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# FCC Test Report

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Report No.: AGC11034211201FE02

**FCC ID** : 2A4AS-2109A

**APPLICATION PURPOSE** : Original Equipment

**PRODUCT DESIGNATION** : IP Camera

**BRAND NAME** : Reolink

**MODEL NAME** : Reolink Duo 4G

**APPLICANT** : EZTECH DIGITAL INC.

**DATE OF ISSUE** : Mar. 07, 2022

**STANDARD(S)** : FCC Part 22H & 24E& 27L Rules

**REPORT VERSION** : V1.0

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



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**REPORT REVISE RECORD**

| Report Version | Revise Time | Issued Date   | Valid Version | Notes           |
|----------------|-------------|---------------|---------------|-----------------|
| V1.0           | /           | Mar. 07, 2022 | Valid         | Initial Release |

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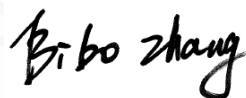
## 1. GENERAL INFORMATION

|                          |                                                                                                             |
|--------------------------|-------------------------------------------------------------------------------------------------------------|
| Applicant                | EZTECH DIGITAL INC.                                                                                         |
| Address                  | 251 Little Falls Drive Wilmington Delaware 19808 United States                                              |
| Manufacturer             | REOLINK INNOVATION LIMITED                                                                                  |
| Address                  | FLAT/RM 705 7/F FA YUEN COMMERCIAL BUILDING 75-77 FA YUEN STREET MONG KOK KL HONG KONG                      |
| Factory                  | Shenzhen Reolink Technology Co., Ltd.                                                                       |
| Address                  | 2-4th Floor, Building 2, YuanLing Industrial Park, ShangWu, Shiyan Street, Bao'an District, Shenzhen, China |
| Product Designation      | IP Camera                                                                                                   |
| Brand Name               | Reolink                                                                                                     |
| Test Model               | Reolink Duo 4G                                                                                              |
| Date of test             | Jan. 06, 2022~Mar. 07, 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

Bibo Zhang  
(Project Engineer)

Mar. 07, 2022

Reviewed By

Calvin Liu  
(Reviewer)

Mar. 07, 2022

Approved By

Max Zhang  
Authorized Officer

Mar. 07, 2022

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## 2. PRODUCT INFORMATION

### 2.1 PRODUCT TECHNICAL DESCRIPTION

A major technical description of EUT is described as following:

|                         |                                                                                                                                                                                                                                                                                                   |                   |                  |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|------------------|
| Product Designation:    | IP Camera                                                                                                                                                                                                                                                                                         |                   |                  |
| Hardware Version:       | BIPC_523MIX4G32M32B174MP                                                                                                                                                                                                                                                                          |                   |                  |
| Software Version:       | v3.0.0.743211203743                                                                                                                                                                                                                                                                               |                   |                  |
| Support Networks:       | WCDMA, HSDPA, HSUPA                                                                                                                                                                                                                                                                               |                   |                  |
| Frequency Bands:        | <input checked="" type="checkbox"/> UMTS FDD Band II <input checked="" type="checkbox"/> UMTS FDD Band IV<br><input checked="" type="checkbox"/> UMTS FDD Band V (U.S. Bands)<br><input type="checkbox"/> UMTS FDD Band I <input checked="" type="checkbox"/> UMTS FDD Band VIII (Non-U.S. Bands) |                   |                  |
| Type of Modulation:     | BPSK,QPSK Modulation For WCDMA/HSDPA/HSUPA                                                                                                                                                                                                                                                        |                   |                  |
|                         | 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:    | WCDMA Band II:                                                                                                                                                                                                                                                                                    | 4M19F9W           |                  |
|                         | WCDMA Band IV:                                                                                                                                                                                                                                                                                    | 4M19F9W           |                  |
|                         | WCDMA Band V:                                                                                                                                                                                                                                                                                     | 4M18F9W           |                  |
| Antenna Type:           | PIFA Antenna                                                                                                                                                                                                                                                                                      |                   |                  |
| Antenna gain:           | WCDMA850:1.98dBi                                                                                                                                                                                                                                                                                  | WCDMA1700:4.19dBi | WCDMA1900:4.6dBi |
| Power Supply:           | DC 3.65V by Built-in Li-ion Battery                                                                                                                                                                                                                                                               |                   |                  |
| Battery parameter:      | DC 3.65V 10000mAh                                                                                                                                                                                                                                                                                 |                   |                  |
| Single Card:            | WCDMA Card Slot                                                                                                                                                                                                                                                                                   |                   |                  |
| Extreme Vol. Limits:    | DC3.10V to 4.20V (Normal: DC 3.65V)                                                                                                                                                                                                                                                               |                   |                  |
| Extreme Temp. Tolerance | -30 °C to +50 °C                                                                                                                                                                                                                                                                                  |                   |                  |

#### WCDMA SLOT :

|              | Maximum ERP/EIRP<br>(dBm) | Max. Average<br>Burst Power (dBm) |
|--------------|---------------------------|-----------------------------------|
| UMTS BAND V  | 22.62                     | 23.33                             |
| UMTS BAND II | 21.10                     | 22.00                             |
| UMTS BAND IV | 21.65                     | 23.26                             |

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## 2.2 RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID: 2A4AS-2109A**, 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

850/1700/1900 WCDMA/HSPA, Multi-Band LTE.

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.

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## 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)

### WCDMA Emission Designator

**Emission Designator = 4M17F9W**

WCDMA BW = 4.17 MHz

F = Frequency Modulation

9 = Composite Digital Info

W = Combination (Audio/Data)

### QAM Modulation

**Emission Designator = 4M48W7D**

LTE BW = 4.48 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

### EDGE Emission Designator

**Emission Designator = 249KG7W**

GSM BW = 249 kHz

G = Phase Modulation

7 = Quantized/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



### 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℃           |
| Humidity range                                                                   | 20 % to 75 %.     | 20 % to 75 %.      |
| Pressure range                                                                   | 86-106kPa         | 86-106kPa          |
| Power supply                                                                     | DC 3.65V          | DC 3.10V or 4.20V  |
| 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.

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### 3.5 LIST OF TEST EQUIPMENT

| Equipment                            | Manufacturer | Model                 | S/N        | Cal. Date     | Cal. Due      |
|--------------------------------------|--------------|-----------------------|------------|---------------|---------------|
| TEST RECEIVER                        | R&S          | ESPI                  | 101206     | May 11, 2021  | May 10, 2022  |
| LISN                                 | R&S          | ESH2-Z5               | 100086     | Jun. 09, 2021 | Jun. 08, 2022 |
| TEST RECEIVER                        | R&S          | ESCI                  | 10096      | Apr. 14, 2021 | Apr. 13, 2022 |
| EXA Signal Analyzer                  | Agilent      | N9010A                | MY53470504 | Nov. 17, 2021 | Nov. 16, 2022 |
| Horn antenna                         | SCHWARZBECK  | BBHA 9170             | #768       | Sep. 19, 2021 | Sep. 18, 2023 |
| preamplifier                         | ChengYi      | EMC184045S<br>E       | 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.08, 2021  | Jun.07, 2022  |
| 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. 09, 2021 | Jun. 08, 2022 |
| Universal Radio Communication Tester | Agilent      | 8960                  | GB46200384 | Aug. 18, 2021 | Aug. 17, 2022 |
| Power Splitter                       | Agilent      | 11636A                | 34         | Jun.08, 2021  | Jun.07, 2022  |
| Attenuator                           | JFW          | 50FHC-006-5<br>0      | N/A        | Jun.08, 2021  | Jun.07, 2022  |
| Horn Ant (18G-40GHz)                 | Schwarzbeck  | BBHA 9170             |            | Sep. 19, 2021 | Sep. 18, 2022 |
| Horn Ant (18G-40GHz)                 | ETS          | QWH_SL_18<br>_40_K_SG |            | Sep. 19, 2021 | Sep. 18, 2022 |
| Power Splitter                       | Agilent      | 11636A                | /          | Sep.14, 2021  | Sep.13, 2022  |
| CMU200                               | R&S          | 120237                | /          | Jun. 09, 2021 | Jun. 08, 2022 |
| Artificial Mains                     | R&S          | 101242                | /          | Jun. 09, 2021 | Jun. 08, 2022 |

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|                                    |               |     |   |               |               |
|------------------------------------|---------------|-----|---|---------------|---------------|
| Network ENV216                     |               |     |   |               |               |
| Filter Bank Notch 1(880-915MHz)    | MICRO-TRONICS | 010 | / | Feb. 23, 2021 | Feb. 22, 2022 |
| 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. 23, 2021 | Feb. 22, 2022 |
| 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. 23, 2021 | Feb. 22, 2022 |
| Filter Bank Notch 3 (1920-1980MHz) | MICRO-TRONICS | 008 | / | Feb. 21, 2022 | Feb. 20, 2023 |

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## 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

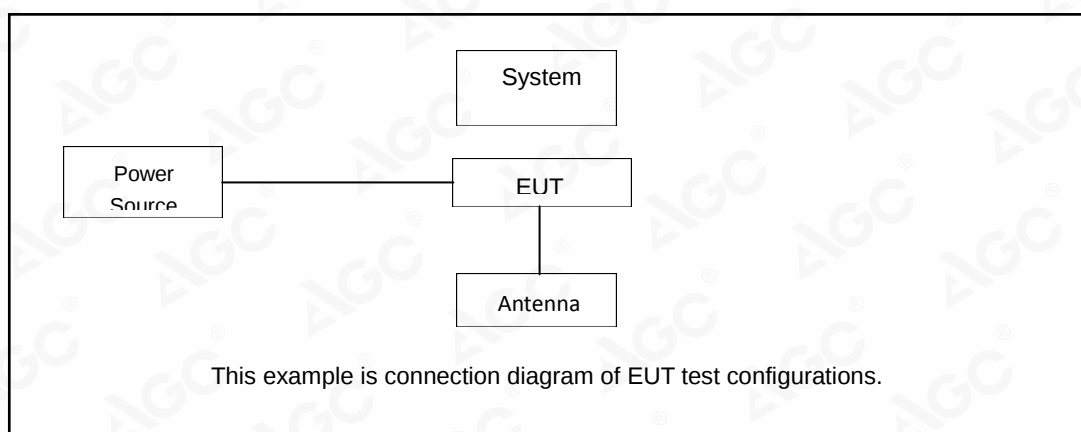


Table 2-1 Equipment Used in EUT System

### 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.      | Identifier          | Note        |
|------|-----------|----------------|---------------------|-------------|
| 1    | IP Camera | Reolink Duo 4G | FCC ID: 2A4AS-2109A | EUT         |
| 2    | Battery   | Battery-Li8    | DC 3.65V 10000mAh   | Accessories |

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## 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)<br>§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),<br>§27.53(h) | Pass   |

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## 6. DESCRIPTION OF TEST MODES

| Bands        | Tx/Rx Frequency           | RF Channel   |              |              |
|--------------|---------------------------|--------------|--------------|--------------|
|              |                           | Low(L)       | Middle(M)    | High(H)      |
| WCDMA band V | TX<br>(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)      |
| WCDMA Band II | TX<br>(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<br>(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         |
|--------------------|-------------------|-------------------|
| WCDMA Band II/IV/V | RMC 12.2kbps Link | RMC 12.2kbps Link |

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**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<br>HS-DPDCH,E-DPDCH and E-DPCCH                                                                                                                            | $0 \leq CM \leq 3.5$ | MAX(CM-1,0) |
| Note: CM=1 for $\beta_c/\beta_d=12/15$ , $\beta_{hs}/\beta_c=24/15$ . 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.

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## 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)

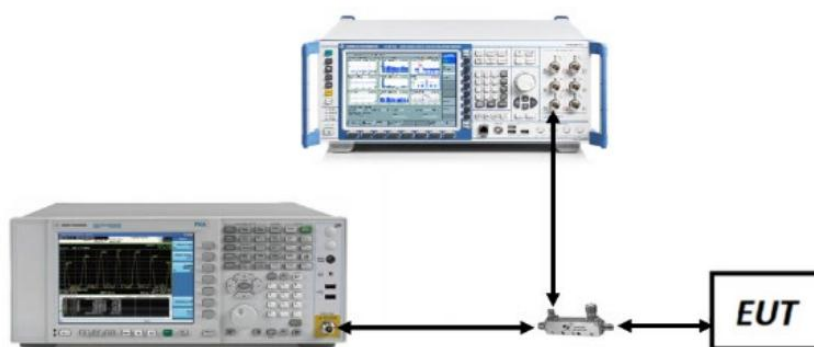
### 7.2 MEASUREMENT METHOD

- 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



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## 7.4 MEASUREMENT RESULT

| 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                              | 21.64      | <b>22.00</b> | 21.46      |
| HSDPA Subtest-1                           | 20.68      | 21.02        | 20.49      |
| HSDPA Subtest-2                           | 19.92      | 20.26        | 19.74      |
| HSDPA Subtest-3                           | 19.86      | 20.23        | 19.59      |
| HSDPA Subtest-4                           | 19.85      | 20.18        | 19.65      |
| HSUPA Subtest-1                           | 18.41      | 18.72        | 18.19      |
| HSUPA Subtest-2                           | 18.50      | 18.74        | 18.25      |
| HSUPA Subtest-3                           | 19.45      | 19.72        | 19.19      |
| HSUPA Subtest-4                           | 17.91      | 18.26        | 17.67      |
| HSUPA Subtest-5                           | 17.87      | 17.73        | 17.17      |

| 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                              | <b>23.26</b> | 22.98      | 22.68      |
| HSDPA Subtest-1                           | 22.31        | 21.99      | 21.64      |
| HSDPA Subtest-2                           | 21.53        | 21.16      | 20.82      |
| HSDPA Subtest-3                           | 21.42        | 21.15      | 20.77      |
| HSDPA Subtest-4                           | 21.42        | 21.11      | 20.79      |
| HSUPA Subtest-1                           | 20.01        | 19.69      | 19.34      |
| HSUPA Subtest-2                           | 20.13        | 19.76      | 19.50      |
| HSUPA Subtest-3                           | 21.08        | 20.72      | 20.33      |
| HSUPA Subtest-4                           | 19.65        | 19.28      | 18.95      |
| HSUPA Subtest-5                           | 19.07        | 20.65      | 18.64      |

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| 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                             | 23.33     | 22.74     | 23.32     |
| HSDPA Subtest-1                          | 22.41     | 21.85     | 22.35     |
| HSDPA Subtest-2                          | 21.72     | 21.12     | 21.59     |
| HSDPA Subtest-3                          | 21.63     | 21.02     | 21.55     |
| HSDPA Subtest-4                          | 21.59     | 21.02     | 21.49     |
| HSUPA Subtest-1                          | 20.19     | 19.64     | 20.12     |
| HSUPA Subtest-2                          | 20.15     | 19.60     | 20.14     |
| HSUPA Subtest-3                          | 21.24     | 20.62     | 21.11     |
| HSUPA Subtest-4                          | 19.64     | 19.11     | 19.64     |
| HSUPA Subtest-5                          | 19.30     | 18.71     | 19.27     |

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## 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            |
|---------------|-------------------------------|
| 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  $\geq 3 \times$  RBW
4. Span = 1.5 times the OBW
5. No. of sweep points  $> 2 \times$  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.

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### 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:

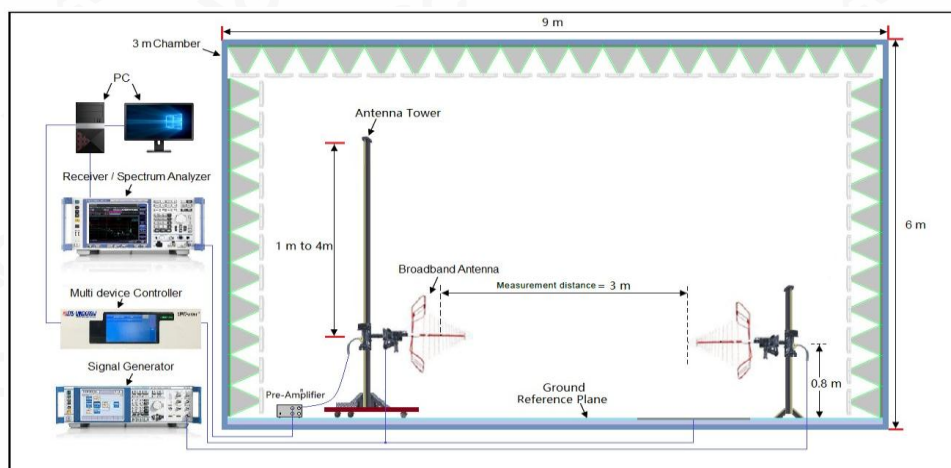
$$P_d(\text{dBm}) = P_g(\text{dBm}) - \text{cable loss (dB)} + \text{antenna gain (dB)}$$

Where:  $P_d$  is the dipole equivalent power and  $P_g$  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

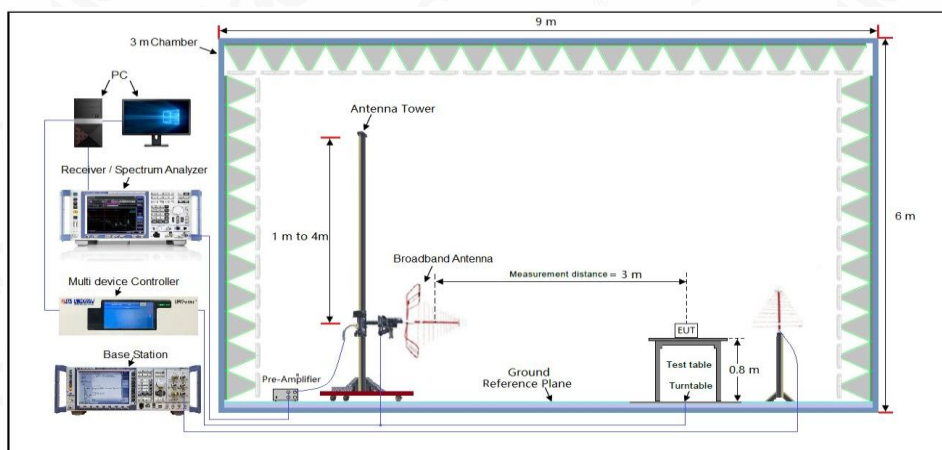
#### Radiated Power 30MHz to 1GHz Test setup



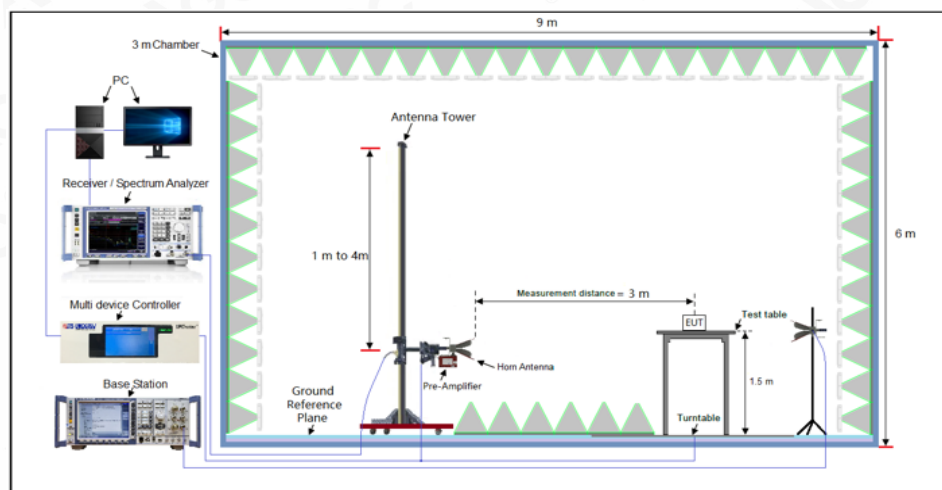
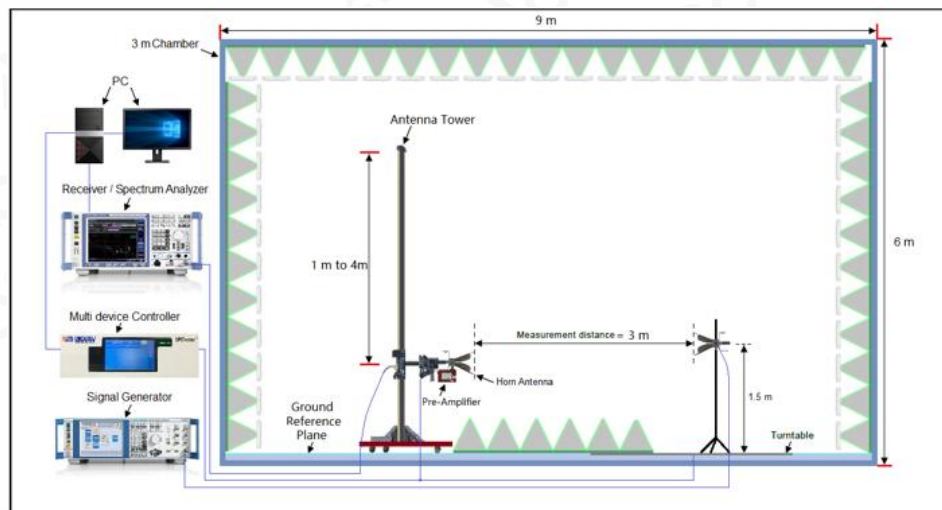
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**Radiated Power Above 1GHz Test setup**



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#### 8.4 MEASUREMENT RESULT

| Mode     | Ch./ Freq. |             | Substitute<br><br>LEVEL<br>(dBm) | Ant.<br><br>Gain<br>(dBd) | C.L  | Pol. | Limit  | ERP   |              |
|----------|------------|-------------|----------------------------------|---------------------------|------|------|--------|-------|--------------|
|          | channel    | Freq. (MHz) |                                  |                           |      |      | W      | W     | dBm          |
| WCDMA850 | 4132       | 826.4       | 27.31                            | 5.90                      | 1.21 | H    | < 7.00 | 0.183 | <b>22.62</b> |
|          | 4183       | 836.6       | 26.63                            | 5.90                      | 1.25 | H    |        | 0.158 | 21.98        |
|          | 4233       | 846.6       | 26.53                            | 5.90                      | 1.24 | H    |        | 0.154 | 21.87        |
| HSPA     | 4132       | 826.4       | 24.31                            | 5.90                      | 1.21 | H    |        | 0.092 | 19.62        |
|          | 4183       | 836.6       | 24.78                            | 5.90                      | 1.25 | H    |        | 0.103 | 20.13        |
|          | 4233       | 846.6       | 24.68                            | 5.90                      | 1.24 | H    |        | 0.100 | 20.02        |

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| Mode          | Ch./ Freq. |             | Substitute<br>LEVEL<br>(dBm) | Ant.<br>Gain<br>(dBi) | C.L  | Pol. | Limit  | EIRP  |              |
|---------------|------------|-------------|------------------------------|-----------------------|------|------|--------|-------|--------------|
|               | channel    | Freq. (MHz) |                              |                       |      |      | W      | W     | dBm          |
| WCDMA<br>1900 | 9262       | 1852.4      | 27.54                        | 8.6                   | 2.11 | H    | < 2.00 | 0.127 | 21.05        |
|               | 9400       | 1880.0      | 27.55                        | 8.6                   | 2.15 | H    |        | 0.129 | <b>21.10</b> |
|               | 9538       | 1907.6      | 27.34                        | 8.6                   | 2.15 | H    |        | 0.123 | 20.89        |
| HSPA          | 9262       | 1852.4      | 25.24                        | 8.6                   | 2.11 | H    |        | 0.075 | 18.75        |
|               | 9400       | 1880.0      | 25.05                        | 8.6                   | 2.15 | H    |        | 0.072 | 18.60        |
|               | 9538       | 1907.6      | 25.63                        | 8.6                   | 2.15 | H    |        | 0.083 | 19.18        |
| WCDMA<br>1700 | 1312       | 1712.4      | 27.90                        | 8.3                   | 2.05 | H    | < 1.00 | 0.146 | <b>21.65</b> |
|               | 1412       | 1732.4      | 27.83                        | 8.3                   | 2.05 | H    |        | 0.144 | 21.58        |
|               | 1513       | 1752.6      | 27.73                        | 8.3                   | 2.06 | H    |        | 0.141 | 21.49        |
| HSPA          | 1312       | 1712.4      | 24.40                        | 8.3                   | 2.05 | H    |        | 0.065 | 18.15        |
|               | 1412       | 1732.4      | 24.44                        | 8.3                   | 2.05 | H    |        | 0.066 | 18.19        |
|               | 1513       | 1752.6      | 24.46                        | 8.3                   | 2.06 | H    |        | 0.066 | 18.22        |

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

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## 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  $\geq$  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 PPk. Use one of the applicable procedures presented 5.2(ANSI C63.26-2015) to measure the total average power and record as PAvg. Determine the P.A.R. from:

$$\text{P.A.R(dB)} = \text{PPk (dBm)} - \text{PAvg (dBm)} \quad (\text{PAvg} = \text{Average Power} + \text{Duty cycle Factor})$$

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  $\geq 3 \times$  RBW.

1. Set the RBW  $\geq$  OBW.
2. Set VBW  $\geq 3 \times$  RBW.
3. Set span  $\geq 2 \times$  OBW.

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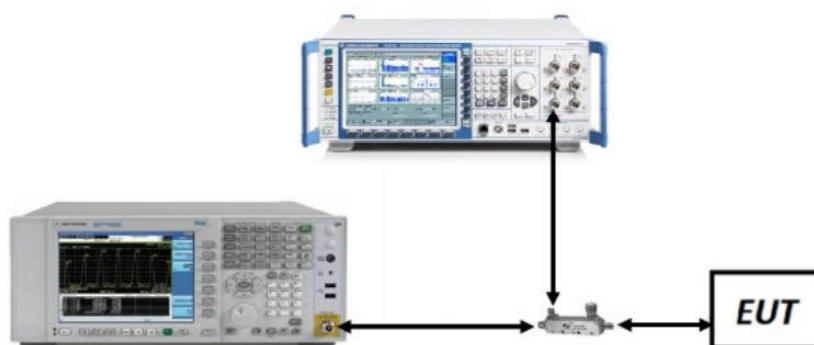


4. Sweep time  $\geq 10 \times (\text{number of points in sweep}) \times (\text{transmission symbol period})$ .
5. Detector = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the peak amplitude level.

### Test Settings(Average Power)

1. Set span to  $2 \times$  to  $3 \times$  the OBW.
2. Set RBW  $\geq$  OBW.
3. Set VBW  $\geq 3 \times$  RBW.
4. Set number of measurement points in sweep  $\geq 2 \times \text{span} / \text{RBW}$ .
5. Sweep time: Set  $\geq [10 \times (\text{number of points in sweep}) \times (\text{transmission period})]$  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  $[10 \log (1/\text{duty cycle})]$  to the measured maximum power level to compute the average power during continuous transmission. For example, add  $[10 \log (1/0.25)] = 6 \text{ dB}$  if the duty cycle is a constant 25%.

### 9.3 MEASUREMENT SETUP



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#### 9.4 MEASUREMENT RESULT

| Bands         | Modulation   | Peak-to-average ratio (dB) |        |         | Limit<br>(dB) | Result |
|---------------|--------------|----------------------------|--------|---------|---------------|--------|
|               |              | Lowest                     | Middle | Highest |               |        |
| WCDMA Band II | RMC 12.2kbps | 2.67                       | 2.73   | 2.74    | 13            | Pass   |
| WCDMA Band II | HSUPA        | 2.85                       | 5.13   | 2.88    | 13            | Pass   |
| WCDMA Band II | HSDPA        | 5.05                       | 3.35   | 5.18    | 13            | Pass   |
| WCDMA Band IV | RMC 12.2kbps | 4.31                       | 4.67   | 4.67    | 13            | Pass   |
| WCDMA Band IV | HSUPA        | 5.22                       | 5.08   | 5.19    | 13            | Pass   |
| WCDMA Band IV | HSDPA        | 6.06                       | 3.92   | 3.62    | 13            | Pass   |
| WCDMA Band V  | RMC 12.2kbps | 2.73                       | 2.71   | 2.76    | 13            | Pass   |
| WCDMA Band V  | HSUPA        | 2.74                       | 2.83   | 2.46    | 13            | Pass   |
| WCDMA Band V  | HSDPA        | 4.88                       | 5.52   | 4.31    | 13            | Pass   |

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## 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.

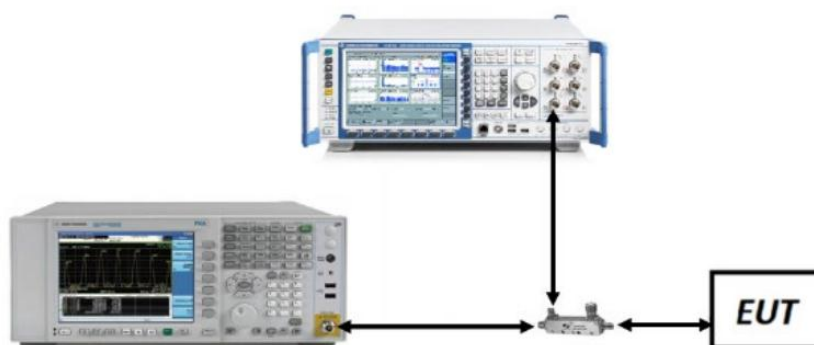
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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  $\geq 3 \times$  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



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#### 10.4 MEASUREMENT RESULT

| Test Band    | Test Mode | Test Channel | Occupied Bandwidth<br>(KHz) | Emission Bandwidth<br>(KHz) | Verdict |
|--------------|-----------|--------------|-----------------------------|-----------------------------|---------|
| WCDMA<br>850 | UMTS      | LCH          | 4173.9                      | 4738                        | PASS    |
|              |           | MCH          | 4181.9                      | 4731                        | PASS    |
|              |           | HCH          | 4150.9                      | 4714                        | PASS    |

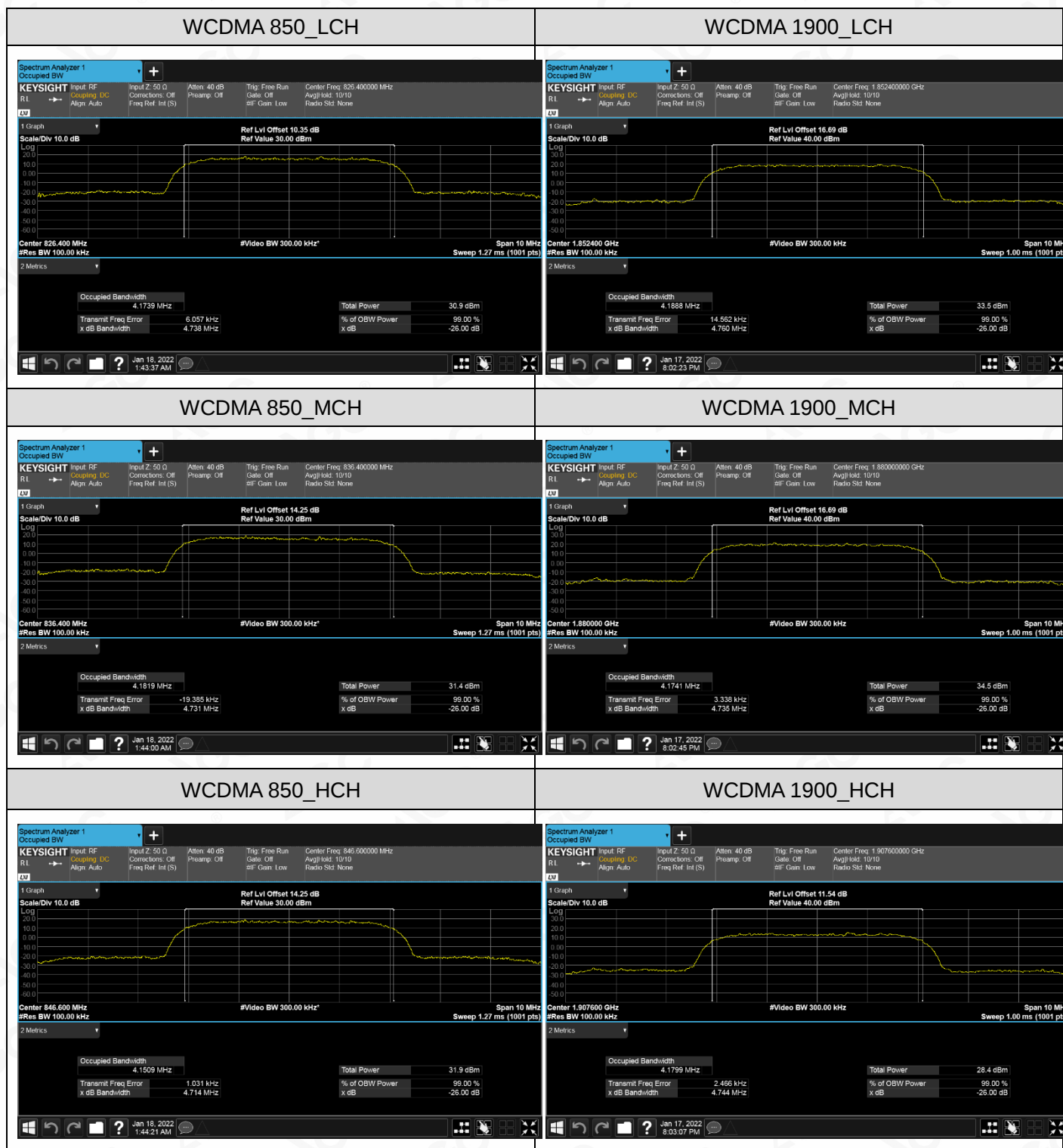
| Test Band     | Test Mode | Test Channel | Occupied Bandwidth<br>(KHz) | Emission Bandwidth<br>(KHz) | Verdict |
|---------------|-----------|--------------|-----------------------------|-----------------------------|---------|
| WCDMA<br>1900 | UMTS      | LCH          | 4188.8                      | 4760                        | PASS    |
|               |           | MCH          | 4174.1                      | 4735                        | PASS    |
|               |           | HCH          | 4179.9                      | 4744                        | PASS    |

| Test Band     | Test Mode | Test Channel | Occupied Bandwidth<br>(KHz) | Emission Bandwidth<br>(KHz) | Verdict |
|---------------|-----------|--------------|-----------------------------|-----------------------------|---------|
| WCDMA<br>1700 | UMTS      | LCH          | 4187.7                      | 4733                        | PASS    |
|               |           | MCH          | 4170.3                      | 4722                        | PASS    |
|               |           | HCH          | 4176.3                      | 4735                        | PASS    |

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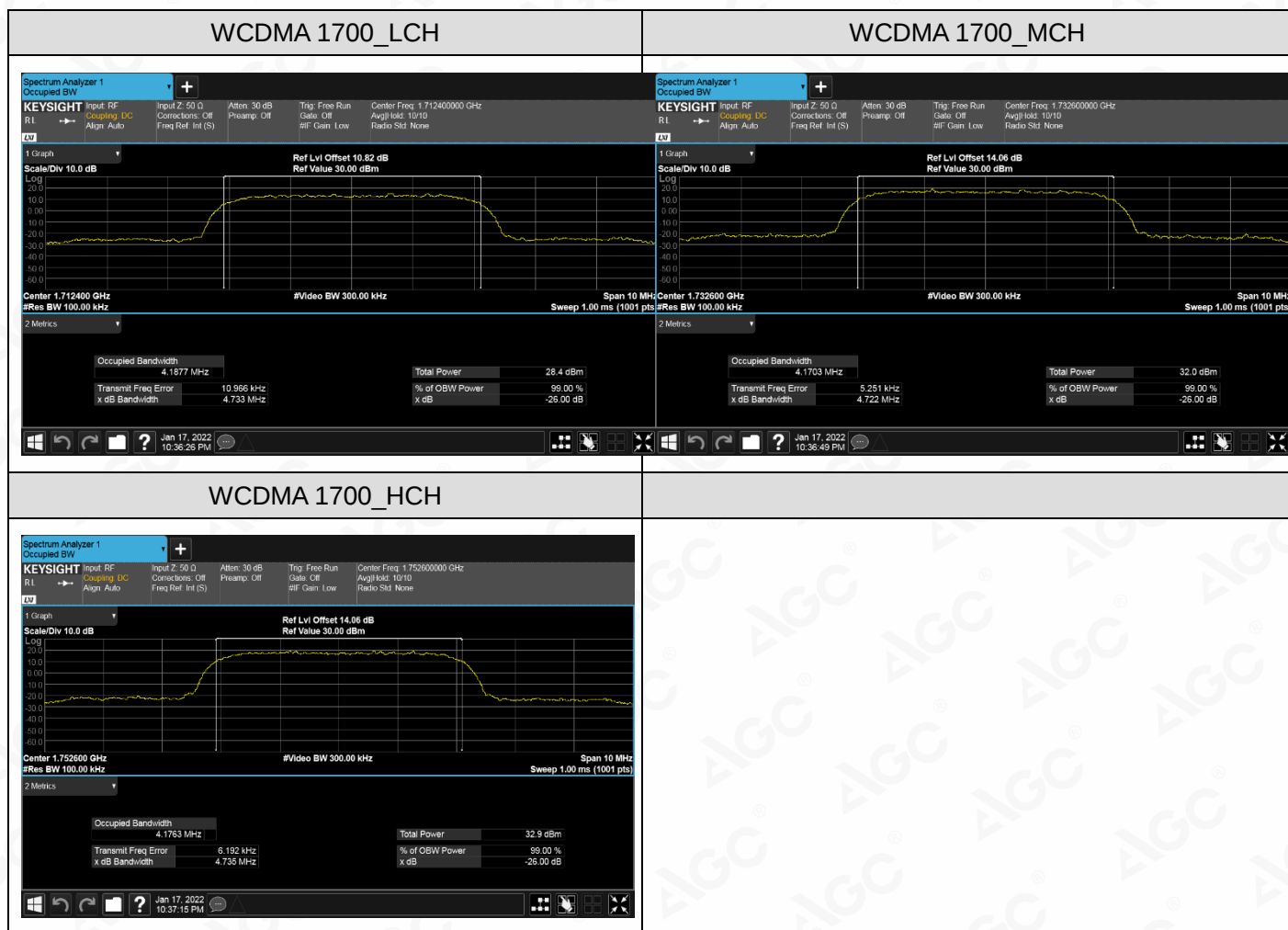




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## 11. BAND EDGE EMISSIONS AT ANTENNA TERMINAL

### 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.

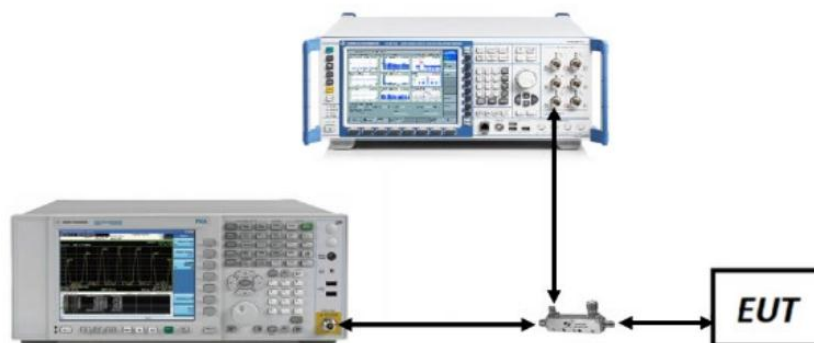
### 11.2 MEASUREMENT METHOD

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  $\geq 2 \times \text{Span/RBW}$
7. Trace mode = trace average
8. Sweep time = auto couple
9. The trace was allowed to stabilize

### TEST NOTE

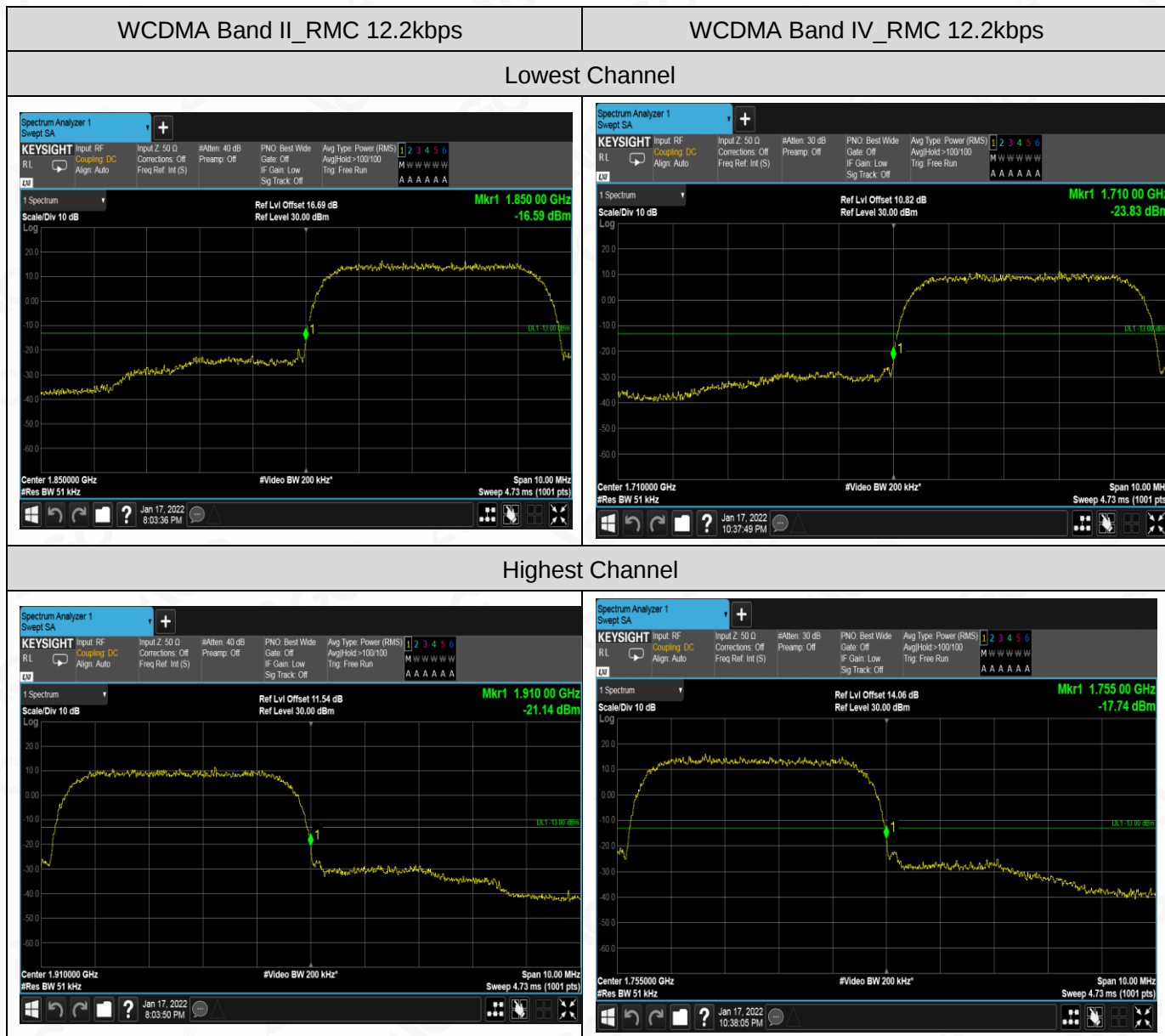
According to FCC 22.917, 24.238, 27.53 specified that power of any emission outside of The authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB. In the 1 MHz bands immediately outside and adjacent to the frequency block 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



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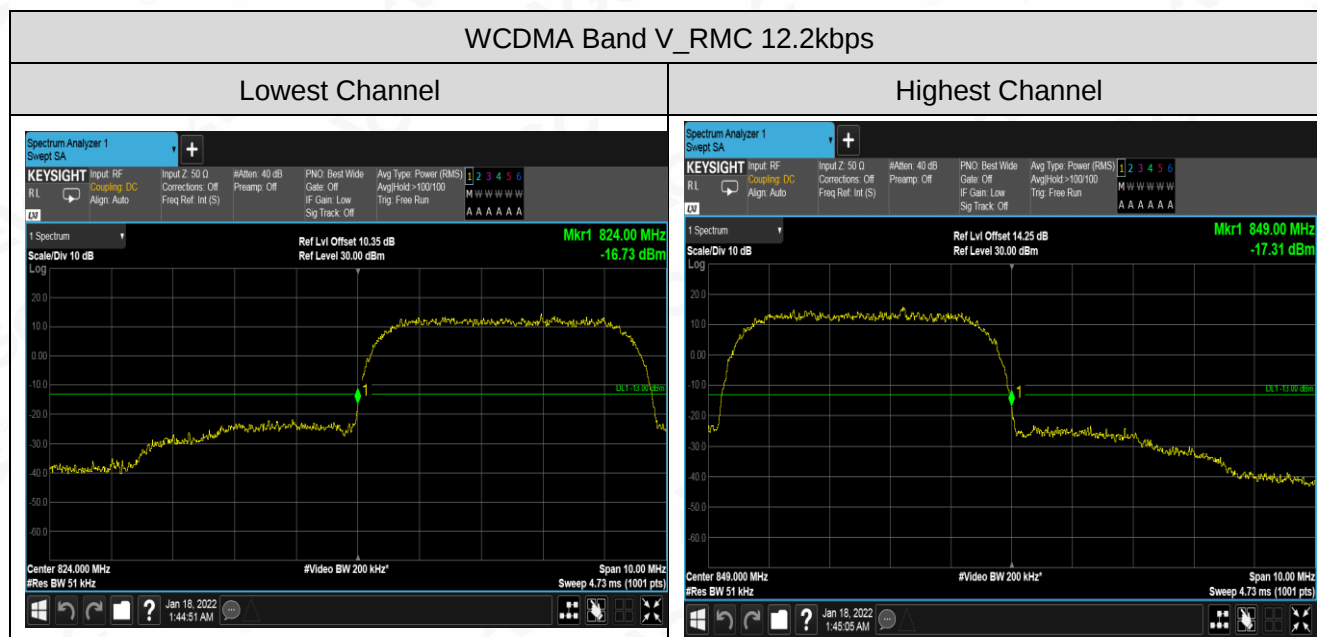
## 11.4 MEASUREMENT RESULT



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## 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

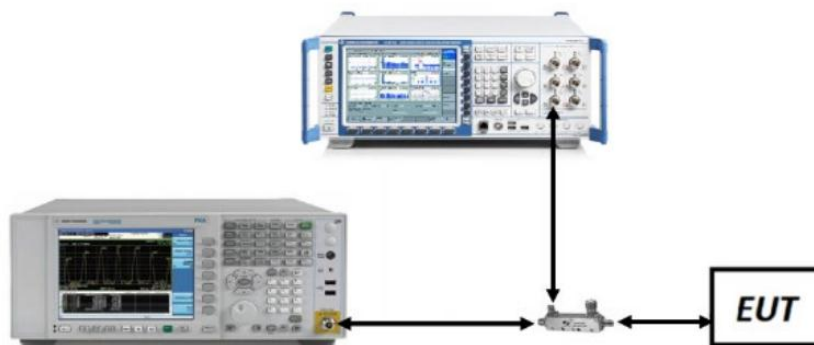
#### Test Settings (GSM)

1. RBW = 1 MHz
2. VBW  $\geq$  3 MHz
3. Detector = Peak
4. Trace Mode = max hold
5. Sweep time = auto
6. Number of points in sweep  $\geq 2 \times \text{Span} / \text{RBW}$

#### Test Settings (WCDMA)

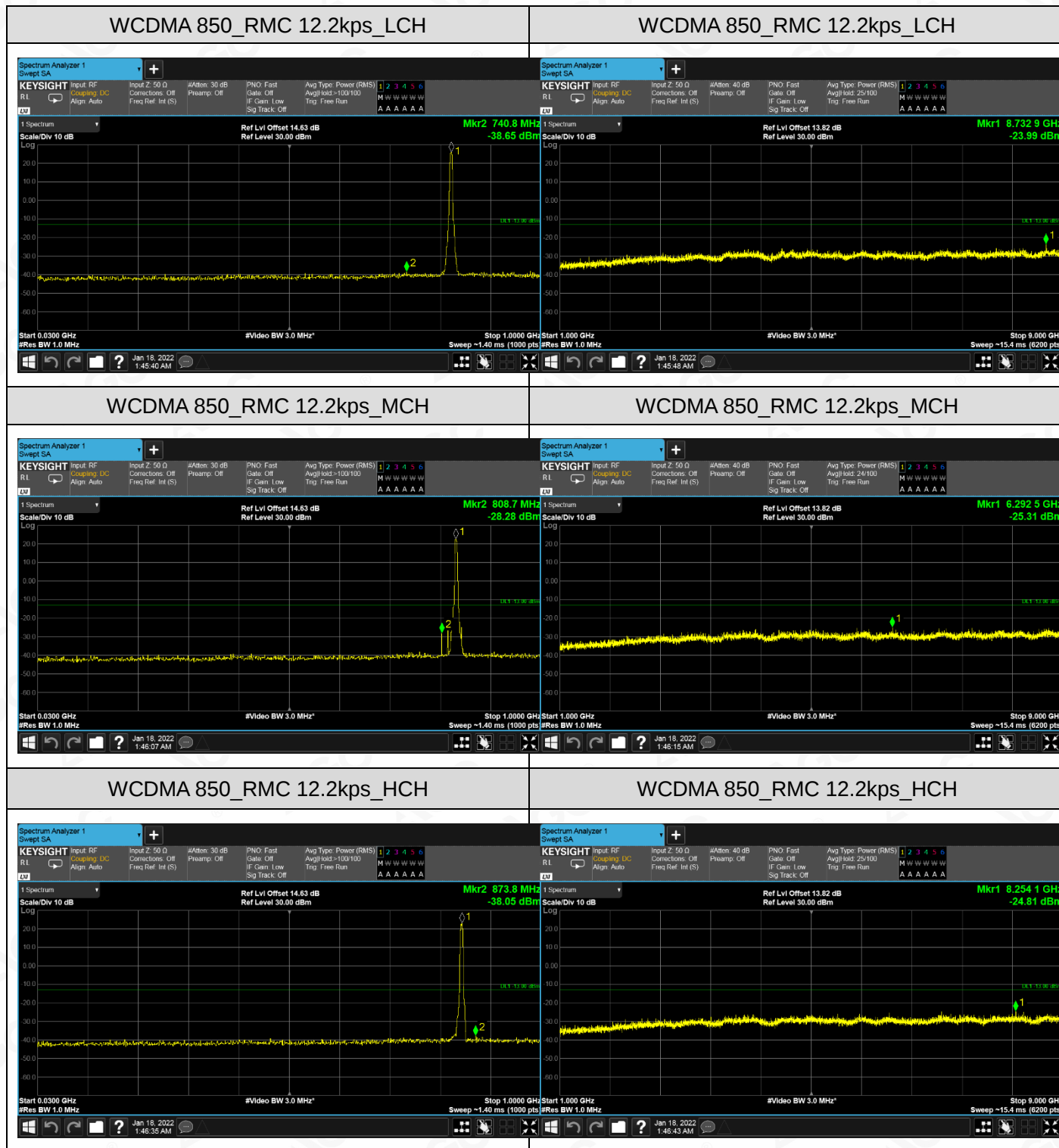
1. RBW = 1 MHz
2. VBW  $\geq$  3 MHz
3. Detector = RMS
4. Trace Mode = trace average
5. Sweep time = auto
6. Number of points in sweep  $\geq 2 \times \text{Span} / \text{RBW}$

### 12.3 MEASUREMENT SETUP



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## 12.4 MEASUREMENT RESULT



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