

TEST REPORT

KCTL Inc.

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KCTL
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1. Applicant

Name: LG Electronics Inc.
Address: 2621, Nambusunhwan-ro, Gangnam-gu, Seoul, Korea

2. Sample Description:

FCC ID: BEJTUVM01IU
IC ID: 2703K-TUVM01IU
Type of equipment: VW OCU module
Basic Model: TUVM01IU-G
Variant Model: TUVM01IU-R, TUV P01IU-G, TUV P01IU-R

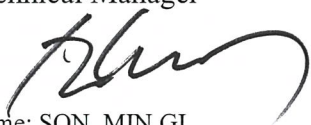
3. Date of Test: March 29 ~ April 01, 2015

4. Test method used: FCC Part 22 Subpart H and Part 24 Subpart E
RSS-132 / 133 Issue 3 Jan 2013, RSS-139 Issue 3 Jul 2015
RSS GEN Issue 4 November 2014

5. Test Results

Test Item: Refer to page 7
Result: Refer to page 8 ~ page 20
Measurement Uncertainty: Refer to page 7

This result shown in this report refer only to the sample(s) tested unless otherwise stated.

Affirmation	Tested by	Technical Manager
	 Name: KIM, EUI JUNG	 Name: SON, MIN GI

2016. 04. 18

KCTL Inc. Testing Laboratory

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1. Client information

Applicant: LG Electronics Inc.
Address: 2621, Nambusunhwan-ro, Gangnam-gu, Seoul, Korea
Telephone number: +82-2-6971-0515
Facsimile number: +82-2-6971-0515
Contact person: Steve Jeon / steve.jeon@lge.com

Manufacturer: LG Electronics Inc.
Address: 2621, Nambusunhwan-ro, Gangnam-gu, Seoul, Korea

3. Description of E.U.T.

3.1 Basic description

Applicant	LG Electronics Inc.
Address of Applicant	2621, Nambusunhwan-ro, Gangnam-gu, Seoul, Korea
Manufacturer	LG Electronics Inc.
Address of Manufacturer	2621, Nambusunhwan-ro, Gangnam-gu, Seoul, Korea
Type of equipment	VW OCU module
Basic Model	TUVM01IU-G
Variant Model*	TUVM01IU-R, TUV P01IU-G, TUV P01IU-R
Serial number	N/A

* Added model name due to External & Internal Antenna.

3.2 General description

Frequency Range	824.2 MHz ~ 893.8 MHz (GSM850) 1 850.2 MHz ~ 1 989.8 MHz (GSM1900) 826.4 MHz ~ 891.6 MHz (WCDMA V) 1 852.4 MHz ~ 1 987.6 MHz (WCDMA II)
Type of Modulation	GMSK (GSM850, GSM1900) QPSK (WCDMA V, WCDMA II)
Type of Antenna	PIFA Antenna_Internal Shark Antenna_External
Antenna Gain	2.1 dB i : GSM850/WCDMA II_Internal 4.609 dB i : GSM1900/WCDMA V_Internal 0 dB i : GSM850 / WCDMA II_External 5.5 dB i : GSM1900 / WCDMA V_External
Transmit Power	NA ₁₎
Power supply	DC 12.0 V
Product SW/HW version	1.0
Radio SW/HW version	1.0
Test SW Version	NA ₁₎
RF power setting in TEST SW	NA ₁₎

* Declared by the applicant.

* NA₁₎: Refer to the MOV-15-RF-I031(1)

3.3 Test frequency Test mode

The transmitter has a maximum average output power as follows:

* GSM

-GSM 850

Frequency (MHz)	Service Option (SO)	Channel
824.20	RC1 2 (Loopback)	128
836.60		190
848.80		251

-GSM 1 900-

Frequency (MHz)	Service Option (SO)	Channel
1 850.20	RC1 2 (Loopback)	512
1 880.00		661
1 909.80		810

* WCDMA

-WCDMA V-

Frequency (MHz)	Service Option (SO)	Channel
826.40	RC1 2 (Loopback)	4 132
836.40		4 183
846.60		4 233

-WCDMA II -

Frequency (MHz)	Service Option (SO)	Channel
1 852.40	RC1 2 (Loopback)	9 262
1 880.00		9 400
1 907.60		9 538

GSM / WCDMA

We found out the test mode with the highest power level after we investigated average output power of all the modulations and (or) data rates for each mode. So we chose below test mode as a representative of worst case.

3.4 Test Voltage

Mode	Voltage
Norminal voltage	DC 12.0 V

4. Summary of test results

4.1 Standards & results

FCC Part 22 Subpart H and Part 24 Subpart E				
FCC Rule Reference	IC Rule Reference	Parameter	Report Section	Test Result
§2.1046, §22.913(a) §24.232(c)	-	RF Radiated Output Power	5.1	C
§2.1053, §22.917(a) §24.238(a)	RSS-132(5.5) RSS-133(6.5) RSS-139(6.5)	Spurious Radiated Emission	5.2	C
§2.1046	RSS-132(5.3) RSS-133(6.4) RSS-139(6.4)	Conducted Output Power	5.3	N/A ₁
§2.1049	RSS-GEN(4.6.1) RSS-133(6.5) RSS-139(6.4)	26 dB Bandwidth	5.4	N/A ₁
§24.232(d)	-	Peak-Average Ratio	5.5	N/A ₁
§2.1051, §22.917(a) §24.238(a)	RSS-132(5.5) RSS-133(6.5) RSS-139(6.5)	Spurious Emission at Antenna Terminal	5.6	N/A ₁
§2.1055, §22.355 §24.235	RSS-132(5.3) RSS-133(6.3) RSS-139(6.3)	Frequency Stability	5.7	N/A ₁
§22.917(a), §24.238(a)	RSS-132(5.5) RSS-133(6.5) RSS-139(6.5)	Band Edge	5.8	N/A ₁
Note: C = complies NC = Not complies NT = Not tested NA = Not Applicable N/A ₁ : Refer to the RF test report # MOV-15-RF-I031(1), FCC ID # BEJTUVM01IU, IC ID # 2703K-TUVM01IU N/A ₂ : The test is not applicable since the EUT is not the device that is designed to be connected to the public utility(AC) power line(This EUT is automotive device)				

4.2 Uncertainty

Measurement Item	Expanded Uncertainty $U = kU_c (k = 2)$	
Conducted RF power	1.44 dB	
Conducted Spurious Emissions	1.53 dB	
Radiated Spurious Emissions	30 MHz ~ 300 MHz:	+ 4.94 dB, - 5.06 dB
		+ 4.93 dB, - 5.05 dB
	300 MHz ~ 1 000 MHz:	+ 4.97 dB, - 5.08 dB
		+ 4.84 dB, - 4.96 dB
	1 GHz ~ 25 GHz:	+ 6.03 dB, - 6.05 dB

5. Test results

5.1 RF Radiated Output Power

5.1.1 Measurement Procedure

1. On a test site, the EUT shall be placed at 80cm height on a turn table, and in the position close to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to correspond to the fundamental frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the peak detector is used for the measurement.
4. During the measurement of the EUT, the resolution bandwidth was to 3 MHz and the video bandwidth was set to 3 MHz.
5. The transmitter shall be switched on, the measuring receiver shall be tuned to the frequency of the transmitter under test.
6. The test antenna shall be raised and lowered through the specified range of height until the maximum signal level is detected by the measuring receiver.
7. The transmitter shall be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
8. The test antenna shall be raised and lowered again through the specified range of height until the maximum signal level is detected by the measuring receiver.
9. The maximum signal level detected by the measuring receiver shall be noted.
10. The EUT was replaced by half-wave dipole (824 ~ 849 MHz) or horn antenna (1 850 ~ 1 910 MHz) connected to a signal generator.
11. In necessary, the input attenuator setting on the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
12. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
13. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, which is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
14. The input level to the substitution antenna shall be recorded as power level in dB m, corrected for any change of input attenuator setting of the measuring receiver.
15. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.

5.1.2 Limit

FCC §22.913(a), The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.FCC §24.232(c) Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

5.1.3 Test Result

WCDMA Band V_Internal

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.		Limit (mW)
		(dBm)	(mW)	
826.40	H	11.20	13.18	7 000
826.40	V	5.90	3.89	7 000
836.40	H	10.20	10.47	7 000
836.40	V	5.70	3.72	7 000
846.60	H	11.40	13.80	7 000
846.60	V	3.20	2.09	7 000

WCDMA Band II_Internal

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.		Limit (mW)
		(dBm)	(mW)	
1 852.40	H	22.60	181.97	2 000
1 852.40	V	17.50	56.23	2 000
1 880.00	H	21.80	151.36	2 000
1 880.00	V	19.10	81.28	2 000
1 907.60	H	21.30	134.90	2 000
1 907.60	V	19.20	83.18	2 000

WCDMA Band V_External

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.		Limit (mW)
		(dBm)	(mW)	
826.40	H	10.40	10.96	7 000
826.40	V	2.90	1.95	7 000
836.40	H	11.20	13.18	7 000
836.40	V	2.60	1.82	7 000
846.60	H	11.60	14.45	7 000
846.60	V	4.60	2.88	7 000

WCDMA Band II_External

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.		Limit (mW)
		(dBm)	(mW)	
1 852.40	H	16.30	42.66	2 000
1 852.40	V	16.20	41.69	2 000
1 880.00	H	21.50	141.25	2 000
1 880.00	V	18.50	70.79	2 000
1 907.60	H	20.90	123.03	2 000
1 907.60	V	16.90	48.98	2 000

GSM-850_Internal

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.		Limit (mW)
		(dBm)	(mW)	
824.20	H	15.80	38.02	7 000
824.20	V	5.90	3.89	7 000
836.60	H	15.70	37.15	7 000
836.60	V	4.60	2.88	7 000
848.80	H	16.10	40.74	7 000
848.80	V	5.00	3.16	7 000

GSM-1 900_Internal

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.		Limit (mW)
		(dBm)	(mW)	
1 850.20	H	10.50	11.22	2 000
1 850.20	V	5.50	3.55	2 000
1 880.00	H	10.10	10.23	2 000
1 880.00	V	6.90	4.90	2 000
1 909.80	H	9.70	9.33	2 000
1 909.80	V	8.00	6.31	2 000

GSM-850_External

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.		Limit (mW)
		(dBm)	(mW)	
824.20	H	14.30	26.92	7 000
824.20	V	3.20	2.09	7 000
836.60	H	13.40	21.88	7 000
836.60	V	3.30	2.14	7 000
848.80	H	13.80	23.99	7 000
848.80	V	3.00	2.00	7 000

GSM-1 900_External

Frequency (MHz)	Ant. Pol. (H/V)	E.R.P.		Limit (mW)
		(dBm)	(mW)	
1 850.20	H	7.60	5.75	2 000
1 850.20	V	4.50	2.82	2 000
1 880.00	H	9.80	9.55	2 000
1 880.00	V	6.40	4.37	2 000
1 909.80	H	8.20	6.61	2 000
1 909.80	V	3.60	2.29	2 000

5.2 Spurious radiated emission

5.2.1 Measurement Procedure

1. On a test site, the EUT shall be placed at 80 cm height on a turn table, and in the position close to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to correspond to the fundamental frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the peak detector is used for the measurement.
4. During the measurement of the EUT, the resolution bandwidth was to 3 MHz and the video bandwidth was set to 3 MHz.
5. The transmitter shall be switched on, the measuring receiver shall be tuned to the frequency of the transmitter under test.
6. The test antenna shall be raised and lowered through the specified range of height until the maximum signal level is detected by the measuring receiver.
7. The transmitter shall be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
8. The test antenna shall be raised and lowered again through the specified range of height until the maximum signal level is detected by the measuring receiver.
9. The maximum signal level detected by the measuring receiver shall be noted.
10. The EUT was replaced by half-wave dipole (824 ~ 849 MHz) or horn antenna (1 850 ~ 1 910 MHz) connected to a signal generator.
11. In necessary, the input attenuator setting on the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
12. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
13. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, which is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
14. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
15. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.

5.2.2 Limit

§ 22.917(a) and §24.238 (a) Out of band emissions. The power of any emission outside of the Authorized operating frequency must be attenuated below the transmitting (P) by a factor of at least $43+10\log(P)$ dB.

5.2.3 Test Result

WCDMA Band V_Internal

Low Channel (826.40 MHz)

Limit = $43+10\log(P)$ dB = 24.20 dBc

(P = 13.2 dBm = 0.013 W)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
1 654.50	H	11.20	-55.90	67.10	-13.00	42.90

Middle Channel (836.40 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
Not Detected	-	-	-	-	-	-

High Channel (846.60 MHz)

Limit = $43+10\log(P)$ dB = 24.40 dBc

(P = 13.8 dBm = 0.013 W)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
1 690.63	H	11.40	-57.50	68.90	-13.00	44.50

*Result = Operation Frequency Power level – Spurious level

*Margin=Limit – Spurious Level

WCDMA Band II_Internal

Low Channel (1 852.40 MHz)

Limit = $43+10\log(P)$ dB = 35.60 dBc

(P = 182.0 dBm = 0.182 W)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
3 706.88	H	22.60	-35.80	58.40	-13.00	22.80

Middle Channel (1 880.00 MHz)

Limit = $43+10\log(P)$ dB = 34.80 dBc

(P = 151.36 dBm = 0.151 W)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
3 761.25	H	21.80	-35.00	56.80	-13.00	22.00

High Channel (1 907.60 MHz)

Limit = $43+10\log(P)$ dB = 34.30 dBc

(P = 134.90 dBm = 0.135 W)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
3 811.88	H	21.30	-36.90	58.20	-13.00	23.90

*Result = Operation Frequency Power level – Spurious level

*Margin=Limit – Spurious Level

WCDMA Band V_External

Low Channel (826.40 Mhz)

Limit = $43+10\log(P)$ dB = 23.40 dBc

(P = 10.96 dBm = 0.011 W)

Frequency (Mhz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
1 650.25	H	10.40	-53.80	64.20	-13.00	40.80

Middle Channel (836.40 Mhz)

Limit = $43+10\log(P)$ dB = 24.20 dBc

(P = 13.18 dBm = 0.013 W)

Frequency (Mhz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
1 671.50	H	11.20	-54.60	65.80	-13.00	41.60

High Channel (846.60 Mhz)

Limit = $43+10\log(P)$ dB = 24.60 dBc

(P = 14.45 dBm = 0.014 W)

Frequency (Mhz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
1 694.88	H	11.60	-52.50	64.10	-13.00	39.50

*Result = Operation Frequency Power level – Spurious level

*Margin=Limit – Spurious Level

WCDMA Band II_External

Low Channel (1 852.40 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
Not Detected	-	-	-	-	-	-

Middle Channel (1 880.00 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
Not Detected	-	-	-	-	-	-

High Channel (1 907.60 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
Not Detected	-	-	-	-	-	-

GSM-850_Internal

Low Channel (824.20 MHz)

Limit = $43 + 10 \log(P)$ dB = 28.80 dBc

(P = 38.02 dBm = 0.038 W)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
2 459.88	H	15.80	-46.70	62.50	-13.00	33.70

Middle Channel (836.60 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
Not Detected	-	-	-	-	-	-

High Channel (848.80 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
Not Detected	-	-	-	-	-	-

GSM-1 900_Internal

Low Channel (1 850.20 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
Not Detected	-	-	-	-	-	-

Middle Channel (1 880.00 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
Not Detected	-	-	-	-	-	-

High Channel (1 909.80 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
Not Detected	-	-	-	-	-	-

GSM-850_External

Low Channel (824.20 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
Not Detected	-	-	-	-	-	-

Middle Channel (836.60 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
Not Detected	-	-	-	-	-	-

High Channel (848.80 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
Not Detected	-	-	-	-	-	-

GSM-1900_External

Low Channel (1 850.20 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
Not Detected	-	-	-	-	-	-

Middle Channel (1 880.00 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
Not Detected	-	-	-	-	-	-

High Channel (1 909.80 MHz)

Frequency (MHz)	Ant. Pol. (H/V)	Operation Frequency Power level (dBm)	Spurious Level (dBm)	*Result (dBc)	Limit (dBm)	*Margin
Not Detected	-	-	-	-	-	-

6. Test equipment used for test

	Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal Date.
■	SPECTRUM ANALYZER	R & S	FSV40	100989	2017.01.07
■	Vector Signal Generator	R & S	SMBV100A	257566	2017.01.07
■	Signal generator	R & S	SMR40	100007	2016.06.15
■	Wideband Power Sensor	R & S	NRP-Z81	102398	2017.02.11
■	DC Power Supply	AGILENT	E3632A	MY51220373	2016.12.09
■	Test Receiver	R & S	ESCI7	100732	2016.09.02
■	Bi-Log Antenna	SCHWARZBECK	VULB 9168	440	2017.10.23
■	Amplifier	SONOMA INSTRUMENT	310N	344922	2016.09.02
■	3 dB Attenuator	SCHWARZBECK	DGA9552N	BU2404	2017.04.08
■	Turn Table	MATURO	CO2000-SOFT	-	-
■	Antenna Mast	MATURO	AM4.0	079/3440509	-
■	Broadband Preamplifier	SCHWARZBECK	BBV9718	9718-233	2017.01.09
■	Broadband Preamplifier	SCHWARZBECK	BBV9721	2	2016.05.19
■	LOOP Antenna	R&S	HFH2-Z2	100355	2018.03.03
■	Horn antenna	ETS.lindgren	3117	155787	2016.11.25
■	Horn antenna	ETS.lindgren	3116	86635	2016.04.29
■	Wireless Communication Test Set	AGILENT	E5515C	GB46200567	2016.09.23
■	Highpass Filter	Wainwright Instruments GmbH	WHKX3.0/18G-12SS	44	2017.02.01
■	Highpass Filter	Wainwright Instruments GmbH	WHKX1.0/1.5S-10SS	14	2017.02.04
■	SPIRAL ANTENNA	COBHAM	PSA-75301R/170	406827-0001	-