Occupied Bandwidth (KHz)	Emission Bandwidth (KHz)	Verdict
WCDMA 850	UMTS	LCH	4169.8	4729	PASS
		MCH	4176.5	4742	PASS
		HCH	4182.4	4729	PASS

Test Band	Test Mode	Test Channel	Occupied Bandwidth (KHz)	Emission Bandwidth (KHz)	Verdict
WCDMA 1900	UMTS	LCH	4181.7	4719	PASS
		MCH	4179.2	4716	PASS
		HCH	4163.7	4720	PASS

Test Band	Test Mode	Test Channel	Occupied Bandwidth (KHz)	Emission Bandwidth (KHz)	Verdict
WCDMA 1700	UMTS	LCH	4172.3	4729	PASS
		MCH	4170.7	4719	PASS
		HCH	4172.0	4717	PASS

GSM 850_LCH_GSM	GSM 850_LCH_EDGE
	
GSM 850_MCH_GSM	GSM 850_MCH_EDGE
	
GSM 850_HCH_GSM	GSM 850_HCH_EDGE
	

PCS 1900_LCH_GSM	PCS 1900_LCH_EDGE
	
PCS 1900-MCH-GSM	PCS 1900_MCH_EDGE
	
PCS 1900-HCH-GSM	PCS 1900_HCH_EDGE
	

WCDMA 850_LCH	WCDMA 1900_LCH
	
WCDMA 850_MCH	**WCDMA 1900_MCH**
	
WCDMA 850_HCH	**WCDMA 1900_HCH**
	

WCDMA 1700_LCH	WCDMA 1700_MCH
	
WCDMA 1700_HCH	
	

11. BAND EDGE EMISSIONS AT ANTENNA TERMINAL

11.1 MEASUREMENT OVERVIEW

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

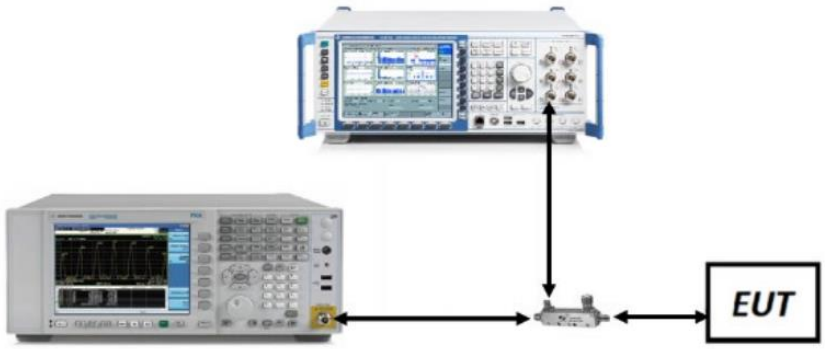
11.2 MEASUREMENT METHOD

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW > 1% of the emission bandwidth
4. VBW > 3 x RBW
5. Detector = RMS
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = trace average
8. Sweep time = auto couple
9. The trace was allowed to stabilize

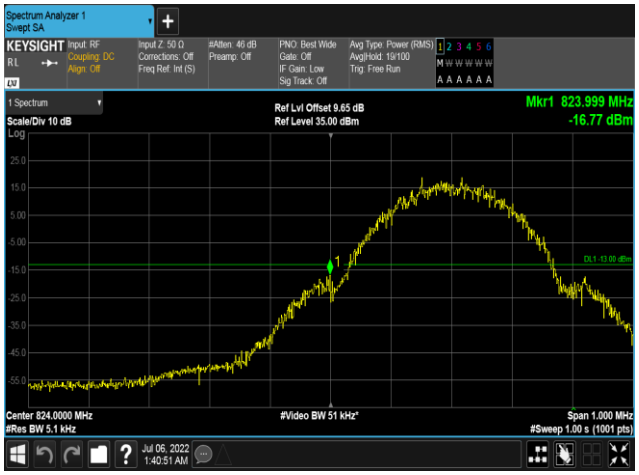
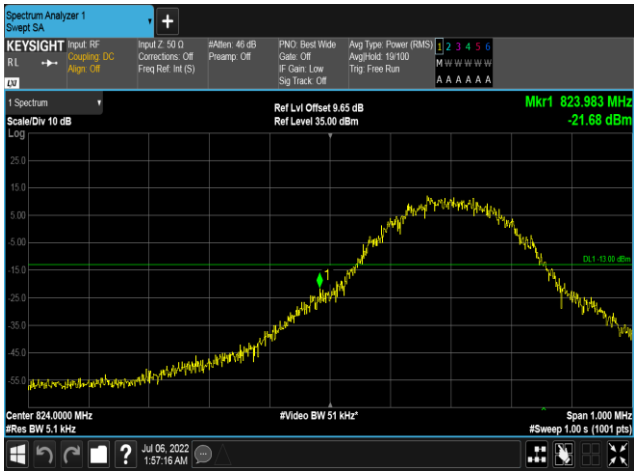
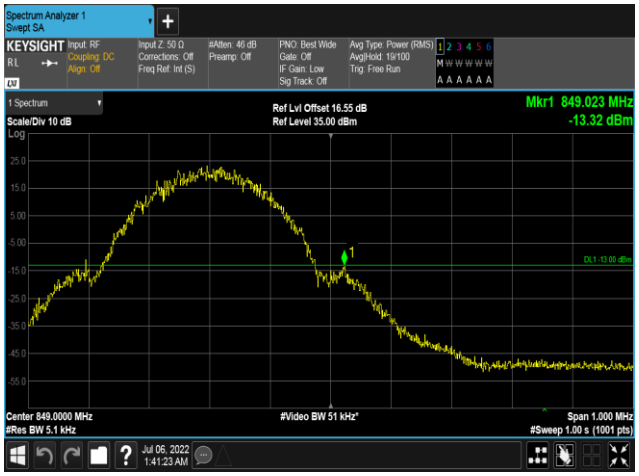
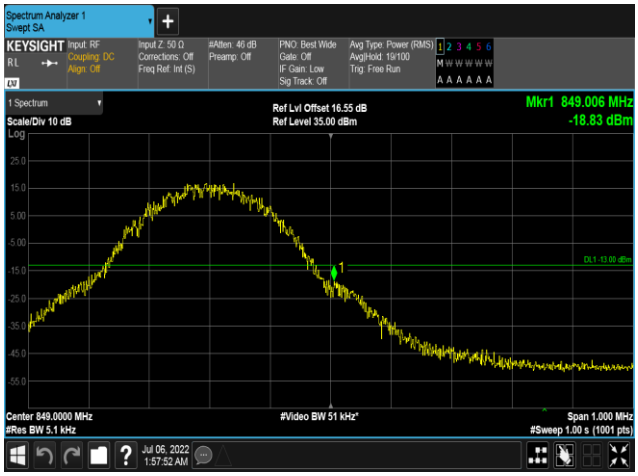
TEST NOTE

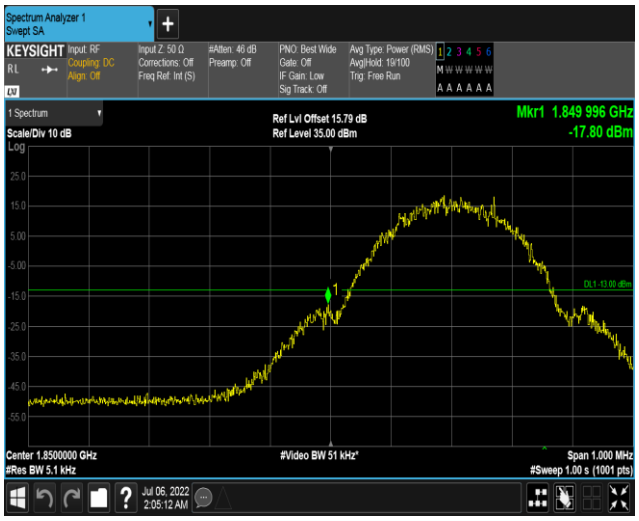
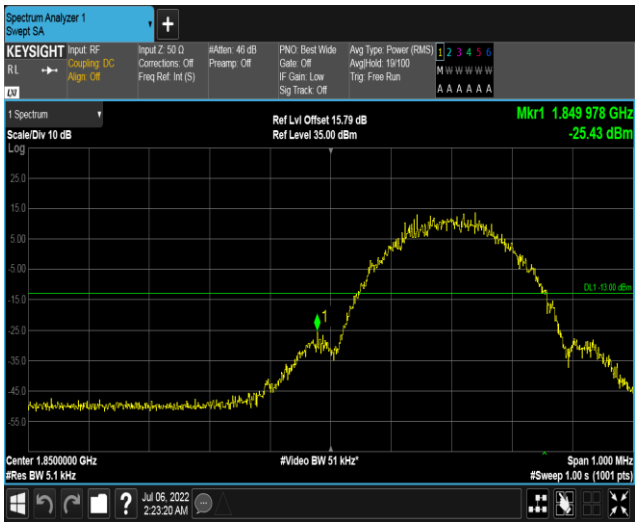
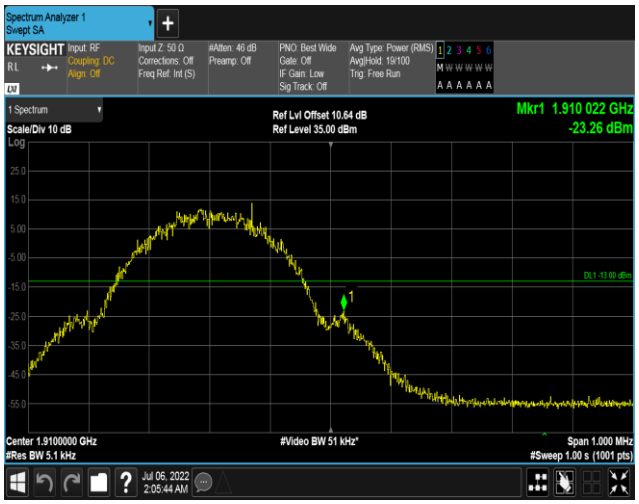
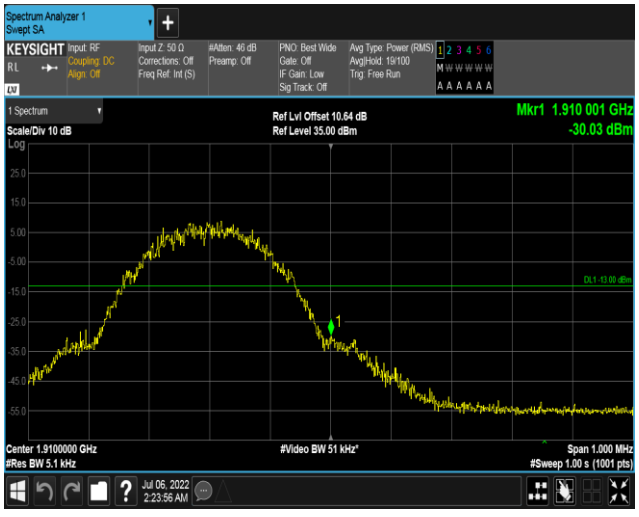
According to FCC 22.917, 24.238, 27.53 specified that power of any emission outside of The authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. All measurements were done at 2 channels(low and high operational frequency range.)
The band edge measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

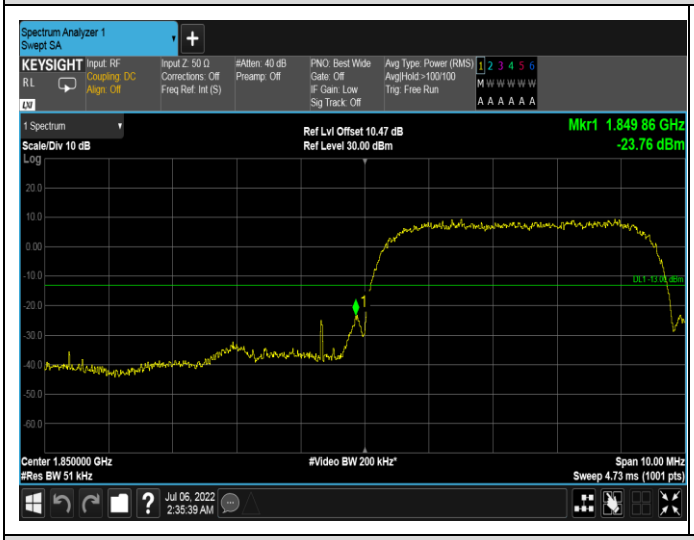
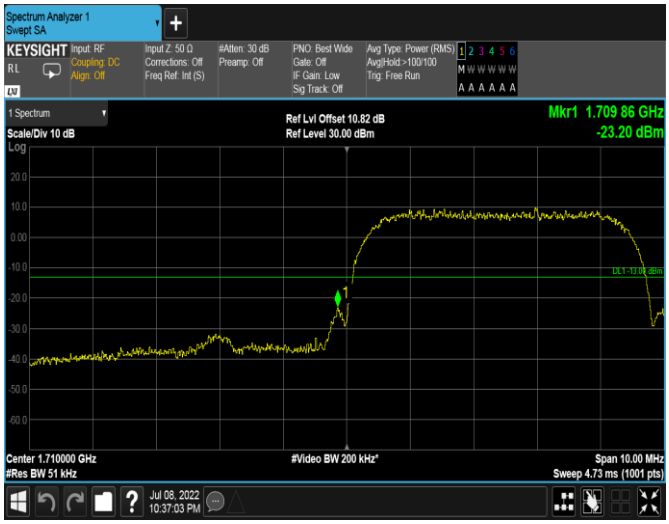
11.3 MEASUREMENT METHOD

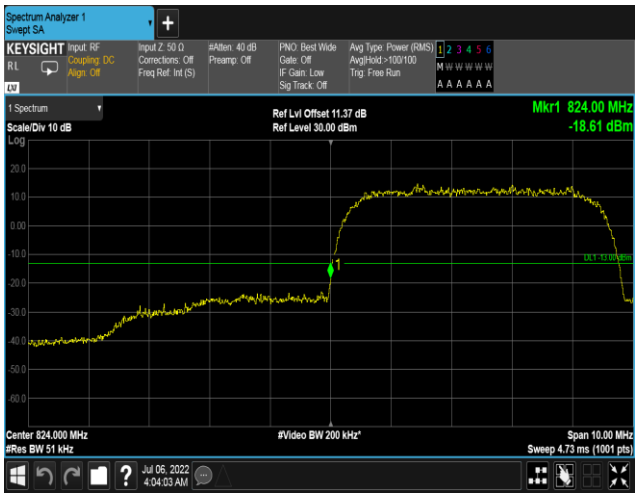
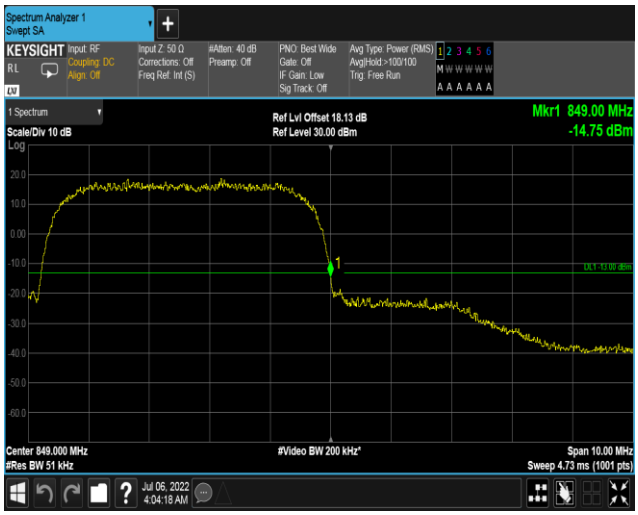


11.4 MEASUREMENT RESULT

GSM 850	
GSM	EDGE
Lowest Channel	
	
Highest Channel	
	

PCS 1900	
GSM	EDGE
Lowest Channel	
	
Highest Channel	
	

WCDMA Band II_RMC 12.2kbps	WCDMA Band IV_RMC 12.2kbps
Lowest Channel	
	
Highest Channel	
	

WCDMA Band V_RMC 12.2kbps	
Lowest Channel	Highest Channel
	

12. SPURIOUS EMISSIONS AT ANTENNA TERMINAL

12.1 PROVISIONS APPLICABLE

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

12.2 MEASUREMENT METHOD

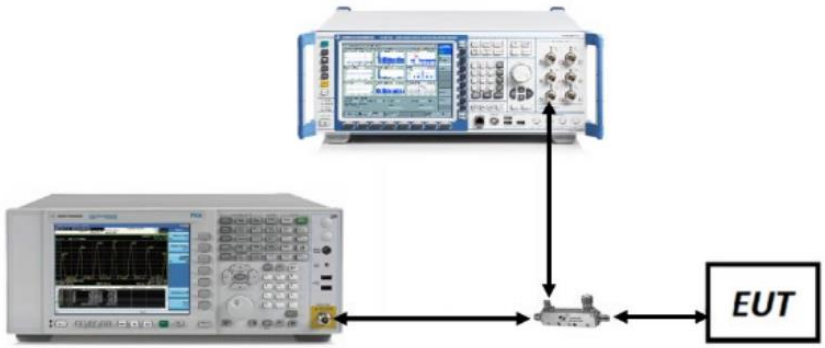
Test Settings (GSM)

1. RBW = 1 MHz
2. VBW ≥ 3 MHz
3. Detector = Peak
4. Trace Mode = max hold
5. Sweep time = auto
6. Number of points in sweep ≥ 2 x Span / RBW

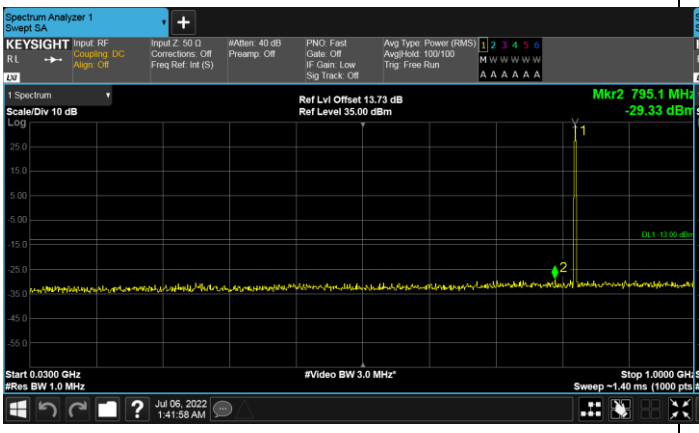
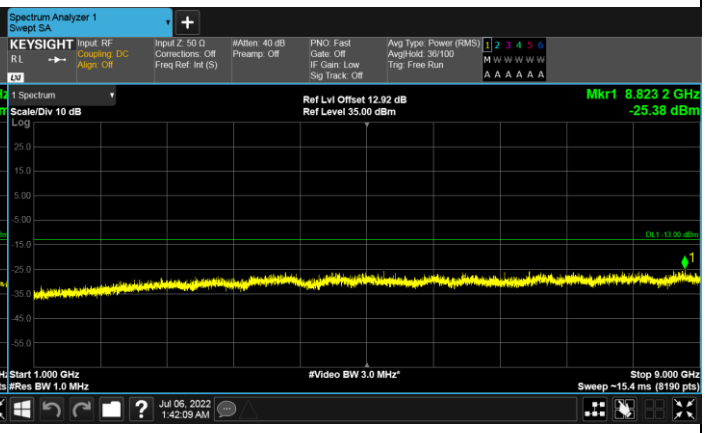
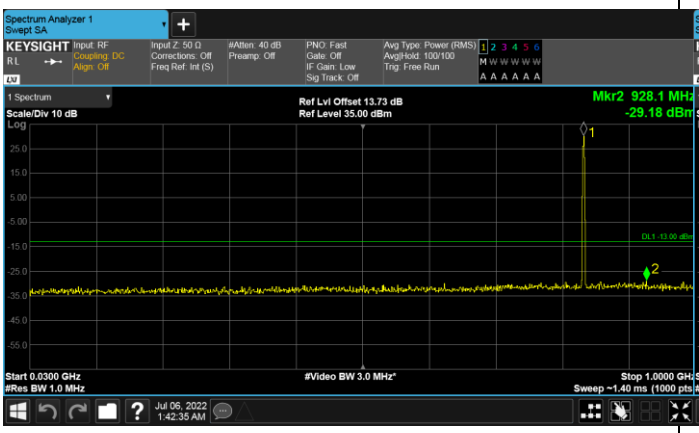
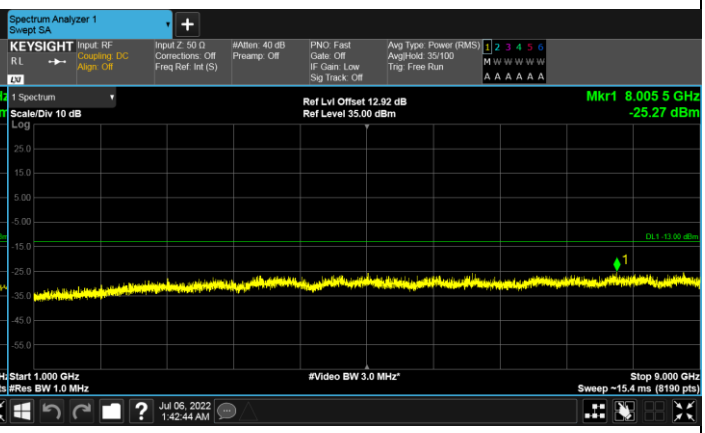
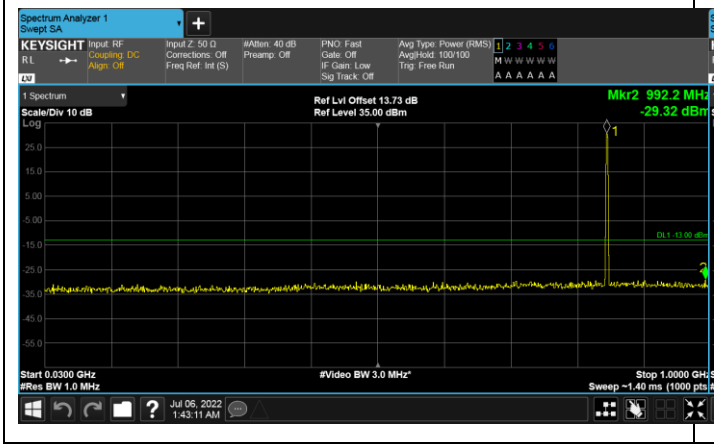
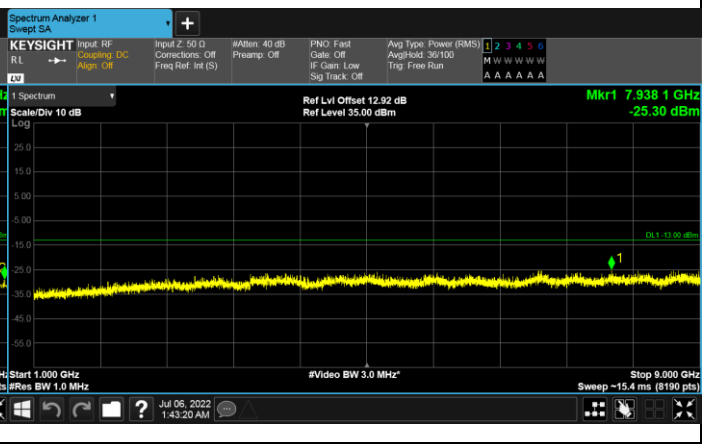
Test Settings (WCDMA)

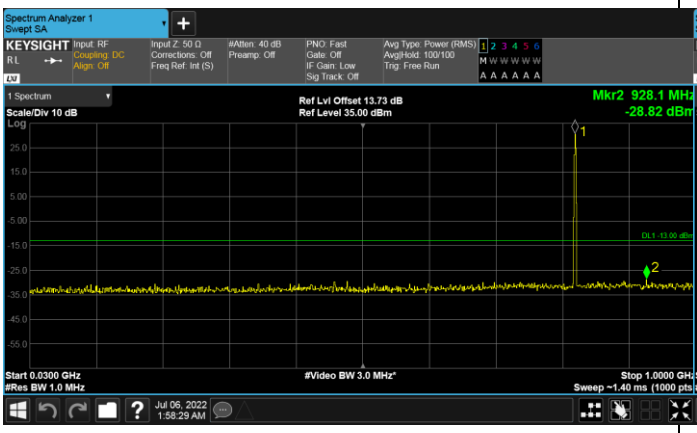
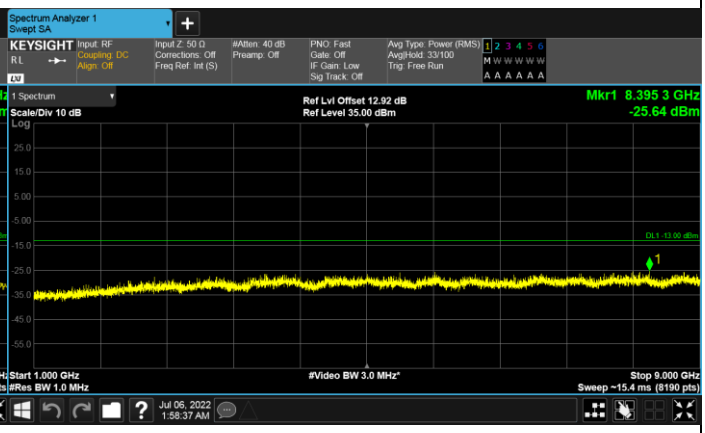
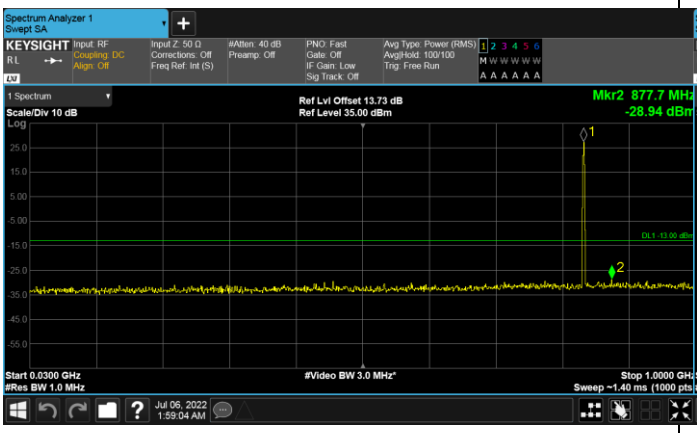
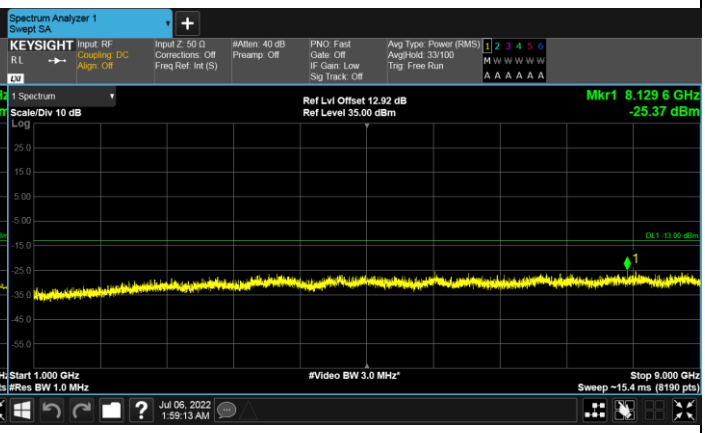
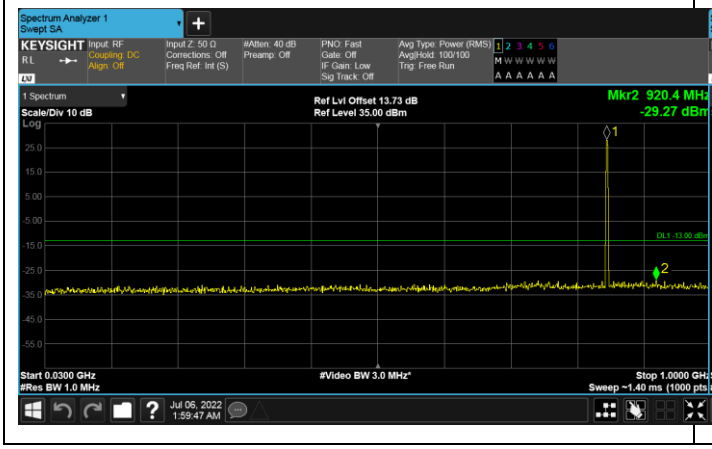
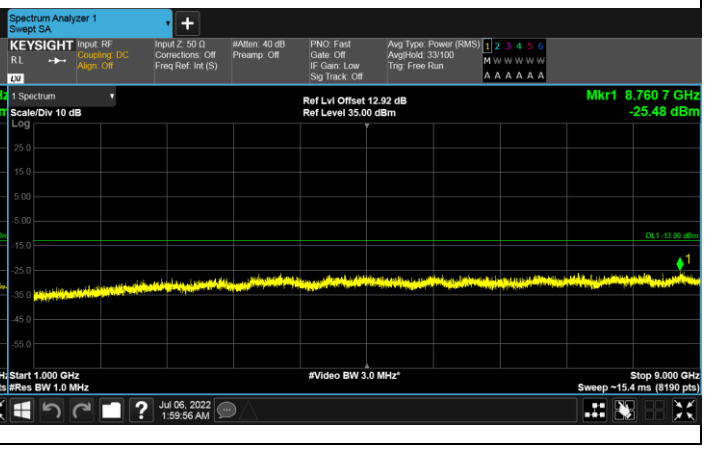
1. RBW = 1 MHz
2. VBW ≥ 3 MHz
3. Detector = RMS
4. Trace Mode = trace average
5. Sweep time = auto
6. Number of points in sweep ≥ 2 x Span / RBW

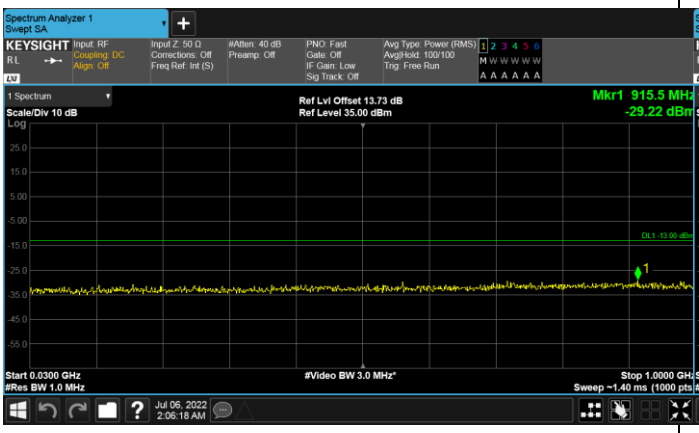
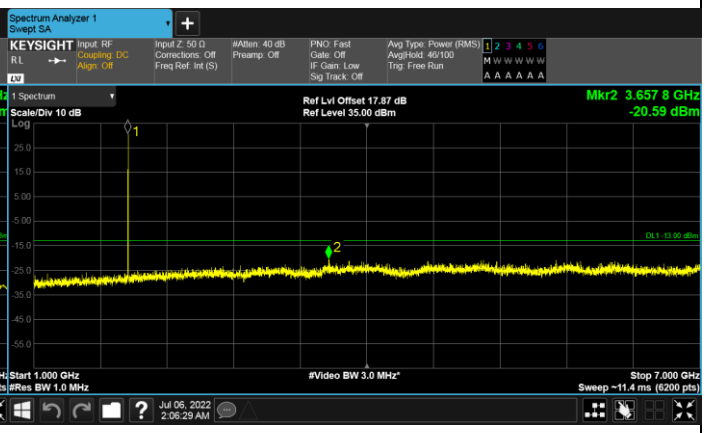
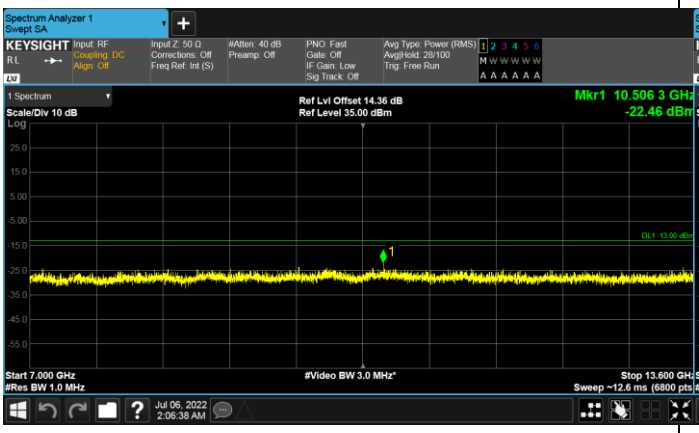
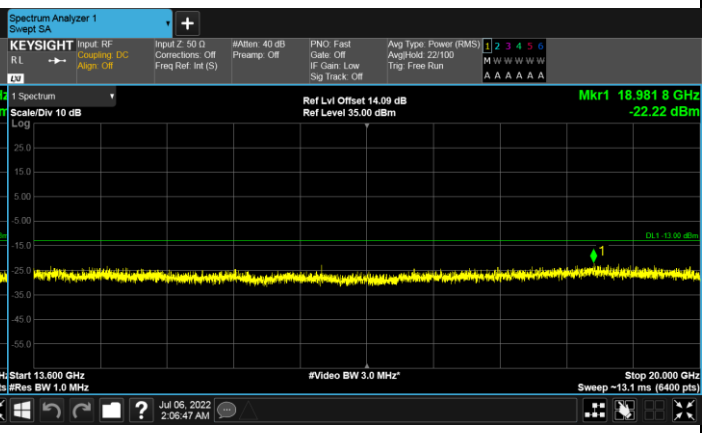
12.3 MEASUREMENT SETUP



12.4 MEASUREMENT RESULT

GSM 850_LCH_GSM	GSM 850_LCH_GSM
	
GSM 850_MCH_GSM	GSM 850_MCH_GSM
	
GSM 850_HCH_GSM	GSM 850_HCH_GSM
	

GSM 850_LCH_EDGE	GSM 850_LCH_EDGE
	
GSM 850_MCH_EDGE	GSM 850_MCH_EDGE
	
GSM 850_HCH_EDGE	GSM 850_HCH_EDGE
	

PCS 1900_LCH_GSM	PCS 1900_LCH_GSM
	
PCS 1900_LCH_GSM	PCS 1900_LCH_GSM
	
PCS 1900_MCH_GSM	PCS 1900_MCH_GSM