

# TEST REPORT

FCC CA\_5B Test for TFGMEIBBCD4  
Class II Permissive Change

**APPLICANT**  
LG Electronics Inc.

**REPORT NO.**  
HCT-RF-2501-FC075

**DATE OF ISSUE**  
January 24, 2025

**Tested by**  
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**Technical Manager**  
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# TEST REPORT

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**Additional Model**

TFGMEIBBCD5, TFGMEIBBCD6, TFGMEIBBCD7, TFGMEIBBCD8,  
TFGMEIBBCD9, TFGMEIBBCDA, TFGMEIBBCDB, TFGMEIBBCDC

**Applicant****LG Electronics Inc.**

10, MagokJungang-ro, Gangseo-gu, Seoul 07796, Republic of Korea

**Product Name**

GM Onstar Gen12 ROW

**Model Name**

TFGMEIBBCD4

**FCC ID**

BEJTFGMEIBBCD4

**Date of Test**

January 6, 2025 ~ January 24, 2025

**Location of Test**

☒ Permanent Testing Lab ☐ On Site Testing

(Address: 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Republic of Korea)

**FCC Classification:**

PCS Licensed Transmitter (PCB)

**FCC Rule Part(s):**

§ 22

**Test Results**

PASS

## REVISION HISTORY

The revision history for this test report is shown in table.

| Revision No. | Date of Issue    | Description     |
|--------------|------------------|-----------------|
| 0            | January 24, 2025 | Initial Release |

## Notice

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### Content

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The measurements shown in this report were made in accordance with the procedures specified in CFR47 section § 2.947. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

HCT CO., LTD. Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998, 21 U.S.C. 853(a)

The results shown in this test report only apply to the sample(s), as received, provided by the applicant, unless otherwise stated.

The test results have only been applied with the test methods required by the standard(s).

The laboratory is not accredited for the test results marked \*.

Information provided by the applicant is marked \*\*.

Test results provided by external providers are marked \*\*\*.

When confirmation of authenticity of this test report is required, please contact [www.hct.co.kr](http://www.hct.co.kr)

The test results in this test report are not associated with the ((KS Q) ISO/IEC 17025) accreditation by KOLAS (Korea Laboratory Accreditation Scheme) / A2LA (American Association for Laboratory Accreditation) that are under the ILAC (International Laboratory Accreditation Cooperation) Mutual Recognition Agreement (MRA).

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**CONTENTS**

|                                                            |    |
|------------------------------------------------------------|----|
| 1. GENERAL INFORMATION                                     | 5  |
| 2. INTRODUCTION                                            | 7  |
| 2.1. DESCRIPTION OF EUT                                    | 7  |
| 2.2. MEASURING INSTRUMENT CALIBRATION                      | 7  |
| 2.3. TEST FACILITY                                         | 7  |
| 3. DESCRIPTION OF TESTS                                    | 8  |
| 3.1 TEST PROCEDURE                                         | 8  |
| 3.2 CONDUCTED OUTPUT POWER                                 | 9  |
| 3.3 RADIATED TEST                                          | 10 |
| 3.3.1 RADIATED POWER                                       | 11 |
| 3.3.2 RADIATED SPURIOUS EMISSIONS                          | 12 |
| 3.4 OCCUPIED BANDWIDTH.                                    | 14 |
| 3.5 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL    | 15 |
| 3.6 BAND EDGE                                              | 16 |
| 3.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE | 18 |
| 4. LIST OF TEST EQUIPMENT                                  | 19 |
| 5. MEASUREMENT UNCERTAINTY                                 | 20 |
| 6. SUMMARY OF TEST RESULTS                                 | 21 |
| 7. SAMPLE CALCULATION                                      | 23 |
| 8. TEST DATA                                               | 25 |
| 8.1 EFFECTIVE RADIATED POWER                               | 26 |
| 8.1.1 External Antenna (Y2XX)                              | 26 |
| 8.2 Radiated Spurious Emissions                            | 27 |
| 8.2.1 External Antenna (Y2XX)                              | 27 |
| 9. ANNEX A_ TEST SETUP PHOTO                               | 28 |

## MEASUREMENT REPORT

### 1. GENERAL INFORMATION

|                                     |                                                                                                                                                                                                                                                                          |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Applicant Name:</b>              | LG Electronics Inc.                                                                                                                                                                                                                                                      |
| <b>Address:</b>                     | 10, Magok Jungang-ro, Gangseo-gu, Seoul 07796, Republic of Korea                                                                                                                                                                                                         |
| <b>FCC ID:</b>                      | BEJTFGMEIBBCD4                                                                                                                                                                                                                                                           |
| <b>Application Type:</b>            | Class II Permissive Change                                                                                                                                                                                                                                               |
| <b>FCC Classification:</b>          | PCS Licensed Transmitter (PCB)                                                                                                                                                                                                                                           |
| <b>FCC Rule Part(s):</b>            | § 22                                                                                                                                                                                                                                                                     |
| <b>EUT Type:</b>                    | GM Onstar Gen12 ROW                                                                                                                                                                                                                                                      |
| <b>Model(s):</b>                    | TFGMEIBBCD4                                                                                                                                                                                                                                                              |
| <b>Additional Model:</b>            | TFGMEIBBCD5, TFGMEIBBCD6, TFGMEIBBCD7, TFGMEIBBCD8, TFGMEIBBCD9, TFGMEIBBCDA, TFGMEIBBCDB, TFGMEIBBCDC                                                                                                                                                                   |
| <b>Tx Frequency:</b>                | 825.6 - 846.5: 3 MHz+5 MHz<br>825.6 - 847.4: 5 MHz+3 MHz<br>826.8 - 844.0: 5 MHz+10 MHz<br>829.0 - 846.2: 10 MHz+5 MHz<br>829.0 - 844.0: 10 MHz+10 MHz                                                                                                                   |
| <b>Date(s) of Tests:</b>            | January 6, 2025 ~ January 24, 2025                                                                                                                                                                                                                                       |
| <b>Serial number:</b>               | Radiated: EBR36018942K_#306                                                                                                                                                                                                                                              |
| <b>External Antenna Information</b> | - External Antenna (DUT4): 85608774<br>- External Antenna (Ant4): 86575530<br>- External Antenna (Ant5): 86531607<br>- External Antenna (Y2XX-Primary): 86784729<br>- External Antenna (Y2XX-Secondary): 85647584<br>- External Antenna (BT1UG/BT1FG): 85846855/85846854 |

**Note:**

1. The tests were performed to an External Antenna(Y2XX, BT1UG/BT1FG) for C2PC, referring to the antenna gain difference of the previously approved external antenna. Original certification report number is HCT-RF-2310-FC004.

**[Antenna Gain Table]**

| Operating Frequency | Original Certification |                    |                    | C2PC               |                    | Maximum Gain [dBi] | Worst Antenna |
|---------------------|------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|---------------|
|                     | DUT4                   | ANT4               | ANT5               | Y2XX               | BT1UG/BT1FG        |                    |               |
|                     | Antenna Gain [dBi]     | Antenna Gain [dBi] | Antenna Gain [dBi] | Antenna Gain [dBi] | Antenna Gain [dBi] |                    |               |
| 824 - 849           | 4.00                   | 5.01               | 5.77               | 4.81               | 1.30               | 5.77               | Original      |
| 1710 - 1755         | 2.60                   | 3.40               | 2.29               | 4.55               | 1.50               | 4.55               | Y2XX          |
| 1850 - 1910         | 3.50                   | 5.63               | 5.84               | 4.89               | 1.10               | 5.84               | Original      |
| 2500 - 2570         | 6.10                   | 5.00               | 6.69               | 6.73               | 1.20               | 6.73               | Y2XX          |
| 3300 - 4200         | 6.20                   | 6.48               | 6.40               | 2.48               | 1.20               | 6.48               | Original      |
| 699 - 716           | 1.30                   | 2.96               | 4.01               | 5.21               | -0.70              | 5.21               | Y2XX          |
| 777 - 787           | 1.9~3.5                | 0.59~3.89          | 2.21~4.12          | 6.16               | -2.70              | 6.16               | Y2XX          |
| 2496 - 2690         | 6.10                   | 5.00               | 6.69               | 6.73               | 1.40               | 6.73               | Y2XX          |
| 663 - 698           | 1.70                   | 1.27               | 1.64               | 4.67               | 0.50               | 4.67               | Y2XX          |

## 2. INTRODUCTION

### 2.1. DESCRIPTION OF EUT

Please refer to the [2G3G] Test Report.

### 2.2. MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

### 2.3. TEST FACILITY

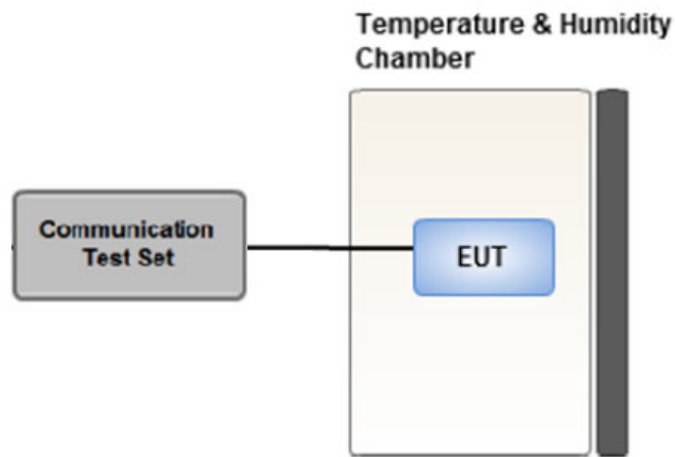
The Fully-anechoic chamber and conducted measurement facility used to collect the radiated data are located at the **74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Republic of Korea**

### 3. DESCRIPTION OF TESTS

#### 3.1 TEST PROCEDURE

| Test Description                                    | Test Procedure Used                                                                     |
|-----------------------------------------------------|-----------------------------------------------------------------------------------------|
| Occupied Bandwidth                                  | - KDB 971168 D01 v03r01 – Section 4.3<br>- ANSI C63.26-2015 – Section 5.4.4             |
| Band Edge                                           | - KDB 971168 D01 v03r01 – Section 6.0<br>- ANSI C63.26-2015 – Section 5.7               |
| Spurious and Harmonic Emissions at Antenna Terminal | - KDB 971168 D01 v03r01 – Section 6.0<br>- ANSI C63.26-2015 – Section 5.7               |
| Conducted Output Power                              | - KDB 971168 D01 v03r01 - Section 5.2.4<br>- ANSI C63.26-2015 - Section 5.2.1 & 5.2.4.2 |
| Peak- to- Average Ratio                             | - KDB 971168 D01 v03r01 – Section 5.7<br>- ANSI C63.26-2015 – Section 5.2.3.4           |
| Frequency stability                                 | - ANSI C63.26-2015 – Section 5.6                                                        |
| Radiated Power                                      | - ANSI C63.26-2015 – Section 5.2.4.4<br>- KDB 971168 D01 v03r01 – Section 5.8           |
| Radiated Spurious and Harmonic Emissions            | - KDB 971168 D01 v03r01 – Section 6.2<br>- ANSI/TIA-603-E-2016 – Section 2.2.12         |

### 3.2 CONDUCTED OUTPUT POWER



Test setup

#### Test Overview

When an average power meter is used to perform RF output power measurements, the fundamental condition that measurements be performed only over durations of active transmissions at maximum output power level applies.

Conducted Output Power was tested in accordance with KDB971168 D01 Power Meas License Digital Systems v03r01, Section 5.2.

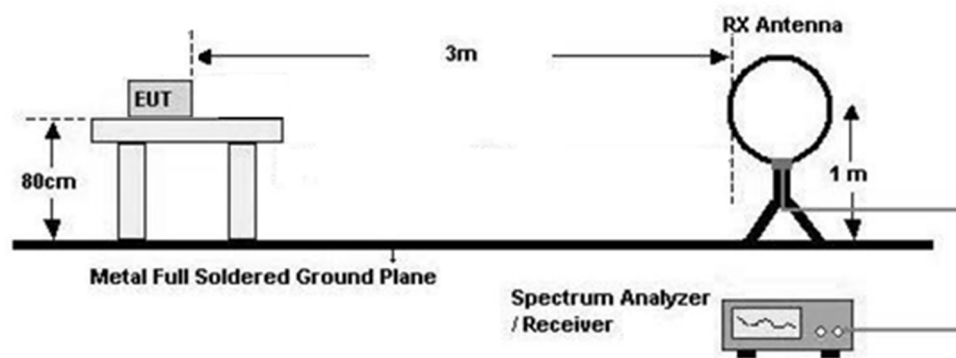
## 3.3 RADIATED TEST

### Test Overview

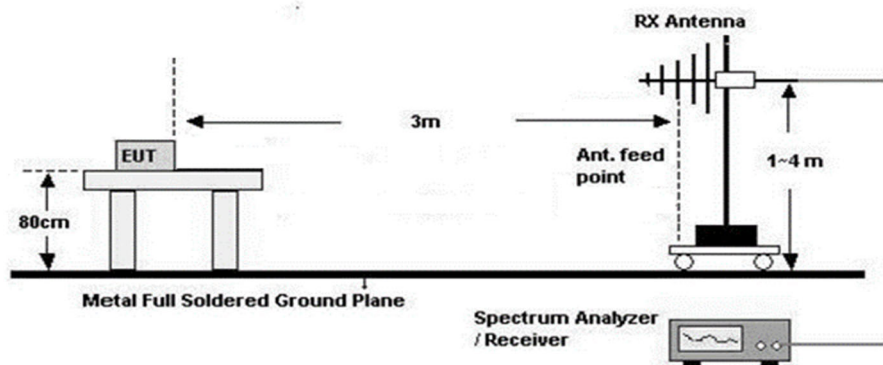
Radiated tests are performed in the semi-anechoic chamber. The equipment under test is placed on a non-conductive table on semi-anechoic chamber.

### Test Configuration

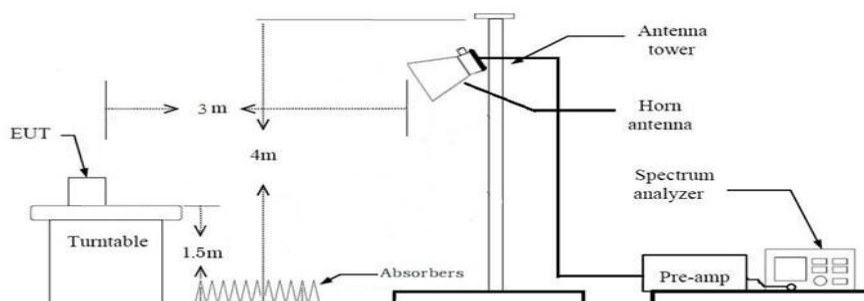
Below 30 MHz



30 MHz - 1 GHz



Above 1 GHz



### 3.3.1 RADIATED POWER

#### Test Settings

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 1 MHz
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

#### Test Note

1. The EUT is placed on a turntable, which is 0.8 m above ground plane. (Below 1 GHz)
2. The EUT is placed on a turntable, which is 1.5 m above ground plane. (Above 1 GHz)
3. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
4. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
5. EUT is set 3 m away from the receiving antenna, which is varied from 1 m to 4 m to find out the highest emissions.
6. 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.
7.  $\text{Total(dB}\mu\text{V/m)} = \text{Measured Value(dB}\mu\text{V)} + \text{Cable Loss(dB)} + \text{Antenna Factor(dB/m)} + \text{Distance Factor(D.F)}$
8.  $\text{EIRP (dBm)}$   
 $= \text{Total (dB}\mu\text{V/m)} + 20 \log D - 104.8$  (where D is the measurement distance in meters.  $D=3$ )  
 $= \text{Total (dB}\mu\text{V/m)} - 95.2(\text{dB})$
9.  $\text{ERP(dBm)} = \text{EIRP(dBm)} - 2.15(\text{dB})$

### 3.3.2 RADIATED SPURIOUS EMISSIONS

#### Test Settings

1. RBW = 100 kHz for emissions below 1 GHz and 1 MHz for emissions above 1 GHz
2. VBW  $\geq 3 \times$  RBW
3. Span = 1.5 times the OBW
4. No. of sweep points  $> 2 \times$  span / RBW
5. Detector = Peak
6. Trace mode = Max Hold
7. The trace was allowed to stabilize
8. Test channel : Low/ Middle/ High
9. Frequency range : We are performed all frequency to 10<sup>th</sup> harmonics from 9 kHz.

#### Test Note

1. The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.  
The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the test data
2. Measurements value show only up to 3 maximum emissions noted, or would be lesser  
if no specific emissions from the EUT are recorded (ie: margin  $> 20$  dB from the applicable limit)  
and considered that's already beyond the background noise floor.

#### Below 30 MHz

1. The loop antenna was placed at a location 3 m from the EUT
2. The EUT is placed on a turntable, which is 0.8 m above ground plane.
3. We have done x, y, z planes in EUT and horizontal and vertical polarization and Parallel to the ground plane in detecting antenna.
4. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
5. Distance Correction Factor(0.009 MHz – 0.490 MHz) =  $40\log(3 \text{ m}/300 \text{ m}) = - 80 \text{ dB}$   
Measurement Distance : 3 m
6. Distance Correction Factor(0.490 MHz – 30 MHz) =  $40\log(3 \text{ m}/30 \text{ m}) = - 40 \text{ dB}$   
Measurement Distance : 3 m
7. Total = Measured Value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)
8. EIRP (dBm)  
= Total (dB $\mu$ V/m) +  $20 \log D - 104.8$  (where D is the measurement distance in meters. D=3)  
= Total (dB $\mu$ V/m) - 95.2(dB)
9. ERP(dBm) = EIRP(dBm) - 2.15(dB)

**KDB 414788 OFS and Chamber Correlation Justification**

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

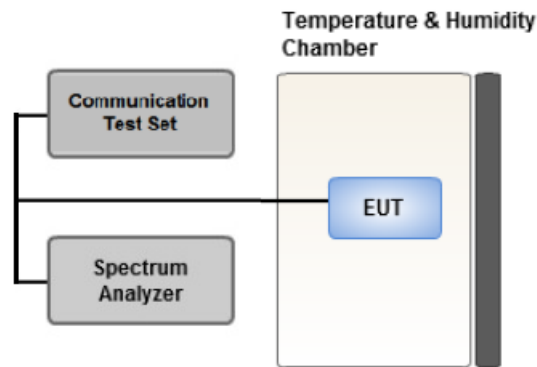
**Below 1 GHz**

1. The EUT is placed on a turntable, which is 0.8 m above ground plane.
2. The Hybrid antenna was placed at a location 3 m from the EUT, which is varied from 1 m to 4 m to find out the highest emissions.
3. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
4. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
5. Total = Measured Value + Antenna Factor(A.F) + Cable Loss(C.L)
7. Total(dBμV/m) = Measured Value(dBμV) + Cable Loss(dB) + Antenna Factor(dB/m) + Distance Factor(D.F)
8. EIRP (dBm)  
= Total (dBμV/m) + 20 log D – 104.8 (where D is the measurement distance in meters. D=3)  
= Total (dBμV/m) - 95.2(dB)
9. ERP(dBm) = EIRP(dBm) - 2.15(dB)

**Above 1 GHz**

1. The EUT is placed on a turntable, which is 1.5 m above ground plane.
2. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
3. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
4. EUT is set 3 m away from the receiving antenna, which is varied from 1 m to 4 m to find out the highest emissions.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. Total(dBμV/m) = Measured Value(dBμV) + Cable Loss(dB) + Antenna Factor(dB/m) + Distance Factor(D.F)  
+ H.P.F(dB) - Amp Gain(dB)
8. EIRP (dBm)  
= Total (dBμV/m) + 20 log D – 104.8 (where D is the measurement distance in meters. D=3)  
= Total (dBμV/m) - 95.2(dB)

### 3.4 OCCUPIED BANDWIDTH.



Test setup

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.

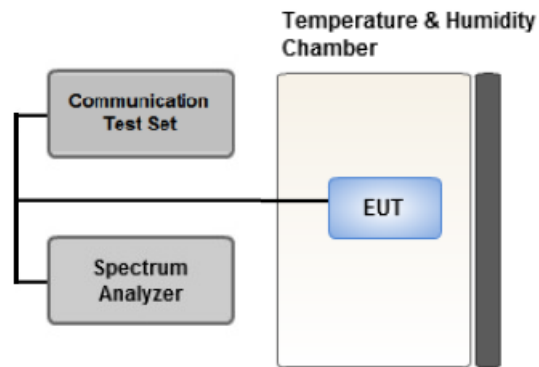
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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

#### Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99 % occupied bandwidth and the 26 dB 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

### 3.5 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL



Test setup

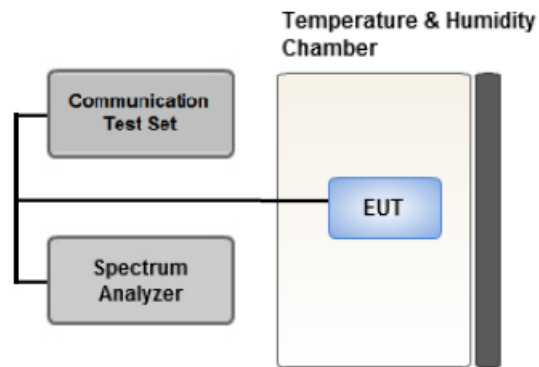
#### Test Overview

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.

#### Test Settings

1. RBW = 1 MHz
2. VBW  $\geq$  3 MHz
3. Detector = RMS
4. Trace Mode = Average
5. Sweep time = auto
6. Number of points in sweep  $\geq$  2 x Span / RBW

### 3.6 BAND EDGE



#### Test setup

##### Test 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 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.

##### Test Settings

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. Within 1 MHz of the channel edge the RBW should be 2 % of EBW, then 1 MHz after that.
4.  $VBW > 3 \times RBW$
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 Notes

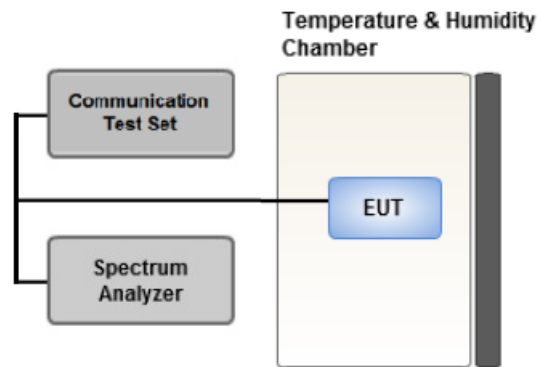
According to FCC 22.917, 24.238, 27.53 specified that power of any emission outside of The authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB. In the 1 MHz bands immediately outside and adjacent to the frequency block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

Where Margin < 1 dB the emission level is either corrected by  $10 \log(1 \text{ MHz/ RB})$  or the emission is integrated over a 1 MHz bandwidth to determine the final result. When using the integration method the integration window is either centered on the emission or, for emissions at the band edge, centered by an offset of 500 kHz from the block edge so that the integration window is the 1 MHz adjacent to the block edge.

### 3.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE



Test setup

#### Test Overview

Frequency stability testing is performed in accordance with the guidelines of ANSI C63.26-2015.

The frequency stability of the transmitter is measured by:

1. Temperature:

The temperature is varied from -30 °C to +50 °C in 10 °C increments using an environmental chamber.

2. Primary Supply Voltage:

.- Unless otherwise specified, vary primary supply voltage from 85 % to 115 % of the nominal value for other than hand carried battery equipment.

.- For hand carried, battery powered equipment, reduce the primary ac or dc supply voltage to the battery operating end point, which shall be specified by the manufacturer.

#### Test Settings

1. The carrier frequency of the transmitter is measured at room temperature (20 °C to provide a reference).
2. The equipment is turned on in a “standby” condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10 °C intervals ranging from -30 °C to +50 °C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

#### 4. LIST OF TEST EQUIPMENT

| Equipment                                               | Model                          | Manufacturer              | Serial No.                 | Due to Calibration | Calibration Interval |
|---------------------------------------------------------|--------------------------------|---------------------------|----------------------------|--------------------|----------------------|
| Antenna Position Tower                                  | MA4640                         | Innco systems             | S4AM                       | 08/07/2025         | Annual               |
| Turn Table                                              | DS2000-S                       | Innco systems             | N/A                        | N/A                | N/A                  |
| Turn Table                                              | Turn Table                     | Ets                       | N/A                        | N/A                | N/A                  |
| Controller<br>(Antenna mast & Turn Table)               | CO3000                         | Innco systems             | CO3000/1251/489<br>20320/P | N/A                | N/A                  |
| Amp & Filter Bank Switch<br>Controller                  | FBSM-01B                       | TNM system                | TM20090002                 | N/A                | N/A                  |
| RF Switch System                                        | FBSR-04C(3G HPF+LNA)           | TNM System                | S4L1                       | 04/11/2025         | Annual               |
| RF Switch System                                        | FBSR-04C(7G HPF+LNA)           | TNM System                | S4L5                       | 04/11/2025         | Annual               |
| RF Switch System                                        | FBSR-04C(LNA)                  | TNM System                | S4L4                       | 04/11/2025         | Annual               |
| RF Switch System                                        | FBSR-04C(Thru)                 | TNM System                | S4L6                       | 04/11/2025         | Annual               |
| HIGHPASS FILTER                                         | WHKX10-900-1000-15000-<br>40SS | WAINWRIGHT<br>INSTRUMENTS | 16                         | 07/24/2025         | Annual               |
| LOW NOISE AMPLIFIER                                     | 310N                           | SONOMA<br>Instrument      | 186169                     | 02/14/2025         | Annual               |
| LOW NOISE AMPLIFIER                                     | TK-PA1840H                     | TESTEK                    | 170011-L                   | 10/11/2025         | Annual               |
| Loop Antenna(9 kHz ~ 30 MHz)                            | FMZB1513                       | Schwarzbeck               | 1513-333                   | 03/07/2026         | Biennial             |
| Horn Antenna(1 ~ 18 GHz)                                | BBHA 9120                      | Schwarzbeck               | 937                        | 02/13/2025         | Biennial             |
| Horn Antenna(15 ~ 40 GHz)                               | BBHA 9170                      | Schwarzbeck               | BBHA9170342                | 09/20/2026         | Biennial             |
| Trilog Broadband Antenna                                | VULB 9168                      | Schwarzbeck               | 9168-0895                  | 08/28/2026         | Biennial             |
| DC Power Supply                                         | E3632A                         | Agilent                   | MY40010147                 | 08/06/2025         | Annual               |
| Spectrum Analyzer(10 Hz ~ 40<br>GHz)                    | FSV40                          | REOHDE &<br>SCHWARZ       | 101436                     | 02/13/2025         | Annual               |
| Base Station                                            | 8960 (E5515C)                  | Agilent                   | MY48360800                 | 08/05/2025         | Annual               |
| Wideband Radio<br>Communication Tester                  | MT8821C                        | Anritsu Corp.             | 6262287701                 | 05/16/2025         | Annual               |
| Wideband Radio<br>Communication Tester                  | MT8000A                        | Anritsu Corp.             | 6272613402                 | 08/28/2025         | Annual               |
| Signal Analyzer(3 Hz ~ 50 GHz)                          | N9030A                         | Agilent                   | US51350313                 | 02/23/2025         | Annual               |
| FCC LTE Mobile Conducted RF<br>Automation Test Software | -                              | HCT CO., LTD.,            | -                          | -                  | -                    |

**Note:**

- Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.
- Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).

## 5. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4:2014.

All measurement uncertainty values are shown with a coverage factor of  $k=2$  to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the  $U_{\text{CISPR}}$  measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

| Parameter           | Expanded Uncertainty ( $\pm$ kHz)        |
|---------------------|------------------------------------------|
| Occupied Bandwidth  | 95 (Confidence level about 95 %, $k=2$ ) |
| Frequency stability | 28 (Confidence level about 95 %, $k=2$ ) |

| Parameter                              | Expanded Uncertainty ( $\pm$ dB)           |
|----------------------------------------|--------------------------------------------|
| Block Edge                             | 0.70 (Confidence level about 95 %, $k=2$ ) |
| Conducted Spurious Emissions           | 1.18 (Confidence level about 95 %, $k=2$ ) |
| Peak- to- Average Ratio                | 0.68 (Confidence level about 95 %, $k=2$ ) |
| Radiated Power                         | 4.74 (Confidence level about 95 %, $k=2$ ) |
| Radiated Disturbance (9 kHz ~ 30 MHz)  | 4.36 (Confidence level about 95 %, $k=2$ ) |
| Radiated Disturbance (30 MHz ~ 1 GHz)  | 5.70 (Confidence level about 95 %, $k=2$ ) |
| Radiated Disturbance (1 GHz ~ 18 GHz)  | 5.52 (Confidence level about 95 %, $k=2$ ) |
| Radiated Disturbance (18 GHz ~ 40 GHz) | 5.66 (Confidence level about 95 %, $k=2$ ) |
| Radiated Disturbance (Above 40 GHz)    | 5.58 (Confidence level about 95 %, $k=2$ ) |

## 6. SUMMARY OF TEST RESULTS

### 6.1 Test Condition : Conducted Test

| Test Description                                                 | FCC Part Section(s)      | Test Limit                                                                           | Test Result              |
|------------------------------------------------------------------|--------------------------|--------------------------------------------------------------------------------------|--------------------------|
| Occupied Bandwidth                                               | § 2.1049                 | N/A                                                                                  | NT <sup>(Note2, 3)</sup> |
| Band Edge / Spurious and Harmonic Emissions at Antenna Terminal. | § 2.1051,<br>§ 22.917(a) | < 43 + 10log <sub>10</sub> (P[Watts]) at Band Edge and for all out-of-band emissions | NT <sup>(Note2, 3)</sup> |
| Conducted Output Power                                           | § 2.1046                 | N/A                                                                                  | NT <sup>(Note2, 3)</sup> |
| Peak- to- Average Ratio                                          | § 22.913(d)              | < 13 dB                                                                              | NT <sup>(Note2, 3)</sup> |
| Frequency stability / variation of ambient temperature           | § 2.1055,<br>§ 22.355    | < 2.5 ppm                                                                            | NT <sup>(Note2, 3)</sup> |

#### **Note:**

1. C = Comply, NT = Not Tested, NA = Not Applicable, NC = Not Comply
2. C2PC models are electrically identical to the Original models.

The Product Equality Declaration includes detailed information about the changes between the devices.

3. Only the radiated tests were performed to verify the change in output power due to the difference in the external antenna gain.

## 6.2 Test Condition : Radiated Test

| Test Description                         | FCC Part Section(s)      | Test Limit                                                 | Test Result   |
|------------------------------------------|--------------------------|------------------------------------------------------------|---------------|
| Equivalent Radiated Power                | § 22.913(a)(5)           | < 7 Watts max. ERP                                         | C (Note 3, 4) |
| Radiated Spurious and Harmonic Emissions | § 2.1053,<br>§ 22.917(a) | < 43 + 10log10 (P[Watts]) for<br>all out-of band emissions | C (Note 3, 4) |

### Note:

1. C = Comply, NT = Not Tested, NA = Not Applicable, NC = Not Comply
2. C2PC models are electrically identical to the Original models.  
The Product Equality Declaration includes detailed information about the changes between the devices.
3. Spot checks were performed because the external antenna gain was lower than the previously approved external antenna(Ant 5).
4. The data from that application has been verified through appropriate spot checks to demonstrate compliance for this device as shown in the test result of section 8.

## 7. SAMPLE CALCULATION

### 7.1 ERP Sample Calculation

| Ch./ Freq. |            | Measured<br>Level (dBm) | Substitute<br>Level (dBm) | Ant. Gain<br>(dBd) | C.L  | Pol. | ERP   |       |
|------------|------------|-------------------------|---------------------------|--------------------|------|------|-------|-------|
| channel    | Freq.(MHz) |                         |                           |                    |      |      | W     | dBm   |
| 128        | 824.20     | -21.37                  | 38.40                     | -10.61             | 0.95 | H    | 0.483 | 26.84 |

$$\text{ERP} = \text{Substitute LEVEL(dBm)} + \text{Ant. Gain} - \text{CL(Cable Loss)}$$

- 1) The EUT mounted on a non-conductive turntable is 2.5 meter above test site ground level.
- 2) During the test, the turn table is rotated until the maximum signal is found.
- 3) Record the field strength meter's level.
- 4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
- 5) Increase the signal generator output till the field strength meter's level is equal to the item (3).
- 6) The signal generator output level with Ant. Gain and cable loss are the rating of effective radiated power.

### 7.2 EIRP Sample Calculation

| Ch./ Freq. |            | Measured<br>Level (dBm) | Substitute<br>Level (dBm) | Ant. Gain<br>(dBi) | C.L  | Pol. | EIRP  |       |
|------------|------------|-------------------------|---------------------------|--------------------|------|------|-------|-------|
| channel    | Freq.(MHz) |                         |                           |                    |      |      | W     | dBm   |
| 20175      | 1,732.50   | -15.75                  | 18.45                     | 9.90               | 1.76 | H    | 0.456 | 26.59 |

$$\text{EIRP} = \text{Substitute LEVEL(dBm)} + \text{Ant. Gain} - \text{CL(Cable Loss)}$$

- 1) The EUT mounted on a non-conductive turntable is 2.5 meter above test site ground level.
- 2) During the test, the turn table is rotated until the maximum signal is found.
- 3) Record the field strength meter's level.
- 4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
- 5) Increase the signal generator output till the field strength meter's level is equal to the item (3).
- 6) The signal generator output level with Ant. Gain and cable loss are the rating of equivalent isotropic radiated power.

### 7.3. 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

## 8. TEST DATA

### Test Overview

The EUT is set up to transmit two contiguous LTE channels. The power level of both carriers 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.

### Test Note

1. All tests were evaluated for the two contiguous channels using various combinations of RB size, RB offset, modulation, and channel bandwidth.
2. Channel bandwidth is shown in the tables below based only on the channel bandwidths that were supported in this device.

| Channel Bandwidth<br>(PCC) | Channel Bandwidth<br>(SCC) | Maximum aggregated bandwidth<br>(MHz) |
|----------------------------|----------------------------|---------------------------------------|
| 3                          | 5                          | 8                                     |
| 5                          | 3                          | 8                                     |
| 5                          | 10                         | 15                                    |
| 10                         | 5                          | 15                                    |
| 10                         | 10                         | 20                                    |

3. All modes of operation were investigated and the worst case configuration results are reported in this section.

- Worst case(Radiated Spurious Emissions) : We have selected higher of the ERP.

4. ERP, Radiated Spurious Emissions

Mode : External Antenna (Y2XX, BT1UG/BT1FG)

Worst Case: External Antenna (Y2XX)

5. All 3 channels(low/mid/high) radiated power were investigated and the worst case channel results are reported.

## 8.1 EFFECTIVE RADIATED POWER

### 8.1.1 External Antenna (Y2XX)

| Mod<br>(Bandwidth)     | PCC   |               | SCC   |               | Modulation | Original (Ant 5)<br>(dBm) | C2PC (Y2XX)<br>(dBm) | Deviation |
|------------------------|-------|---------------|-------|---------------|------------|---------------------------|----------------------|-----------|
|                        | Ch.   | Freq<br>(MHz) | Ch.   | Freq<br>(MHz) |            |                           |                      |           |
| 5B<br>(5 MHz + 10 MHz) | 20528 | 836.8         | 20600 | 844.0         | QPSK       | 26.14                     | 25.78                | 0.36      |

| Mod | PCC   |               | SCC   |               | Modulation | Measured<br>Level<br>(dBm) | A.F.+D.F.+C.L.<br>(dB) | Total<br>(dBμV/m) | Pol. | ERP   |       |
|-----|-------|---------------|-------|---------------|------------|----------------------------|------------------------|-------------------|------|-------|-------|
|     | Ch.   | Freq<br>(MHz) | Ch.   | Freq<br>(MHz) |            |                            |                        |                   |      | W     | dBm   |
| 5B  | 20528 | 836.8         | 20600 | 844.0         | QPSK       | 93.48                      | 29.65                  | 123.13            | V    | 0.378 | 25.78 |

## 8.2 Radiated Spurious Emissions

### 8.2.1 External Antenna (Y2XX)

|                       |                          |
|-----------------------|--------------------------|
| ▣ PCC Channel :       | <u>20428 (826.8 MHz)</u> |
| ▣ PCC BW(MHz) :       | <u>5</u>                 |
| ▣ PCC RB/ RB Offset : | <u>1/ 24</u>             |
| ▣ SCC Channel :       | <u>20500 (834.0 MHz)</u> |
| ▣ SCC BW(MHz) :       | <u>10</u>                |
| ▣ SCC RB/ RB Offset : | <u>1/ 0</u>              |
| ▣ DISTANCE:           | <u>3 meters</u>          |
| ▣ LIMIT:              | <u>-13.0 dBm</u>         |

| Freq.(MHz) | Measured Level (dB $\mu$ V) | A.F. + C.L.+ H.P.F.<br>- A.G. + D.F. (dB) | Total (dB $\mu$ V/m) | Pol. | Result (dBm) |
|------------|-----------------------------|-------------------------------------------|----------------------|------|--------------|
| 4 152.00   | 51.00                       | -7.20                                     | 43.80                | V    | -51.40       |

#### Note:

1. All modes of operation were investigated and the worst case configuration results are reported.

| Band | Bandwidth (MHz) |     | Freq (MHz) | RSE (dBm) |        | Gap  |
|------|-----------------|-----|------------|-----------|--------|------|
|      | PCC             | SCC |            | Original  | C2PC   |      |
| 5B   | 5               | 10  | 4 152.00   | -49.82    | -51.40 | 1.58 |

## 9. ANNEX A\_ TEST SETUP PHOTO

Please refer to test setup photo file no. as follows;

| No. | Description         |
|-----|---------------------|
| 1   | HCT-RF-2501-FC075-P |