

# FCC BT LE REPORT

#### **FCC Certification**

#### **Applicant Name:**

LG Electronics MobileComm U.S.A., Inc.

#### Address:

1000 Sylvan Avenue, Englewood Cliffs NJ 07632

Date of Issue: November 17, 2016 Test Site/Location: HCT CO., LTD., 74,Seoicheon-ro 578beon-gil,Majangmyeo,Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA Report No.: HCT-R-1611-F019 HCT FRN: 0005866421

# FCC ID : ZNFL01J

# APPLICANT : LG Electronics MobileComm U.S.A., Inc.

Model(s):	L-01J
EUT Type:	GSM/WCDMA/LTE Phone with WLAN, Bluetooth and NFC
RF Peak Output Power:	4.944 dBm (3.122 mW)
Frequency Range:	2402 MHz -2480 MHz
Modulation type	GFSK
FCC Classification:	Digital Transmission System(DTS)
FCC Rule Part(s):	Part 15.247

#### Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. 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)

Report prepared by : Kyung Soo Kang Test Engineer of RF Team

Approved by : Jong Seok Lee Manager of RF Team

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# **Version**

TEST REPORT NO.	DATE	DESCRIPTION
HCT-R-1611-F019	November 17, 2016	- First Approval Report



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# **1. GENERAL INFORMATION**

Applicant:	LG Electronics MobileComm U.S.A., Inc.				
Address:	1000 Sylvan Avenue, Englewood Cliffs NJ 07632				
FCC ID:	ZNFL01J				
EUT Type:	GSM/WCDMA/LTE Phone with WLAN, Bluetooth and NFC				
Model (s):	L-01J				
Date(s) of Tests:	October 11, 2016 ~ November 16, 2016				
Place of Tests:	HCT Co., Ltd.				
	74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea				

Model	L-01J			
EUT Type	GSM/WCDMA/LTE Phone with WLAN, Bluetooth and NFC			
Power Supply	DC 3.85 V			
Battery Information	Model: BL-T28 Type: Lithium Polymer Battery Pack			
Frequency Range	TX: 2402 MHz ~ 2480 MHz RX: 2402 MHz ~ 2480 MHz			
	Peak	Data packet length (Min)_ 4.944 dBm (3.122 mW) / Data packet length (Max)_4.884 dBm (3.079 mW)		
	Average	Data packet length (Min)_4.690 dBm (2.944 mW) / Data packet length (Max)_4.710 dBm (2.958 mW)		
BT Operating Mode	BT_Low	Energy Mode		
Modulation Type	GFSK			
Number of Channels	40 Channels			
Antenna Specification	Manufacturer: AT&C Co., LTD. Antenna type: INTERNAL ANTENNA Peak Gain : -1.5 dBi			

## **2. EUT DESCRIPTION**



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# 3. TEST METHODOLOGY

FCC KDB 558074 D01 DTS Meas Guidance v03r05 dated April 8, 2016 entitled "Guidance for Performing Compliance Measurements on Digital Transmission Systems(DTS) and the measurement procedure described in ANSI C63.10(Version : 2013) 'the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices'.

# **3.1 EUT CONFIGURATION**

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

## 3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

# 3.3 GENERAL TEST PROCEDURES

#### **Conducted Emissions**

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2 of ANSI C63.10. (Version :2013) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

#### **Radiated Emissions**

The EUT is placed on a turn table, which is 0.8 m above ground plane below 1GHz. Above 1GHz with 1.5m using absorbers between the EUT and receive antenna. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3.75 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 8 of ANSI C63.10. (Version: 2013)

### **Conducted Antenna Terminal**

See Section from 9.1 to 9.2.(KDB 558074 v03r05)

# 3.4 DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel low, mid and high with highest data rate (worst case) is chosen for full testing.



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# 4. 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 equipments, which is traceable to recognized national standards.

Espectially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2006).

# 5. FACILITIES AND ACCREDITATIONS

# 5.1 FACILITIES

The SAC(Semi-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, Korea. The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated July 07, 2015 (Registration Number: 90661)

## 5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements. Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

# 6. ANTENNA REQUIREMENTS

#### According to FCC 47 CFR §15.203:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

\* The antennas of this E.U.T are permanently attached.

\*The E.U.T Complies with the requirement of §15.203



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# 7. 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 (±dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.82
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80
Radiated Disturbance (1 GHz ~ 18 GHz)	6.07



# 8. SUMMARY TEST OF RESULTS

Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
6 dB Bandwidth	§15.247(a)(2)	> 500 kHz		PASS
Conducted Maximum Peak Output Power	§15.247(b)(3)	< 1 Watt		PASS
Power Spectral Density	§15.247(e) < 8 dBm / 3 kHz Band		CONDUCTED	PASS
Band Edge(Out of Band Emissions)	§15.247(d)	Conducted > 20 dBc		PASS
AC Power line Conducted Emissions	§15.207	cf. Section 8.7		PASS
Radiated Spurious Emissions	§15.205, 15.209	cf. Section 8.6.1	RADIATED	PASS
Radiated Restricted Band Edge	§15.247(d), 15.205, 15.209	cf. Section 8.6.2	RADIATED	PASS



## 9. TEST RESULT 9.1 DUTY CYCLE

#### TEST PROCEDURE

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW  $\geq$  OBW if possible; otherwise, set RBW to the largest available value. Set VBW  $\geq$  RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T  $\leq$  16.7 microseconds.)

#### **TEST CONFIGURATION**



### TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer. We tested accroding to the zerospan measurement method, 6.0)b) in KDB 558074 v03r05.

The largest available value of RBW is 8 MHz and VBW is 50 MHz. The zero-span method of measuring duty cycle shall not be used if  $T \le 6.25$  microseconds. (50/6.25 = 8)

The zero-span method was used because all measured T data are > 6.25 microseconds and both RBW and VBW are > 50/T.

- 1. RBW = 8 MHz (the largest available value)
- 2. VBW = 8 MHz (≥ RBW)
- 3. SPAN = 0 Hz
- 4. Detector = Peak
- 5. Number of points in sweep > 100
- 6. Trace mode = Clear write
- 7. Measure  $T_{\text{total}} \, \text{and} \, T_{\text{on}}$
- 8. Calculate Duty Cycle =  $T_{on}/T_{total}$  and Duty Cycle Factor = 10\*log(1/Duty Cycle)



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Data packet length (Min)

LE Mode	T <sub>on</sub> (ms)	T <sub>total</sub> (ms)	Duty Cycle	Duty Cycle Factor (dB)			
	0.3901	0.6245	0.6247	2.04			
Data packet length (Max)	Data packet length (Max)						
LE Mode	T <sub>on</sub> (ms)	T <sub>total</sub> (ms)	Duty Cycle	Duty Cycle Factor			
	2.1350	2.5000	0.8540	0.69			

## RESULT PLOTS\_Data packet length (Min)

enter Freq 2.40200	0000 GHz PNO: Fast	-+- Trig: Free	Run	Avg Type: Pwr(RMS)	TRACE 2 3 4 5	Frequency
Ref Offset 10.7 dB/div Ref 20.00 dB	' dB Bm	, , , , , , , , , , , , , , , , , , , ,		Δ	Mkr3 624.5 µs -0.08 dB	Auto Tune
	Ka		-∲ <sup>1∆2</sup>	304		Center Freq 2.402000000 GHz
			Maria Las			Start Freq 2.402000000 GHz
						Stop Freq 2.402000000 GHz
enter 2.402000000 GH es BW 8 MHz	Hz #V	BW 8.0 MHz	DIANTIO	Sweep 1.2	Span 0 Hz 267 ms (1001 pts)	CF Step 8.000000 MHz
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	390.1 µs 268.5 µs 624.5 µs 268.5 µs	(Δ) 5.79 4.23 dE (Δ) 0.08 4.23 dE	dB 3m dB 3m		YONG TON YACUE	Freq Offset 0 Hz
9						

#### RESULT PLOTS\_ Data packet length (Max)

		in GaincLow	Atten: 20 dB			CET P NNNNN	
dB/div	Ref Offset 10 Ref 20.00 c	.7 dB JBm			ΔN	lkr3 2.500 ms -0.03 dB	Auto Tune
00 00 00		X.			¢1	∆2 <u>3</u> ∆4	Center Free 2.402000000 GH
		Berkhurgerb				-14.10	Start Free 2.402000000 GH
10							Stop Fre 2.402000000 GH
enter 2.4 25 BW 8	402000000 G MHz	Hz #VBV	N 8.0 MHz	FUNCTION	Sweep 5.0	Span 0 Hz 00 ms (1001 pts) FUNCTION VALUE	CF Ster 8.000000 MH Auto Ma
$\Delta 2 = 1$ $\Delta 4 = 1$ $\Delta 4 = 1$ 4 = F = 1 5 = 6	t (Δ) t (Δ) t	2.135 ms (Δ) 1.810 ms 2.500 ms (Δ) 1.810 ms	0 24 dB 4 23 dBm 0 -0.03 dB 4 23 dBm				Freq Offse 0 H
890							



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## 9.2 6 dB BANDWIDTH MEASUREMENT

#### Test Requirements and limit, §15.247(a)(2)

The bandwidth at 6 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequencies.

The minimum permissible 6 dB bandwidth is 500 kHz.

#### **TEST CONFIGURATION**



#### TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer.

The Spectrum Analyzer is set to (Procedure 8.1 in KDB 558074 v03r05)

RBW = 100 kHz VBW  $\geq$  3 x RBW Detector = Peak Trace mode = max hold Sweep = auto couple Allow the trace to stabilize

Note : We tested 6 dB bandwidth using the automatic bandwidth measurement capability of a spectrum analyzer. X dB is set 6 dB.

#### TEST RESULT\_Data packet length (Min)

Mode	Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Pass/Fail
BT LE	0	717.0		Pass
	19	717.7	> 500	Pass
	39	717.0		Pass

#### TEST RESULT\_ Data packet length (Max)

Mode	Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Pass/Fail
BTLE	0	687.7		Pass
	19	690.3	> 500	Pass
	39	686.9		Pass



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#### RESULT PLOTS\_Min



#### 6 dB Bandwidth plot (Low-CH 0)

#### 6 dB Bandwidth plot (Mid-CH 19)





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#### 6 dB Bandwidth plot (High-CH 39)

#### RESULT PLOTS\_Max



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#### 6 dB Bandwidth plot (Low-CH 0)

#### 6 dB Bandwidth plot (Mid-CH 19)



6 dB Bandwidth plot (High-CH 39)



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### 9.3 OUTPUT POWER MEASUREMENT

Test Requirements and limit, §15.247(b)(3)



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A transmitter antenna terminal of EUT is connected to the input of a Spectrum Analyzer.

Measurement is made while the EUT is operating in transmission mode at the appropriate frequencies.

The maximum permissible conducted output power is 1 Watt.

## **TEST CONFIGURATION**



#### TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer. We use the spectrum analyzer's integrated band power measurement function.

This EUT TX condition is actual operating mode by BT LE mode test program.

#### The Spectrum Analyzer is set to

- Peak Power (Procedure 9.1.1 in KDB 558074 v03r05)
  - RBW ≥ DTS Bandwidth
  - VBW ≥ 3 x RBW
  - SPAN ≥ 3 x RBW
  - Detector Mode = Peak
  - Sweep = auto couple
  - Trace Mode = max hold
  - Allow trace to fully stabilize.
  - Use peak marker function to determine the peak amplitude level
- Average Power (Procedure 9.2.2.4 in KDB 558074 v03r05)
  - Measure the duty cycle
  - Set span to at least 1.5 times the OBW
  - RBW = 1-5 % of the OBW, not to exceed 1 MHz.
  - VBW  $\ge$  3 x RBW.
  - Number of points in sweep  $\ge 2 x \text{ span} / \text{RBW}$ . (This gives bin-to-bin spacing  $\le \text{RBW}/2$ ,

so that narrowband signals are not lost between frequency bins.)

- Sweep time = auto.
- Detector = RMS(i.e., power averaging)
- Do not use sweep triggering. Allow the sweep to "free run".
- Trace average at least 100 traces in power averaging(RMS) mode.
- Compute power by integrating the spectrum across the OBW of the signal using the instrument's band



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power measurement function with band limits set equal to the OBW band edges. Add 10 log (1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times.

#### Sample Calculation

Output Power = Reading Value + ATT loss + Cable loss(1 ea) + Duty Cycle Factor Output Power = 10 dBm + 10 dB + 0.8 dB + 0.2 dB = 21.0 dBm

Note :

- 1. Spectrum reading values are not plot data. The power results in plot is already including the actual values of loss for the attenuator and cable combination.
- 2. Spectrum offset = Attenuator loss + Cable loss
- 3. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. So, 10.7 dB is offset for 2.4 GHz Band.

#### TEST RESULTS-Peak



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#### Conducted Output Power Measurements\_Data packet length (Min)

LE Me	ode	Measured	Limit
Frequency[MHz]	Channel No.	Power(dBm)	(dBm)
2402	0	4.536	30
2440	19	4.944	30
2480	39	3.024	30

#### Conducted Output Power Measurements\_ Data packet length (Max)

LE Mo	ode	Measured	Limit	
Frequency[MHz]	Channel No.	Power(dBm)	(dBm)	
2402	0	4.473	30	
2440	19	4.884	30	
2480	39	2.859	30	

#### TEST RESULTS-Average

#### Conducted Output Power Measurements\_ Data packet length (Min)

LE M	ode		Duty Cycle	Measured		
Frequency[MHz]	Channel No.	Measured Power(dBm)	Factor (dB)	Duty Cycle Factor(dB)	Limit (dBm)	
2402	0	2.16	2.04	4.21	30	
2440	19	2.65	2.04	4.69	30	
2480	39	0.73	2.04	2.78	30	

#### Conducted Output Power Measurements\_ Data packet length (Max)

LE Mode			Duty Ovele	Measured		
Frequency[MHz]	Channel No.	Measured Power(dBm)	Factor (dB)	Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)	
2402	0	3.54	0.69	4.22	30	
2440	19	4.03	0.69	4.71	30	
2480	39	1.90	0.69	2.58	30	

#### RESULT PLOTS-Peak\_Data packet length (Min) Conducted Output Power (Low-CH 0)



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#### Conducted Output Power (Mid-CH 19)





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Agiler	nt Spectrum Analyzer - Swept SA							
LXI R	L RF 50 Ω AC		SENSE:INT	#Aug Type	ALIGNAUTO	03:49:12 A	MOct 19, 2016	Frequency
Cer	iter Freq 2.4800000	PNO: Fast +++ Trig:	Free Run	Avg Hold:	1/1	TY		
		IFGain:Low Atter	n: 10 dB			DI	TPPPPP	
	Ref Offset 10.7 dB				Mkr1	2.4797	'13 GHz	Auto Tune
10 dl	B/div Ref 10.70 dBm					3.0	24 dBm	
Log		1						
								Center Freq
0.700								2.480000000 GHz
	and the second second							
-9.30								Otarit Farm
								StartFreq
-19.3								2.478500000 GHz
-29.3								Stop Freg
								2 481500000 GHz
-39.3							-	
-49.3								CF Step
								Auto Man
-59.3								
-69.3								Freq Offset
								0 Hz
-79.3								
Cen	ter 2 480000 GHz					Snan 3	000 MHz	
#Re	s BW 1.0 MHz	#VBW 3.0 M	Hz		Sweep	1.07 ms (	1000 pts)	
MSG	Devints changed: all traces	cleared			STATUS	5		

#### Conducted Output Power (High-CH 39)



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## RESULT PLOTS-Peak\_Data packet length (Max) Conducted Output Power (Low-CH 0)

gilent Spectrum Analyzer RL :31 AM Oct 19, 2016 Frequency #Avg Type: Pwr(RMS) Avg|Hold: 1/1 TRACE 123456 TYPE MWWWWW DET PPPPP Center Freq 2.402000000 GHz Trig: Free Run Atten: 10 dB PNO: Fast + IFGain:Low Auto Tune Mkr1 2.402 215 GHz 4.473 dBm Ref Offset 10.7 dB Ref 10.70 dBm 10 dB/div **(**1 **Center Freq** 2.402000000 GHz Start Freq 2.400500000 GHz Stop Freq 2.403500000 GHz CF Step 300.000 kHz <u>Auto</u> Man **Freq Offset** 0 Hz Span 3.000 MHz Sweep 1.07 ms (1000 pts) Center 2.402000 GHz #Res BW 1.0 MHz #VBW 3.0 MHz Points changed; all traces cleared STATUS

### Conducted Output Power (Mid-CH 19)

Agilent Spectrum Analyzer - Swept SA					
X RL RF 50Ω AC	SEP	NSE:INT #Ava Typ	ALIGNAUTO 03:57:5 Pwr(BMS) If	4 AM Oct 19, 2016	Frequency
Center Freq 2.44000000	PNO: Fast +++ Trig: Free	Run Avg Hold:	1/1		
	IFGain:Low Atten: 10	dB		DETFFFFFF	
Ref Offset 10.7 dB			Mkr1 2.439	722 GHz	Auto Tune
10 dB/div Ref 10.70 dBm			4.	884 dBm	
Log	<u></u> 1				
					Center Freq
0.700					2.440000000 GHz
And and a start of the start of					
-9.30					
					StartFreq
-19.3					2.438500000 GHz
					· · · · · · · · · · · · · · · · · · ·
-29.3					Stop Fred
					2 441500000 GHz
-39.3			2) 		
-49.3					CF Step
					Auto Man
-59.3					
					En al Official
-69.3					FreqOffset
					0 Hz
-79.3					
Center 2.440000 GHz			Span	3.000 MHz	
#Res BW 1.0 MHz	#VBW 3.0 MHz		Sweep 1.07 ms	(1000 pts)	
MSG Deints changed; all traces	cleared		STATUS		



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Agilen	it Spectrum Analyzer - Swept SA							
Con	L RF 50 Ω AC		SENSE:INT	#Ava Tvp	ALIGNAUTO e: Pwr(RMS	01:07:37 A	MOct 25, 2016	Frequency
GOI		PNO: Fast +++ Tr	ig: Free Run	Avg Hold:	1/1	TYI D		
_		IFGain:Low At	tten: 10 dB					
	Ref Offset 10.7 dB				Mkr1	2.479 7	40 GHz	Auto Tune
10 dE	B/div Ref 10.70 dBm					2.8	59 dBm	
LOg		1						Conton From
0.700			_			8	15	Center Freq
0.1 00								2.48000000 GHZ
-9.30	all all and a second							
	ANT COLOR							Start Freq
-19.3								2.478500000 GHz
100000								
-29.3								
								Stop Freq
-39.3							s	2.481500000 GHz
-49.3								CF Step
								300.000 kHz
-59.3								<u>Auto</u> Man
-69.3								Freq Offset
								0 Hz
-79.3								
						0		
Cen #Po	CEF 2.480000 GHZ	#\/B\//3.0	MHz		Sween	Span 3	1000 WHZ	
witte		#VBVV J.0	101112		oweep	1.07 IIIS (	rooo prsj	
MSG	Points changed; all traces	cleared			STATUS	5		

#### Conducted Output Power (High-CH 39)



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#### RESULT PLOTS-Average\_Data packet length (Min) Conducted Output Power (Low-CH 0)

ilent Spectrum Analyzer - Channel Power ALIGN AUTO 03:45:32 AM Oct 19, 2016 Radio Std: None Center Freq: 2.402000000 GHz Trig: Free Run Avg|Hold #Atten: 10 dB Frequency Center Freg 2.402000000 GHz Avg|Hold: 100/100 Radio Device: BTS #IFGain:Low Ref Offset 10.7 dB Ref 20.00 dBm 10 dB/div og **Center Freq** 2.402000000 GHz CF Step 218.066 kHz Center 2.402 GHz #Res BW 33 kHz Span 2.181 MHz Sweep 2.533 ms Auto Man #VBW 100 kHz **Freq Offset Channel Power Power Spectral Density** 0 Hz -58.21 dBm /Hz 2.16 dBm / 1.09 MHz STATUS

### Conducted Output Power (Mid-CH 19)





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#### **Conducted Output Power (High-CH 39)**



Model: L-01J

#### RESULT PLOTS-Average\_Data packet length (Max) Conducted Output Power (Low-CH 0)

ilent Spectrum Analyzer - Channel Power ALIGN AUTO :56:40 AM Oct 19, 2016 Center Freq: 2.402000000 GHz Trig: Free Run Avg|Hold #Atten: 10 dB Frequency Radio Std: None Center Freq 2.402000000 GHz Avg|Hold: 100/100 Radio Device: BTS #IFGain:Low Ref Offset 10.7 dB Ref 20.00 dBm 10 dB/div og **Center Freq** 2.402000000 GHz CF Step 217.457 kHz Center 2.402 GHz #Res BW 33 kHz Span 2.175 MHz Sweep 2.467 ms Auto Man #VBW 100 kHz **Freq Offset Channel Power Power Spectral Density** 0 Hz -56.83 dBm /Hz 3.54 dBm / 1.087 MHz STATUS

### Conducted Output Power (Mid-CH 19)





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#### **Conducted Output Power (High-CH 39)**



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# 9.4 POWER SPECTRAL DENSITY

#### Test Requirements and limit, §15.247(e)

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

# Minimum Standard – The transmitter power density average over 1-second interval shall not be greater than 8dBm in any 3kHz BW.

#### **TEST CONFIGURATION**



#### TEST PROCEDURE

We tested according to Procedure 10.2 in KDB 558074, issued 01/07/2016

The spectrum analyzer is set to :

Set analyzer center frequency to DTS channel center frequency.

Span = 1.5 times the DTS channel bandwidth.

 $RBW = 3 kHz \le RBW \le 100 kHz.$ 

VBW  $\geq$  3 x RBW.

Sweep = auto couple

Detector = peak

Trace Mode = max hold

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

#### Sample Calculation

PSD = Reading Value + ATT loss + Cable loss(1 ea) Output Power = -5 dBm + 10 dB + 0.8 dB = 5.8 dBm Note :

- 1. Spectrum reading values are not plot data. The PSD results in plot is already including the actual values of loss for the attenuator and cable combination.
- 2. Spectrum offset = Attenuator loss + Cable loss
- 3. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. So,10.7 dB is offset for 2.4 GHz Band.



Model: L-01J

#### TEST RESULTS

#### Conducted Power Density Measurements\_Data packet length (Min)

Frequency (MHz)	Channel No.		Test Result					
		Mode	PSD	Limit	Pass/			
			(dBm)	(dBm)	Fail			
2402	0		-9.918	8	Pass			
2440	19	LE	-9.303	8	Pass			
2480	39		-11.103	8	Pass			

#### Conducted Power Density Measurements\_ Data packet length (Max)

Frequency (MHz)	Channel No.		Test Result					
		Mode	PSD	Limit	Pass/			
			(dBm)	(dBm)	Fail			
2402	0		-11.054	8	Pass			
2440	19	LE	-10.530	8	Pass			
2480	39		-12.727	8	Pass			



Model: L-01J

## RESULT PLOTS\_Data packet length (Min) Power Spectral Density (Low-CH 0)



### Power Spectral Density (Mid-CH 19)





Model: L-01J



#### **Power Spectral Density (High-CH 39)**



Model: L-01J

### RESULT PLOTS\_Data packet length (Max) Power Spectral Density (Low-CH 0)

ilent Spectrum Analyze Oct 19, 2016 Frequency #Avg Type: Pwr(RMS) Avg|Hold: 1/1 TRACE 123456 TYPE MWWWWW DET PPPPP Center Freq 2.402000000 GHz Trig: Free Run Atten: 10 dB PNO: Far IFGain:Low Auto Tune Mkr1 2.401 965 4 GHz -11.054 dBm Ref Offset 10.7 dB Ref 10.00 dBm l0 dB/div **Center Freq** 2.402000000 GHz 1 Start Freq 2.401484252 GHz 1.00 Stop Freq 2.402515748 GHz CF Step 103.150 kHz Auto Man **Freq Offset** 0 Hz Span 1.031 MHz Sweep 109 ms (1000 pts) Center 2.4020000 GHz #Res BW 3.0 kHz #VBW 9.1 kHz Points changed; all traces cleared STATU

### Power Spectral Density (Mid-CH 19)





Model: L-01J

Agilent Spectrum A	nalyzer - Swept SA									
LXI RL RI	F 50 Ω AC		SENS	SE:INT		ALIGNAUTO	01:07:59 A	MOct 25, 2016	E	requency
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10 dB/div Re	f 10.00 dBm						-12.7	27 dBm		
Log										
									(	Center Freq
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40.0										
70.0										CE Sten
-30.0										103.035 kHz
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-60.0										
-70.0										Freq Onset
										UHZ
-80.0										
Center 2 4900	000 GH7						Snan 1	030 MHz		
#Res BW 3.0	kHz	#VBW	9.1 kHz			Sweep	109 ms (	1000 pts)		
NEC Doints sh	angod: all tracco a	loarad				STATIO		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
	anged, all traces c	leared				STATUS				

## Power Spectral Density (High-CH 39)