

TEST REPORT

FCC 2G3G Test for TFGMEIBBCD4

Class II Permissive Change

APPLICANT

LG Electronics Inc.

REPORT NO.

HCT-RF-2501-FC058

DATE OF ISSUE

January 24, 2025

Tested by
Kyung Soo Kang



Technical Manager
Jong Seok Lee



HCT CO., LTD.
Bongjai Huh
BongJai Huh / CEO

**HCT CO.,LTD.**

2-6, 73, 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Republic of Korea
Tel. +82 31 645 6300 Fax. +82 31 645 6401

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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, § 24, § 27

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

Content

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

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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MEASUREMENT REPORT

1. GENERAL INFORMATION

Applicant Name:	LG Electronics Inc.
Address:	10, Magok Jungang-ro, Gangseo-gu, Seoul 07796, Republic of Korea
FCC ID:	BEJTFGMEIBBCD4
Application Type:	Class II Permissive Change
FCC Classification:	PCS Licensed Transmitter (PCB)
FCC Rule Part(s):	§ 22, § 24, § 27
EUT Type:	GM Onstar Gen12 ROW
Model(s):	TFGMEIBBCD4
Additional Model:	TFGMEIBBCD5, TFGMEIBBCD6, TFGMEIBBCD7, TFGMEIBBCD8, TFGMEIBBCD9, TFGMEIBBCDA, TFGMEIBBCDB, TFGMEIBBCDC
Tx Frequency:	824.20 - 848.80 MHz (GSM850) 826.40 - 846.60 MHz (WCDMA850) 1 850.20 - 1 909.80 MHz (GSM1900) 1 852.4 - 1 907.6 MHz (WCDMA1900) 1 712.4 - 1 752.6 MHz (WCDMA1700)
Rx Frequency:	869.20 - 893.80 MHz (GSM850) 871.40 - 891.60 MHz (WCDMA850) 1 930.20 - 1 989.80 MHz (GSM1900) 1 932.4 - 1 987.6 MHz (WCDMA1900) 2 112.4 - 2 152.6 MHz (WCDMA1700)
Date(s) of Tests:	January 6, 2025 ~ January 24, 2025
Serial number:	Radiated: EBR36018942K_#306
External Antenna Information	- External Antenna (DUT4): 85608774 - External Antenna (Ant4): 86575530 - External Antenna (Ant5): 86531607 - External Antenna (Y2XX-Primary): 86784729 - External Antenna (Y2XX-Secondary): 85647584 - External Antenna (BT1UG/BT1FG): 85846855/85846854

Note:

- 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-FC001.

[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

The EUT was a GM Onstar Gen12 ROW with GSM/GPRS/EGPRS/UMTS and LTE, Sub6.

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

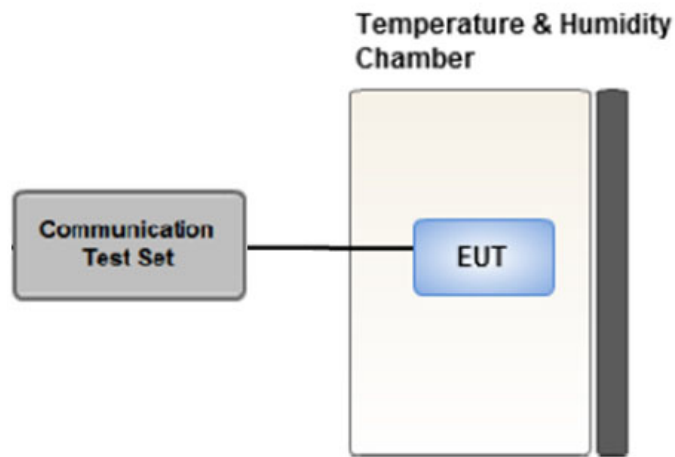
The Fully-anechoic chamber and conducted measurement facility used to collect the radiated data are located at the **74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Republic of Korea**

3. DESCRIPTION OF TESTS

3.1 TEST PROCEDURE

Test Description	Test Procedure Used
Occupied Bandwidth	- KDB 971168 D01 v03r01 – Section 4.3 - ANSI C63.26-2015 – Section 5.4.4
Band Edge	- KDB 971168 D01 v03r01 – Section 6.0 - ANSI C63.26-2015 – Section 5.7
Spurious and Harmonic Emissions at Antenna Terminal	- KDB 971168 D01 v03r01 – Section 6.0 - ANSI C63.26-2015 – Section 5.7
Conducted Output Power	- KDB 971168 D01 v03r01 – Section 5.2
Peak- to- Average Ratio	- KDB 971168 D01 v03r01 – Section 5.7 - ANSI C63.26-2015 – Section 5.2.3.4 - ANSI C63.26-2015 – Section 5.2.6(only GSM)
Frequency stability	- ANSI C63.26-2015 – Section 5.6
Radiated Power	- ANSI C63.26-2015 – Section 5.2.4.4 - KDB 971168 D01 v03r01 – Section 5.8
Radiated Spurious and Harmonic Emissions	- KDB 971168 D01 v03r01 – Section 6.2 - 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.

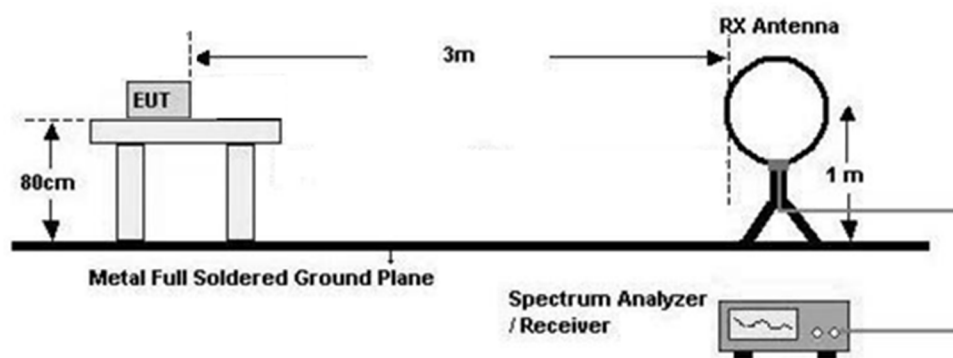
3.3 RADIATED TEST

Test Overview

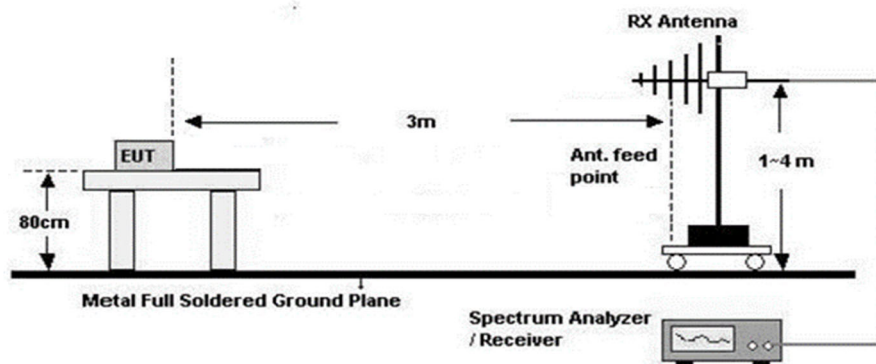
Radiated tests are performed in the semi-anechoic chamber. The equipment under test is placed on a non-conductive table on semi-anechoic chamber.

Test Configuration

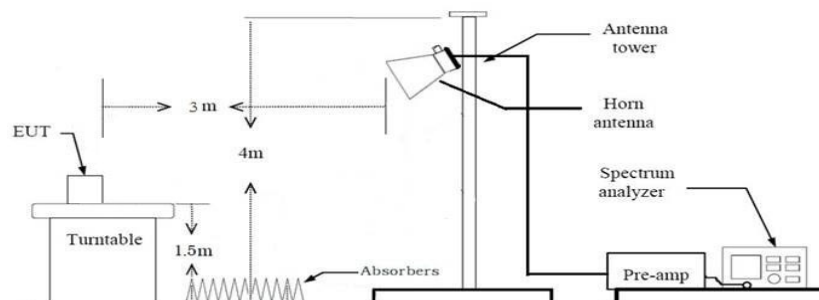
Below 30 MHz



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. 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 10th 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 μ V/m) + $20 \log D - 104.8$ (where D is the measurement distance in meters. D=3)
= Total (dB μ 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.

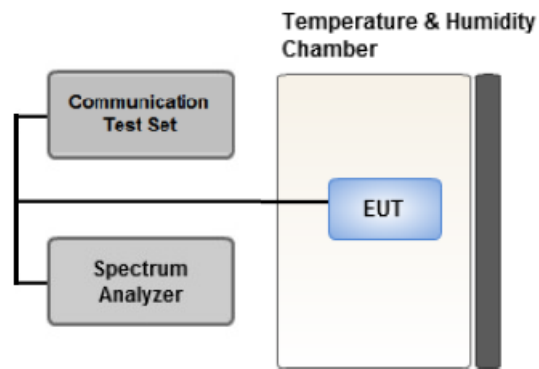
Below 1 GHz

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 PEAK- TO- AVERAGE RATIO



Test setup

① CCDF Procedure for PAPR

Test Settings

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 P_{Pk} .

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

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

Test Settings(Peak Power)

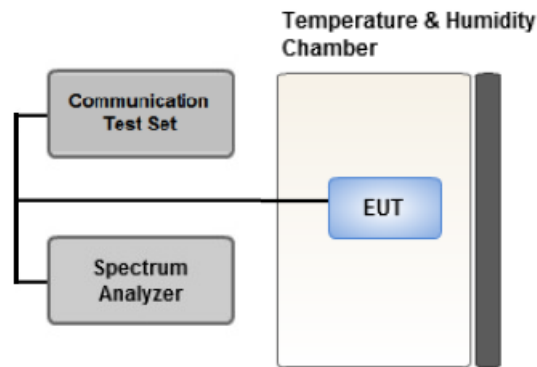
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW $\geq 3 \times$ RBW.

1. Set the RBW $\geq$ OBW.
2. Set VBW $\geq 3 \times$ RBW.
3. Set span $\geq 2 \times$ OBW.
4. Sweep time $\geq 10 \times$ (number of points in sweep) $\times$ (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 $\geq 2 \times$ span / 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 $[10 \log (1/0.25)] = 6$ dB if the duty cycle is a constant 25 %.

3.5 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.

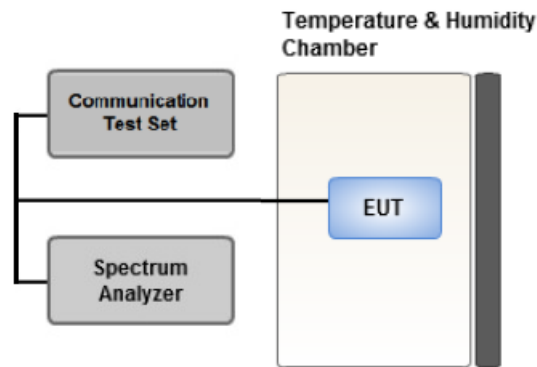
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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

3.6 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL



Test setup

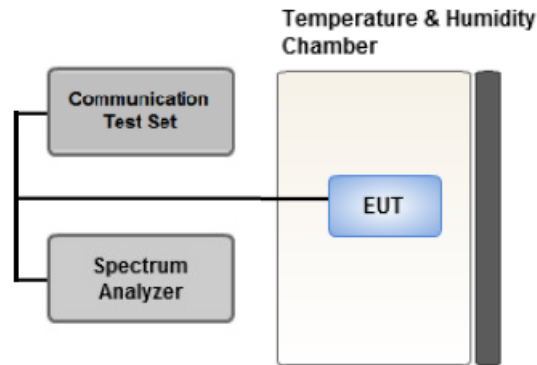
Test Overview

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 = Peak
4. Trace Mode = Max Hold
5. Sweep time = auto
6. Number of points in sweep $\geq 2 \times \text{Span} / \text{RBW}$

3.7 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 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. 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 Notes

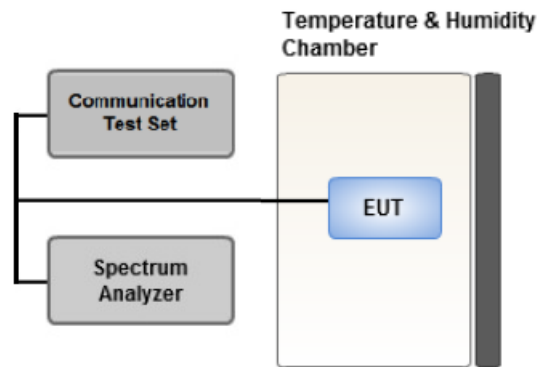
According to FCC 22.917, 24.238, 27.53 specified that power of any emission outside of The authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \times \log(P)$ dB. In the 1 MHz bands immediately outside and adjacent to the frequency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

3.8 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.

3.9 WORST CASE(RADIATED TEST)

- The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
- All modes of operation were investigated and the worst case configuration results are reported.
Mode : External Antenna (Y2XX, BT1UG/BT1FG)
Worst Case: External Antenna (Y2XX)
- TFGMEIBBCD4 & additional models were tested and the worst case results are reported.
(Worst case : TFGMEIBBCD4)
- The worst case is reported with the EUT positioning, modulations, and paging service configurations shown in the test data.
- Please refer to the table below.

[External Antenna Y2XX Worst case_3G]

Test Description	Modulation	Paging Service	Axis	Test Channel
Effective Radiated Power, Equivalent Isotropic Radiated Power	QPSK (WCDMA)	12.2 kbps RMC	WCDMA B2 : X WCDMA B4 : X WCDMA B5 : X	Low, Mid, High
Radiated Spurious and Harmonic Emissions	QPSK (WCDMA)	12.2 kbps RMC	WCDMA B2 : X WCDMA B4 : X WCDMA B5 : X	Low, Mid, High

[External Antenna Y2XX Worst case_2G]

Test Description	Mod	Axis	Test Channel
Effective Radiated Power, Equivalent Isotropic Radiated Power	Voice	GSM850 : X GSM1900 : X	Low, Mid, High
	EDGE(1 TX Slot)	GSM850 : X GSM1900 : X	GSM 850 : High GSM1900 : Mid
Radiated Spurious and Harmonic Emissions	Voice	GSM850 : X GSM1900 : X	Low, Mid, High

[Test Channel]

	UplinkChannel				
	2G (GSM850)	2G (GSM1900)	3G (WCDMA B2)	3G (WCDMA B4)	3G (WCDMA B5)
Low	128	512	9262	1312	4132
Mid	190	661	9400	1412	4183
High	251	810	9538	1513	4233

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 (Antenna mast & Turn Table)	CO3000	Innco systems	CO3000/1251/489 20320/P	N/A	N/A
Amp & Filter Bank Switch 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- 40SS	WAINWRIGHT INSTRUMENTS	16	07/24/2025	Annual
LOW NOISE AMPLIFIER	310N	SONOMA 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 GHz)	FSV40	REOHDE & SCHWARZ	101436	02/13/2025	Annual
Base Station	8960 (E5515C)	Agilent	MY48360800	08/05/2025	Annual
Wideband Radio Communication Tester	MT8821C	Anritsu Corp.	6262287701	05/16/2025	Annual
Wideband Radio 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 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_{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 ^{Note2, 3)}
Band Edge / Spurious and Harmonic Emissions at Antenna Terminal.	§ 2.1051, § 22.917(a), § 24.238(a), § 27.53(h)	< 43 + 10 x log ₁₀ (P[Watts]) at Band Edge and for all out-of-band emissions	NT ^{Note2, 3)}
Conducted Output Power	§ 2.1046	N/A	NT ^{Note2, 3)}
Peak- to- Average Ratio	§ 22.913(d), § 24.232(d), § 27.50(d)(5)	< 13 dB	NT ^{Note2, 3)}
Frequency stability / variation of ambient temperature	§ 2.1055, § 22.355	< 2.5 ppm	NT ^{Note2, 3)}
	§ 24.235, § 27.54	Emission must remain in band	NT ^{Note2, 3)}

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 (WCDMA1700)

Test Description	FCC Part Section(s)	Test Limit	Test Result
Equivalent Isotropic Radiated Power	§ 27.50(d)(4)	< 1 Watts max. EIRP	C (Note 3, 4)
Radiated Spurious and Harmonic Emissions	§ 2.1053, § 27.53(h)	< 43 + 10 x log10 (P[Watts]) for 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. The full tests were performed because the external antenna gain was higher than the previously approved external antenna(Ant 4).
4. The data from that application has been verified through full test to demonstrate compliance for this device as shown in the test result of section 8.

6.3 Test Condition : Radiated Test (GSM850/1900, WCDMA 850/1900)

Test Description	FCC Part Section(s)	Test Limit	Test Result
Effective Radiated Power	§ 22.913(a)(5)	< 7 Watts max. ERP	C (Note 3, 4)
Equivalent Isotropic Radiated Power	§ 24.232(c), § 27.50(d)(4)	< 2 Watts max. EIRP < 1 Watts max. EIRP	C (Note 3, 4)
Radiated Spurious and Harmonic Emissions	§ 2.1053, § 22.917(a), § 24.238(a), § 27.53(h)	< 43 + 10 x log10 (P[Watts]) for 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 Level (dBm)	Substitute Level (dBm)	Ant. Gain (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 Level (dBm)	Substitute Level (dBm)	Ant. Gain (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

8.1 EFFECTIVE RADIATED POWER

8.1.1 External Antenna (Y2XX)

[2G]

Mod (Bandwidth)	Freq (MHz)	Modulation	Original (Ant 5) (dBm)	C2PC (Y2XX) (dBm)	Deviation
GSM850	848.8	VOICE	33.18	33.18	0.00
EGDE	848.8	VOICE	26.95	25.72	1.23

Mode	Ch./ Freq.		Measured (dBμV/m)	A.F.+D.F.+C.L. (dB)	Total (dBμV/m)	Pol.	Limit	ERP	
	channel	Freq.(MHz)					W	W	dBm
GSM850	251	848.8	91.64	29.65	121.29	V	< 7.00	2.082	33.18
EDGE	251	848.8	84.18	29.65	113.83	V		0.374	25.72

[3G]

Mod (Bandwidth)	Freq (MHz)	Modulation	Original (Ant 5) (dBm)	C2PC (Y2XX) (dBm)	Deviation
WCDMA850	846.6	RMC	24.62	25.29	-0.67

Mode	Ch./ Freq.		Measured (dBμV/m)	A.F.+D.F.+C.L. (dB)	Total (dBμV/m)	Pol.	Limit	ERP	
	channel	Freq.(MHz)					W	W	dBm
WCDMA850	4233	846.6	93.00	29.64	122.64	V	< 7.00	0.338	25.29

8.2 EQUIVALENT ISOTROPIC RADIATED POWER

8.2.1 External Antenna (Y2XX)

[2G]

Mod (Bandwidth)	Freq (MHz)	Modulation	Original (Ant 5) (dBm)	C2PC (Y2XX) (dBm)	Deviation
GSM1900	1880.0	VOICE	26.47	29.33	-2.86
EDGE	1880.0	VOICE	26.06	24.98	1.08

Mode	Ch./ Freq.		Measured (dBμV/m)	A.F.+D.F.+C.L. (dB)	Total (dBμV/m)	Pol.	Limit	EIRP	
	channel	Freq.(MHz)					W	W	dBm
GSM1900	661	1880.0	84.72	30.57	115.29	V	< 2.00	0.857	29.33
EDGE	661	1880.0	80.37	30.57	110.94	V		0.315	24.98

[3G]

Mod (Bandwidth)	Freq (MHz)	Modulation	Original (Ant 5) (dBm)	C2PC (Y2XX) (dBm)	Deviation
WCDMA1900	1880.0	RMC	26.67	23.81	2.86

Mode	Ch./ Freq.		Measured (dBμV/m)	A.F.+D.F.+C.L. (dB)	Total (dBμV/m)	Pol.	Limit	EIRP	
	channel	Freq.(MHz)					W	W	dBm
WCDMA1900	9400	1880.0	88.44	30.57	119.01	V	< 2.00	0.240	23.81

Mode	Ch./ Freq.		Measured (dBμV/m)	A.F.+D.F.+C.L. (dB)	Total (dBμV/m)	Pol.	Limit	EIRP	
	channel	Freq. (MHz)					W	W	dBm
WCDMA1700	1312	1712.4	88.95	29.84	118.79	V	< 1.00	0.229	23.59
	1412	1732.4	89.58	29.58	119.16	V		0.249	23.96
	1513	1752.6	87.90	29.58	117.48	V		0.169	22.28

8.3 RADIATED SPURIOUS EMISSIONS

8.3.1 External Antenna (Y2XX)

- ☐ MODULATION SIGNAL: GSM850
☐ DISTANCE: 3 meters

Ch.	Freq. (MHz)	Measured Level (dBμV)	A.F. + C.L. + H.P.F. - A.G. + D.F. (dB)	Total (dBμV/m)	Pol.	Result (dBm)	Limit
251 (848.8)	2 546.40	56.94	-14.69	42.25	V	-52.95	-13.00

Note:

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

Band	channel	Freq (MHz)	RSE (dBm)		Gap
			Original	C2PC	
GSM850	251	2 546.40	-41.07	-52.95	11.88

▣ MODULATION SIGNAL: GSM1900

▣ DISTANCE: 3 meters

Ch.	Freq.(MHz)	Measured Level (dBμV)	A.F. + C.L. + H.P.F. - A.G. + D.F. (dB)	Total (dBμV/m)	Pol.	Result (dBm)	Limit
512 (1850.2)	11 101.20	45.93	6.98	52.91	V	-42.29	-13.00

Note:

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

Band	channel	Freq (MHz)	RSE (dBm)		Gap
			Original	C2PC	
GSM1900	512	11 101.20	-41.91	-42.29	0.38

▣ MODULATION SIGNAL: WCDMA850

▣ DISTANCE: 3 meters

Ch.	Freq.(MHz)	Measured Level (dBμV)	A.F. + C.L.+ H.P.F. - A.G. + D.F. (dB)	Total (dBμV/m)	Pol.	Result (dBm)	Limit
4233 (846.6)	2 539.80	55.00	-14.69	40.31	V	-54.89	-13.00

Note:

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

Band	channel	Freq (MHz)	RSE (dBm)		Gap
			Original	C2PC	
WCDMA850	4233	2 539.80	-45.96	-54.89	8.93

MODULATION SIGNAL: WCDMA1900

DISTANCE: 3 meters

Ch.	Freq.(MHz)	Measured Level (dBμV)	A.F. + C.L.+ H.P.F. - A.G. + D.F. (dB)	Total (dBμV/m)	Pol.	Result (dBm)	Limit
9262 (1852.4)	5 557.20	53.87	-2.54	51.33	V	-43.87	-13.00

Note:

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

Band	channel	Freq (MHz)	RSE (dBm)		Gap
			Original	C2PC	
WCDMA1900	9262	5 557.20	-40.37	-43.87	3.50

MODULATION SIGNAL: WCDMA1700

DISTANCE: 3 meters

Ch.	Freq.(MHz)	Measured Level (dBμV)	A.F. + C.L.+ H.P.F. - A.G. + D.F. (dB)	Total (dBμV/m)	Pol.	Result (dBm)	Limit
1312 (1712.4)	3 424.80	52.81	-8.09	44.72	V	-50.48	-13.00
	5 137.20	49.91	-2.87	47.04	V	-48.16	-13.00
	6 849.60	48.49	0.57	49.06	V	-46.14	-13.00
	8 562.00	46.39	4.26	50.65	V	-44.55	-13.00
	10 274.40	46.45	6.17	52.62	V	-42.58	-13.00
1412 (1732.4)	3 464.80	53.54	-8.10	45.44	V	-49.76	-13.00
	5 197.20	50.06	-2.86	47.20	V	-48.00	-13.00
	6 929.60	47.46	0.82	48.28	V	-46.92	-13.00
	8 662.00	46.27	4.60	50.87	V	-44.33	-13.00
	10 394.40	45.68	6.68	52.36	V	-42.84	-13.00
1513 (1752.6)	3 505.20	51.55	-7.66	43.89	V	-51.31	-13.00
	5 257.80	50.35	-2.74	47.61	V	-47.59	-13.00
	7 010.40	48.03	0.91	48.94	V	-46.26	-13.00
	8 763.00	46.41	4.99	51.40	V	-43.80	-13.00
	10 515.60	45.34	6.95	52.29	V	-42.91	-13.00

Note:

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

9. ANNEX A_ TEST SETUP PHOTO

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

No.	Description
1	HCT-RF-2501-FC058-P