# **TEST REPORT**

# **Dt&C**

## DT&C Co., Ltd.

42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea,17042 Tel : 031-321-2664, Fax : 031-321-1664

- 1. Report No: DRTFCC1808-0221
- 2. Customer
  - Name : LG Electronics USA, Inc.
  - Address : 1000 Sylvan Ave. Englewood Cliffs, New Jersey, United States 07632
- 3. Use of Report : FCC Original Grant
- 4. Product Name / Model Name : Mobile Phone / LM-V409V FCC ID : ZNFV409V
- 5. Test Method Used : KDB558074 D01v04

Test Specification : FCC Part 15 Subpart C.247

- 6. Date of Test : 2018.08.07 ~ 2018.08.13
- 7. Testing Environment : Refer to appended test report.
- 8. Test Result : Refer to the attached test result.

Affirmation	Tested by	1	Reviewed by	A	
	Name : SunGeun Lee	(Signayre)	Name : Geunki Son	10	(Signature)

The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose. This test report shall not be reproduced except in full, without the written approval of DT&C Co., Ltd.

2018.08.24.

## DT&C Co., Ltd.

If this report is required to confirmation of authenticity, please contact to report@dtnc.net

## **Test Report Version**

Test Report No.	Date	Description
DRTFCC1808-0221	Aug. 24, 2018	Initial issue

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## **1. General Information**

#### **1.1 Testing Laboratory**

#### DT&C Co., Ltd.

The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042. The test site complies with the requirements of § 2.948 according to ANSI C63.4-2014.

#### - FCC MRA Accredited Test Firm No. : KR0034

www.dtnc.net		
Telephone	:	+ 82-31-321-2664
FAX	:	+ 82-31-321-1664

### 1.2 Test Environment

Ambient Condition				
<ul> <li>Temperature</li> </ul>	+21 ℃ ~ +25 ℃			
<ul> <li>Relative Humidity</li> </ul>	41 % ~ 48 %			

#### **1.3 Measurement Uncertainty**

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C63.4-2014 and ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95 % level of confidence.

Test items	Measurement uncertainty
Transmitter Output Power	0.9 dB (The confidence level is about 95 %, $k = 2$ )
Conducted spurious emission	0.9 dB (The confidence level is about 95 %, $k = 2$ )
AC conducted emission	2.4 dB (The confidence level is about 95 %, $k = 2$ )
Radiated spurious emission (1 GHz Below)	5.1 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (1 GHz ~ 18 GHz)	5.4 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (18 GHz Above)	5.3 dB (The confidence level is about 95 %, $k = 2$ )

## **1.4 Details of Applicant**

Applicant	:	LG Electronics USA, Inc.
Address	:	1000 Sylvan Ave. Englewood Cliffs, New Jersey, United States 07632
Contact person	:	Kyung-Su Han

## 1.5 Description of EUT

EUT	Mobile Phone
Model Name	LM-V409V
Add Model Name	NA
Serial Number	Identical prototype
Power Supply	DC 3.85 V
Frequency Range	2402 MHz ~ 2480 MHz
Max. RF Output Power	9.57 dBm
Modulation Technique	GFSK
Antenna Specification	Antenna Type: PIFA Antenna Gain: -1.26 dBi (PK)

## **1.6 Declaration by the applicant / manufacturer**

N/A

## **1.7 Test Equipment List**

Туре	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	17/12/28	18/12/28	MY50200816
Spectrum Analyzer	Agilent Technologies	N9020A	18/01/03	19/01/03	MY48011700
Multimeter	FLUKE	17B	17/12/26	18/12/26	26030065WS
DC Power Supply	Agilent	66332A	18/07/02	19/07/02	US37473422
Signal Generator	Rohde Schwarz	SMBV100A	17/12/27	18/12/27	255571
Signal Generator	ANRITSU	MG3695C	18/02/12	19/02/12	173501
Thermohygrometer	BODYCOM	BJ5478	18/07/09	19/07/09	N/A
Thermohygrometer	BODYCOM	BJ5478	18/01/03	19/01/03	120612-1
Loop Antenna	Schwarzbeck	FMZB1513	18/01/30	20/01/30	1513-128
Biglog Antenna	Schwarzbeck	VULB 9160	18/07/13	20/07/13	3359
Horn Antenna	ETS-Lindgren	3115	17/01/13	19/01/13	9202-3820
Horn Antenna	Schwarzbeck	BBHA 9120C	17/12/04	19/12/04	9120C-561
Horn Antenna	A.H.Systems Inc.	SAS-574	17/07/31	19/07/31	155
PreAmplifier	H.P	8447D	17/12/26	18/12/26	2944A07774
PreAmplifier	tsj	MLA-0118-J01-45	18/02/08	19/02/08	17138
PreAmplifier	tsj	MLA-1840-J02-45	18/07/06	19/07/06	16966-10728
Attenuator	SMAJK	SMAJK-2-3	18/07/02	19/07/02	3
Attenuator	Aeroflex/Weinschel	56-3	18/07/02	19/07/02	Y2370
Attenuator	SRTechnology	F01-B0606-01	18/07/02	19/07/02	13092403
Attenuator	Hefei Shunze	SS5T2.92-10-40	18/07/03	19/07/03	16012202
High Pass Filter	Wainwright Instruments	WHNX8.0/26.5- 6SS	18/07/02	19/07/02	3
High Pass Filter	Wainwright Instruments	WHKX12-935- 1000-15000-40SS	18/07/02	19/07/02	8
High Pass Filter	Wainwright Instruments	WHKX10-2838- 3300-18000-60SS	18/07/02	19/07/02	1
Power Meter & Wide Bandwidth		ML2495A			1306007
Sensor	Anritsu	MA2490A	18/04/17	19/04/17	1249001
EMI Test Receiver	Rohde Schwarz	ESW44	18/08/06	19/08/06	101645
EMI Test Receiver	Rohde Schwarz	ESCI7	18/02/12	19/02/12	100910
PULSE LIMITER	Rohde Schwarz	ESH3-Z2	17/09/29	18/09/29	101333
LISN	SCHWARZBECK	NNLK 8121	18/03/20	19/03/20	06183
CABLE	DTNC	CABLE	18/06/22	19/06/22	RF-82
CABLE	HUBER+SUHNER	SUCOFLEX	17/12/22	18/12/22	C-1
CABLE	HUBER+SUHNER	SUCOFLEX	17/12/22	18/12/22	C-2
CABLE	HUBER+SUHNER	SUCOFLEX	17/12/22	18/12/22	C-3
CABLE	HUBER+SUHNER	SUCOFLEX	17/12/22	18/12/22	C-4
CABLE	DTNC	CABLE	18/03/26	19/03/26	RF-68
CABLE	DTNC	CABLE	18/03/26	19/03/26	P-IN
CABLE	DTNC	CABLE	18/03/26	19/03/26	RF-71
CABLE	Radiall	TESTPRO3	18/06/22	19/06/22	RF-74
CABLE	Radiall	TESTPRO3	18/02/28	19/02/28	RF-66

Note1: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017. Note2: The cable is not a regular calibration item, so it has been calibrated by DT & C itself.

## 1.8 Summary of Test Results

FCC Part	RSS Std.	Parameter Limit		Test Condition	Status Note 1	
15.247(a)	RSS-247 [5.2]	6 dB Bandwidth	> 500 kHz		С	
15.247(b)	RSS-247 [5.4]	Out of Band Emissions / 20 dBc in any			С	
15.247(d)	RSS-247 [5.5]			Conducted	с	
15.247(e)	RSS-247 [5.2]	Transmitter Power Spectral Density	< 8 dBm/3 kHz		с	
-	RSS-Gen [6.7]	Occupied Bandwidth (99 %)	NA		NA	
15.247(d) 15.205 15.209	RSS-247 [5.5] RSS-GEN [8.9] RSS-GEN [8.10]	General Field Strength Limits (Restricted Bands and Radiated FCC 15.209 limits Emission Limits)		Radiated	C Note 3	
15.207	RSS-Gen [8.8]	AC Line Conducted Emissions	AC Line Conducted Emissions FCC 15.207 limits		С	
15.203	-	Antenna Requirements	FCC 15.203	-	С	
Note 2: For ra	Note 1: C=Comply NC=Not Comply NT=Not Tested NA=Not Applicable Note 2: For radiated emission tests below 30 MHz were performed on semi-anechoic chamber which is correlated with OATS. Note 3: This test item was performed in each axis and the worst case data was reported.					



## 2. Test Methodology

The measurement procedures described in the ANSI C63.10-2013 and the guidance provided in KDB558074 D01v04 were used in measurement of the EUT.

The EUT was tested per the guidance of KDB558074 D01v04. And ANSI C63.10-2013 was used to reference appropriate EUT setup and maximizing procedures of radiated spurious emission and AC line conducted emission testing.

#### 2.1 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.

#### 2.2 EUT Exercise

The EUT was operated in the test 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.

#### 2.3 General Test Procedures

#### **Conducted Emissions**

The power-line conducted emission test procedure is not described on the KDB558074 D01v04.

So this test was fulfilled with the requirements in Section 6.2 of ANSI C63.10-2013.

The EUT is placed on the wooden table, which is 0.8 m above ground plane and the conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-peak and Average detector.

#### **Radiated Emissions**

Basically the radiated tests were performed with KDB558074 D01v04. But some requirements and procedures like test site requirements, EUT setup and maximizing procedure were fulfilled with the requirements in Section 5 and 6 of the ANSI C63.10-2013 as stated on section 12.1 of the KDB558074 D01v04.

The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 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 highest emission, the relative positions of the EUT were rotated through three orthogonal axes.

#### 2.4 Description of Test Modes

The EUT has been tested with the operating condition for maximizing the emission characteristics. A test program is used to control the EUT for staying in continuous transmitting. The Bluetooth low energy mode with below low, middle and high channels were tested and reported.

		Frequency [MHz]			
Test Mode	Description	Lowest Frequency	Middle Frequency	Highest Frequency	
TM 1	BT LE (1Mbps)	2402	2440	2480	
TM 2	BT LE (2Mbps)	2402	2440	2480	

#### 2.5 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. TRF-RF-238(05)170516 Prohibits the copying and re-issue of this report without DT&C approval. Pages: 8 / 58



## 3. Test Result

#### 3.1 Maximum Peak Conducted Output Power

#### Test Requirements and limit, §15.247(b) & RSS-247 [5.4]

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.

#### 3.1.1 Test Setup

Refer to the APPENDIX I.

#### 3.1.2 Test Procedures

Maximum Peak Conducted Output Power is measured using Measurement Procedure Option 1 of KDB558074 D01v04

1. Set the RBW ≥ DTS bandwidth. Actual RBW = 2 MHz & 2.4 MHz

- 2. Set  $VBW \ge 3 \times RBW$ . Actual VBW = 6 MHz & 8 MHz
- 3. Set span ≥ 3 x RBW.
- 4. Sweep time = auto couple
- 5. Detector = **peak**
- 6. Trace mode = **max hold**
- 7. Allow trace to fully stabilize
- 8. Use peak marker function to determine the peak amplitude level.

#### 3.1.3 Test Results

Test mode	Tested Channel	Burst Average Output Power	Peak Output Power	
Test mode	Testeu Chaimei	dBm	dBm	
	Lowest	8.76	9.49	
TM 1	Middle	8.11	8.41	
	Highest	8.60	9.30	
	Lowest	8.77	9.57	
TM 2	Middle	8.13	8.53	
	Highest	8.63	9.43	

Note 1 : The Burst average output power was tested using an average power meter for reference only.

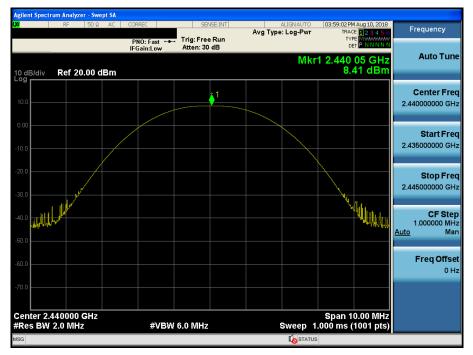
Note 2 : See next pages for actual measured spectrum plots.

TM 1 Test Channel : Lowest



#### **Peak Output Power**

TM 1 Test Channel : Middle



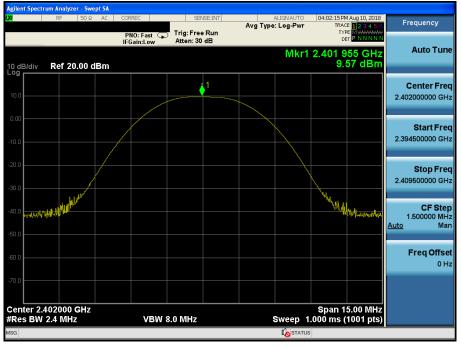


TM 1 Test Channel : Highest



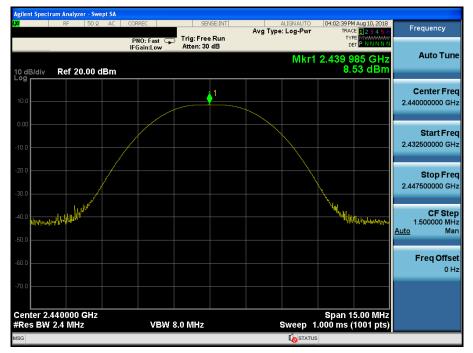


TM 2 Test Channel : Lowest



#### **Peak Output Power**

TM 2 Test Channel : Middle





TM 2 Test Channel : Highest





#### 3.2 6 dB Bandwidth Measurement

#### Test Requirements and limit, §15.247(a) & RSS-247 [5.2]

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

#### The minimum permissible 6 dB bandwidth is 500 kHz.

#### 3.2.1 Test Setup

Refer to the APPENDIX I.

#### **3.2.2 Test Procedures**

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of KDB558074 D01v04

- 1. Set resolution bandwidth (RBW) = 100 kHz
- 2. Set the video bandwidth (VBW)  $\ge$  3 x RBW.

#### (RBW : 100 kHz / VBW : 300 kHz)

- 3. Detector = peak.
- 4. Trace mode = **max hold**.
- 5. Sweep = auto couple.
- 6. Allow the trace to stabilize.
- 7. Option 1 Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

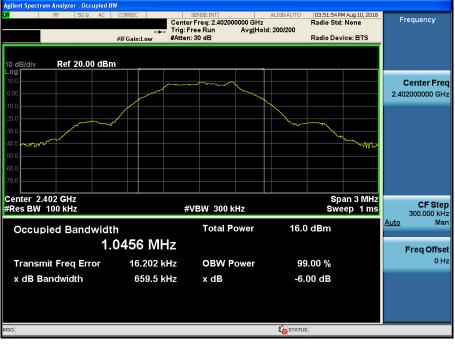
Option 2 - The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW  $\ge$  3 × RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be  $\ge$  6 dB.

#### 3.2.3 Test Results

Test Mode	Tested Channel	Test Results [MHz]
	Lowest	0.660
TM 1	Middle	0.667
	Highest	0.668
	Lowest	1.134
TM 2	Middle	1.131
	Highest	1.162

#### 6 dB Bandwidth

TM 1 Test Channel : Lowest



6 dB Bandwidth

#### TM 1 Test Channel : Middle



#### 6 dB Bandwidth

TM 1 Test Channel : Highest



#VBW 300 kHz

x dB

Total Power

**OBW Power** 

#### 6 dB Bandwidth



#### 6 dB Bandwidth

Center 2.402 GHz #Res BW 100 kHz

**Occupied Bandwidth** 

Transmit Freq Error

x dB Bandwidth

2.0437 MHz

22.192 kHz

1.134 MHz

#### TM 2 Test Channel : Middle

**I**STATUS

16.6 dBm

99.00 %

-6.00 dB

Span 5 MHz Sweep 1 ms

CF Step 500.000 kHz

Freq Offset 0 Hz

<u>Auto</u>

Man



#### 6 dB Bandwidth

TM 2 Test Channel : Highest





#### 3.3 Maximum Power Spectral Density.

#### ■ Test requirements and limit, §15.247(e) & RSS-247 [5.2]

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 power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission

#### 3.3.1 Test Setup

Refer to the APPENDIX I.

#### **3.3.2 Test Procedures**

#### Method PKPSD of KDB558074 D01v04 is used.

- 1. Set analyzer center frequency to DTS channel center frequency.
- 2. Set the span to **1.5 times** the DTS bandwidth.
- 3. Set the RBW : 3 kHz  $\leq$  RBW  $\leq$  100 kHz.
- 4. Set the VBW  $\geq$  3 x RBW.
- 5. Detector = **peak.**
- 6. Sweep time = **auto couple.**
- 7. Trace mode = max hold.
- 8. Allow trace to fully stabilize.
- 9. Use the **peak marker function** to determine the maximum amplitude level within the RBW.
- 10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

#### 3.3.3 Test Results

Test Mode	Tested Channel	PKPSD [dBm]
	Lowest	-6.56
TM 1	Middle	-7.64
	Highest	-6.87
	Lowest	-9.12
TM 2	Middle	-10.18
	Highest	-9.28

#### TM 1 Test Channel : Lowest

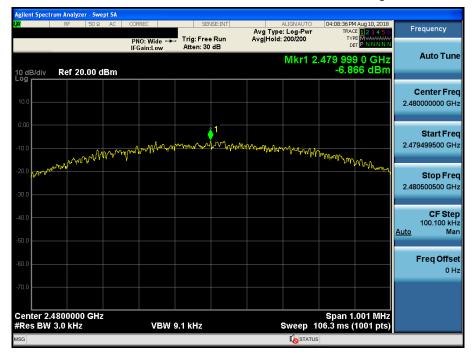


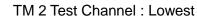
#### Maximum PKPSD

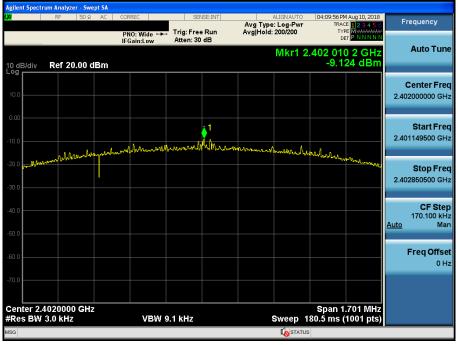
TM 1 Test Channel : Middle



TM 1 Test Channel : Highest

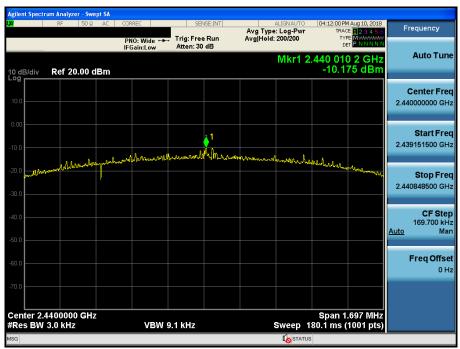






#### Maximum PKPSD

TM 2 Test Channel : Middle



TM 2 Test Channel : Highest



#### 3.4 Unwanted Emissions (Conducted)

#### Test requirements and limit, §15.247(d) & RSS-247 [5.5]

**§15.247(d)** specifies that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions :

If the peak output power procedure is used to measure the fundamental emission power to demonstrate compliance to **15.247(b)(3)** requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated **by at least 20 dB** relative to the maximum measured in-band peak PSD level.

If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to **15.247(b)(3)** requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured inband average PSD level.

In either case, attenuation to levels below the general emission limits specified in §15.209(a) is not required.

#### 3.4.1 Test Setup

Refer to the APPENDIX I including path loss

#### 3.4.2 Test Procedures

The transmitter output is connected to a spectrum analyzer.

#### - Measurement Procedure 1 – Reference Level of KDB558074 D01v04

- 1. Set instrument center frequency to DTS channel center frequency.
- 2. Set the span to  $\geq$  1.5 times the DTS bandwidth.
- 3. Set the RBW = 100 kHz.
- 4. Set the VBW  $\geq$  3 x RBW.
- 5. Detector = peak.
- 6. Sweep time = auto couple.
- 7. Trace mode = max hold.
- 8. Allow trace to fully stabilize.
- 9. Use the peak marker function to determine the maximum PSD level LIMIT LINE = 20 dB below of the reference level.

#### - Measurement Procedure 2 - Unwanted Emissions of KDB558074 D01v04

- 1. Set the center frequency and span to encompass frequency range to be measured.
- 2. Set the RBW = 100 kHz.(Actual 1 MHz , See below note)
- 3. Set the VBW ≥ 3 x RBW.(Actual 3 MHz, See below note)
- 4. Detector = **peak**.
- 5. Ensure that the number of measurement points ≥ span / RBW
- 6. Sweep time = auto couple.
- 7. Trace mode = max hold.
- 8. Allow the trace to stabilize (this may take some time, depending on the extent of the span).
- 9. Use the peak marker function to determine the maximum amplitude level.

Note . The conducted spur	Note . The conducted spundus emission was tested with below settings.											
Frequency range	RBW	VBW	Detector	Trace	Sweep Point							
9 kHz ~ 30 MHz	100 kHz	300 kHz										
30 MHz ~ 10 GHz	1 MHz	3 MHz	Peak	Max Hold	40001							
10 GHz ~ 25 GHz	1 MHz	3 MHz										

**Note :** The conducted spurious emission was tested with below settings.

If the emission level with above setting was close to the limit (ie, less than 3 dB margin) then zoom scan is required using RBW = 100 kHz, VBW = 300 kHz, SPAN = 100 MHz and BINS = 2001 to get accurate emission level within 100 kHz BW.

#### FCC ID: ZNFV409V

#### 3.4.3 Test Results

🛈 Dt&C



#### TM 1 Reference (Test Channel : Lowest)

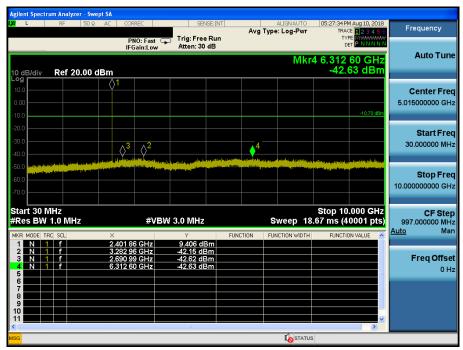
TM 1 Low Band-edge (Test Channel : Lowest)



Agiler		ctrun	n Ana	ılyzer	Swe	pt SA													
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2 3	N	1	f			1	9.855	5 MHz		-58.03 di	3m								Freq Offset
4																			•
5																			0 Hz
6																			
7																			
8																			
10																			
11																	~		
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MSG														IL ST.	ATUS	DC Co	upled		
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## TM 1 Conducted Spurious Emissions 1 (Test Channel : Lowest)

TM 1 Conducted Spurious Emissions 2 (Test Channel : Lowest)



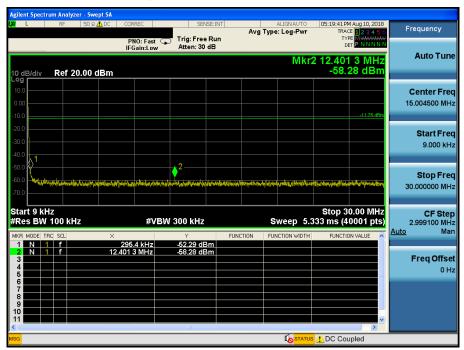
Agilent Spectrum Analyzer - Sv					
<b>X L</b> RF 50:	Ω AC CORREC	SENSE:INT	ALIGNAUTO Avg Type: Log-Pwr	05:28:30 PM Aug 10, 2018 TRACE 2 3 4 5 6 TYPE MWWWWW DET P N N N N N	Frequency
10 dB/div Ref 20.00	IFGain:Low	Atten: 30 dB	Mkr4 2	23.856 250 GHz -35.20 dBm	Auto Tune
Log 10.0 0.00 -10.0				-10.70 dBm	Center Fred 17.500000000 GH;
	n an			<u></u>	Start Free 10.000000000 GH
-50.0 -60.0 -70.0					Stop Free 25.00000000 GH
Start 10.000 GHz #Res BW 1.0 MHz	#VB	W 3.0 MHz	Sweep 40	Stop 25.000 GHz .00 ms (40001 pts)	<b>CF Stej</b> 1.500000000 GH <u>Auto</u> Ma
1 N 1 F 2 N 1 F 3 N 1 F 4 N 1 F 5	24.217 375 GHz 24.806 875 GHz 24.691 000 GHz 23.856 250 GHz	-34.14 dBm -34.26 dBm -34.78 dBm -35.20 dBm			Freq Offse 0 H:
6 7 8 9 9 10					
< Iss			<b>I</b> o status		

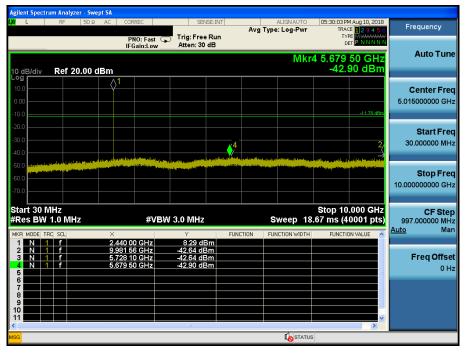
## TM 1 Conducted Spurious Emissions 3 (Test Channel : Lowest)



#### TM 1 Reference (Test Channel : Middle)

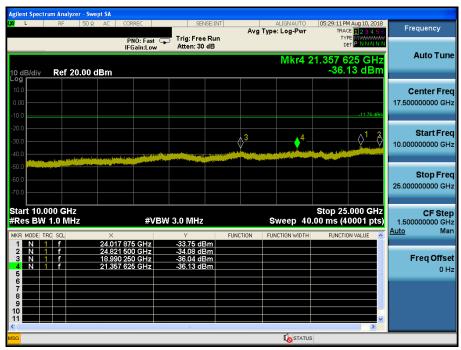
TM 1 Conducted Spurious Emissions 1 (Test Channel : Middle)





#### TM 1 Conducted Spurious Emissions 2 (Test Channel : Middle)

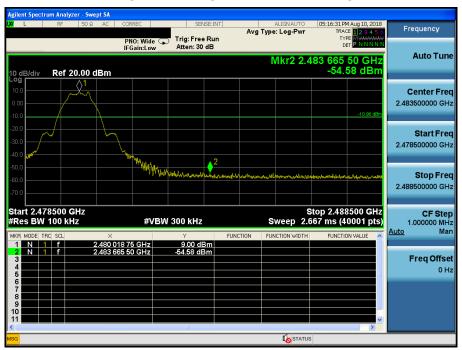
TM 1 Conducted Spurious Emissions 3 (Test Channel : Middle)

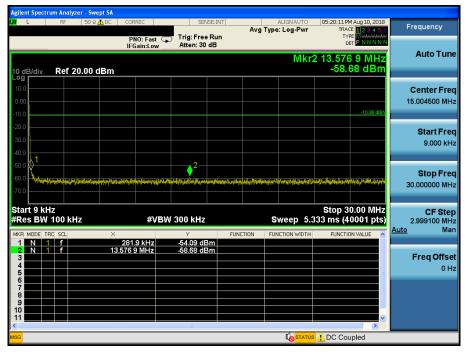




#### TM 1 Reference (Test Channel : Highest)

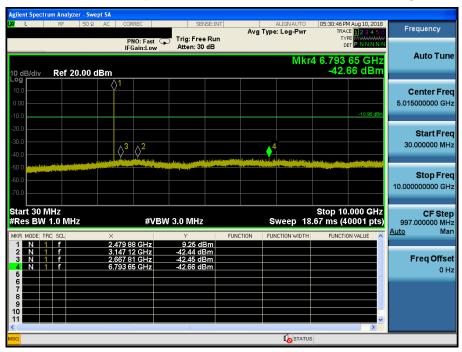
TM 1 High Band-edge (Test Channel : Highest)





### TM 1 Conducted Spurious Emissions 1 (Test Channel : Highest)

TM 1 Conducted Spurious Emissions 2 (Test Channel : Highest)

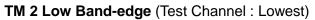


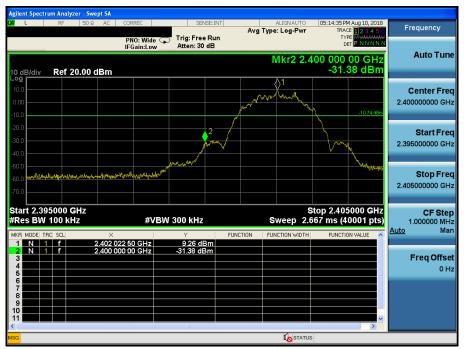
L RF 50			SENSE:	Avg	ALIGNAUTO Type: Log-Pwr	05:31:20 PM A TRACE	123456	Frequency
	IFG	0: Fast 😱 ain:Low	Atten: 30 dB	in 	Mkr4 2	4.428 87	5 GHz	Auto Tun
0 dB/div Ref 20.00	dBm					-35.0	9 dBm	Center Free 17.500000000 GH
	ورون ورون ورون ورون ورون ورون ورون ورون				approxit for the form of the form of the second	a del anno 1990 anno 1	-0 <sup>3</sup> •4!	Start Fre 10.000000000 GH
50.0 60.0 70.0								<b>Stop Fre</b> 25.00000000 GH
Start 10.000 GHz #Res BW 1.0 MHz		#VBW	3.0 MHz		Sweep 40	•	001 pts)	<b>CF Ste</b> 1.50000000 GH Auto Ma
MKR         MODE         TRC         SCL           1         N         1         f           2         N         1         f           3         N         1         f           4         N         1         f           5	× 24.725 500 24.568 000 24.091 000 24.428 875	GHz GHz	-34.34 dBm -34.72 dBm -34.75 dBm -35.09 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION	VALUE	Freq Offse
6 7 8 9 10								
SG SG					STATUS	ĺ		

## TM 1 Conducted Spurious Emissions 3 (Test Channel : Highest)



#### TM 2 Reference (Test Channel : Lowest)

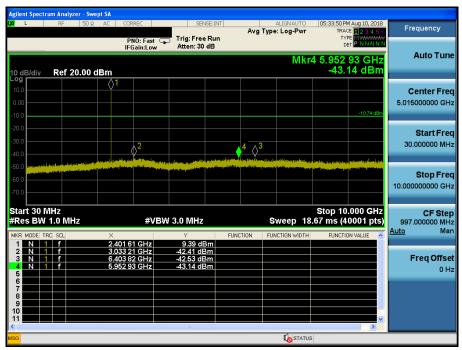




				alyzer - Sw																
L <mark>XI</mark>	L		RF	50 Ω	🛕 DC	COR	REC		SEN	ISE:INT		Avg Ty					M Aug 10, 201 CE <u>1 2 3 4 5</u>		Frequenc	v
						PN	IO: Fast	0	Trig: Free			Avgiy	pe: L	_og-rw	r	TY	PE MWWWWW ET P NNNN	₩₩		,
							ain:Low		Atten: 30	dB						D	et <mark>PINNN</mark>			
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	s B			kH7			#V	BW	300 kHz				Sw	een <i>!</i>	5 33		0001 pt		2.999100	Step
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мкн 1	MODE	TRC 1	SCL		×	281	9 kHz		Y -53.536 dE		INCI	rion f	UNCT	ION WID1	TH	FUNCTI	ON VALUE	-	_	
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## TM 2 Conducted Spurious Emissions 1 (Test Channel : Lowest)

TM 2 Conducted Spurious Emissions 2 (Test Channel : Lowest)



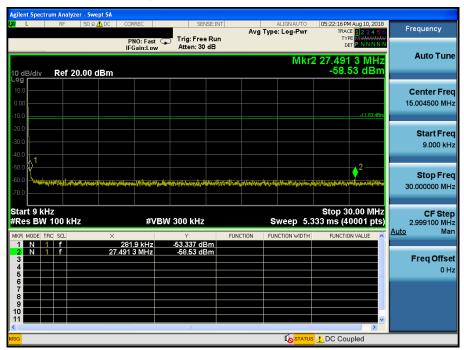
L RF 50		REC	SENSE:IN	Avg	ALIGNAUTO Type: Log-Pwr	05:32:54 PM Aug TRACE	23456	Frequency
	P IF	NO: Fast Ģ Gain:Low	Atten: 30 dB		Mkr4 2	DET P		Auto Tun
dB/div Ref 20.00	) dBm					-34.56	dBm	
.0								Center Fre
.0							10.74 dBm	17.500000000 GH
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J.O								Stop Fre
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art 10.000 GHz tes BW 1.0 MHz		#\/B\/	V 3.0 MHz		Sween 40	Stop 25.00 .00 ms (4000		CF Ste
R MODE TRC SCL	×	#VDV	Y 3.0 MH2	FUNCTION	FUNCTION WIDTH	FUNCTION VA		1.50000000 GI <u>Auto</u> M
1 N 1 F 2 N 1 F	24.740 50 24.703 37	5 GHz	-33.63 dBm -33.88 dBm					
3 N 1 f 4 N 1 f	24.969 25 24.835 00		-34.32 dBm -34.56 dBm					Freq Offs
							-	
							>	

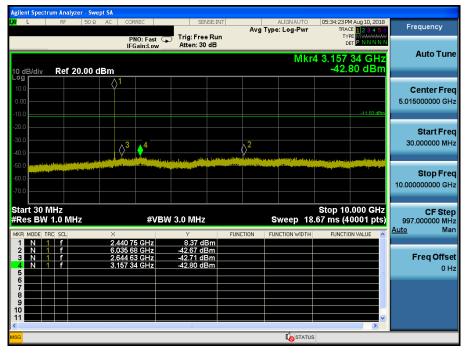
## TM 2 Conducted Spurious Emissions 3 (Test Channel : Lowest)



#### TM 2 Reference (Test Channel : Middle)

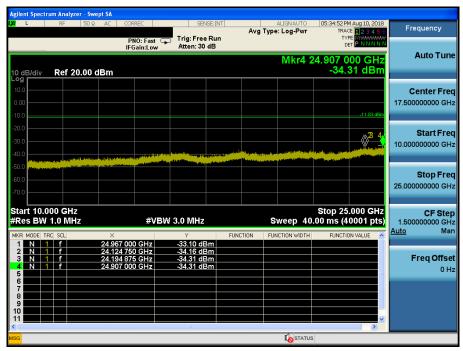
TM 2 Conducted Spurious Emissions 1 (Test Channel : Middle)





## TM 2 Conducted Spurious Emissions 2 (Test Channel : Middle)

TM 2 Conducted Spurious Emissions 3 (Test Channel : Middle)





## TM 2 Reference (Test Channel : Highest)

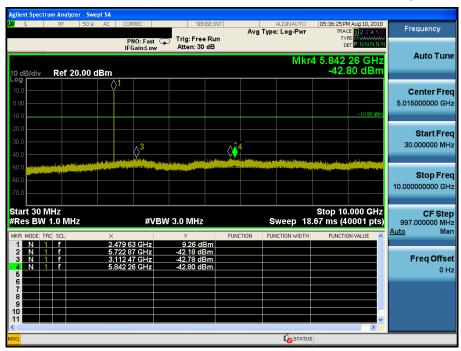
TM 2 High Band-edge (Test Channel : Highest)



	nt Spec	ctrun		lyzer - Sv													
L <b>XI</b>	L		RF	50 \$	Ω 🧘 DO		RREC			ISE:INT			ALIGNAUTO	TRA	M Aug 10, 2018 CE 12345 ( PE M WAAAAAA		Frequency
10 d Log	B/div		Ref	20.00	dBn	IF	PNO: Fast Gain:Lov		Atten: 30				Mkr	2 24.06 <sup>°</sup>	1 0 MHz 53 dBm		Auto Tune
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-20.0 -30.0 -40.0																	Start Freq 9.000 kHz
-50.0 -60.0 -70.0	¥.,,,	y) proge	tiken op h	ndependisid	<b>1</b>	láp traigh	<b>A</b> utomation	et git sta	anteinen oppinister førte	an genteranti	hara	in water	Nighter Production	2			Stop Freq 30.000000 MHz
	rt9l sB∖			kHz			#V	/BW	300 kHz			s	weep 5.		0.00 MHz 0001 pts)	Auto	CF Step 2.999100 MHz Man
MKR 1 3 4 5 6 7 8 9 10 11 <	N	TRC 1 1	SCL f				1.9 kHz O MHz		Y -52,343 dE -58,53 dE	3m	FUNCT		IT I I I I I I I I I I I I I I I I I I		ON VALUE		Freq Offset 0 Hz
mod													- No STATU		upieu		

## TM 2 Conducted Spurious Emissions 1 (Test Channel : Highest)

TM 2 Conducted Spurious Emissions 2 (Test Channel : Highest)



L RF	50Ω AC	CORREC	SENSE:IA	Avg	ALIGNAUTO Type: Log-Pwr	05:35:43 PM Aug 10, 20 TRACE 1 2 3 4 1	Frequency
		PNO: Fast C IFGain:Low	Trig: Free Ru Atten: 30 dB	1	Mkr4 2	TYPE MAAAAA DET P N N N	Auto Tun
dB/div Ref 20	0.00 dBm					-34.43 dB	n
0.0							<b>Center Fre</b> 17.500000000 GH
20.0						-10.95 d	
30.0			and a state of the	pro 1414 March Colored			4 Start Fre 10.000000000 GH
50.0	en Marcel (Dirich producted)			a national de la constantion de la cons	A CONTRACTOR OF CONTRACTOR	a difference and a second s	Stop Fre
50.0 70.0							25.000000000 GH
tart 10.000 GHz Res BW 1.0 MH		#VB	№ 3.0 MHz		Sweep 40	Stop 25.000 GH .00 ms (40001 pt	s) 1.500000000 GH
IN 1 F		5 250 GHz	-33.62 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	Auto Ma
2 N 1 f 3 N 1 f 4 N 1 f	24.67	1 625 GHz 7 500 GHz 2 000 GHz	-33.69 dBm -33.78 dBm -34.43 dBm				Freq Offse 0 H
6 7 8							
9 10 11							<ul> <li>■</li> <li>■</li> </ul>
G					I STATUS	>	

## TM 2 Conducted Spurious Emissions 3 (Test Channel : Highest)

## 3.5 Unwanted Emissions (Radiated)

## Test Requirements and limit,

## §15.247(d), §15.205, §15.209 & RSS-247 [5.5], RSS-Gen [8.9], RSS-Gen [8.10]

In any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a) and (b), then the 15.209(a) limit in the table below has to be followed.

## • FCC Part 15.209(a) and (b)

Frequency (MHz)	Limit (uV/m)	Measurement Distance (meter)
0.009 ~ 0.490	2400/F (kHz)	300
0.490 ~ 1.705	24000/F (kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100 **	3
88 ~ 216	150 **	3
216 ~ 960	200 **	3
Above 960	500	3

\*\* Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 ~ 72 MHz, 76 ~ 88 MHz, 174 ~ 216 MHz or 470 ~ 806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.52025	156.52475 ~	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	12.57675 ~	156.52525	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	12.57725	156.7 ~ 156.9	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	13.36 ~ 13.41	162.0125 ~ 167.17	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.42 ~ 16.423	167.72 ~ 173.2	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	16.69475 ~	240 ~ 285	2655 ~ 2900		
8.291 ~ 8.294	16.69525	322 ~ 335.4	3260 ~ 3267		
8.362 ~ 8.366	16.80425 ~	399.90 ~ 410	3332 ~ 3339		
8.37625 ~ 8.38675	16.80475	608 ~ 614	3345.8 ~ 3358		
	25.5 ~ 25.67	960 ~ 1240	3600 ~ 4400		
	37.5 ~ 38.25				
	73 ~ 74.6				
	74.8 ~ 75.2				

• FCC Part 15.205 (a) : Only spurious emissions are permitted in any of the frequency bands listed below :

• FCC Part 15.205(b) : The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.



## 3.5.1 Test Setup

Refer to the APPENDIX I.

## 3.5.2 Test Procedures

- 1. The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m.
- 2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
- 3. 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.
- 4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 6. Repeat above procedures until the measurements for all frequencies are complete.

## Note: Measurement Instrument Setting for Radiated Emission Measurements.

#### 1. Frequency Range Below 1 GHz

RBW = 100 or 120 kHz, VBW = 3 x RBW, Detector = Peak or Quasi Peak

#### 2. Frequency Range > 1 GHz

#### Peak Measurement > 1 GHz

RBW = 1 MHz, VBW = 3 MHz, Detector = Peak, Sweep time = Auto, Trace mode = Max Hold until the trace stabilizes

#### Average Measurement> 1GHz

- 1. RBW = 1 MHz (unless otherwise specified).
- 2. VBW  $\geq$  3 x RBW.
- 3. Detector = RMS (Number of points ≥ 2 x Span / RBW)
- 4. Averaging type = power (i.e., RMS).
- 5. Sweep time = auto.
- 6. Perform a trace average of at least 100 traces.
- 7. A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:
- 1) If power averaging (RMS) mode was used in step 4, then the applicable correction factor is 10 log(1/x), where x is the duty cycle.
- 2) If linear voltage averaging mode was used in step 4, then the applicable correction factor is 20 log(1/x), where x is the duty cycle.
- 3) If a specific emission is demonstrated to be continuous (≥ 98 percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

Test Mode	Duty Cycle (%)	T <sub>on</sub> (ms)	T <sub>on</sub> + T <sub>off</sub> (ms)	DCF = 10 log(1/Duty) (dB)
TM 1	85.36	2.134	2.500	0.69
TM 2	57.29	1.076	1.878	2.42

Note : Refer to appendix II for duty cycle measurement procedure and plots



## 3.5.3 Test Results

## Frequency Range : 9 kHz ~ 25 GHz \_ TM 1

## Lowest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2389.90	V	Z	PK	50.81	2.70	N/A	N/A	53.51	74.00	20.49
2389.50	V	Z	AV	41.43	2.70	0.69	N/A	44.82	54.00	9.18
4802.60	Н	Z	PK	51.20	1.43	N/A	N/A	52.63	74.00	21.37
4802.22	Н	Z	AV	39.51	1.43	0.69	N/A	41.63	54.00	12.37

## Middle Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4880.97	Н	Z	PK	49.43	1.63	N/A	N/A	51.06	74.00	22.94
4880.89	Н	Z	AV	39.10	1.63	0.69	N/A	41.42	54.00	12.58

## Highest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.73	V	Z	PK	52.96	3.10	N/A	N/A	56.06	74.00	17.94
2483.56	V	Z	AV	41.71	3.10	0.69	N/A	45.50	54.00	8.50
4960.71	Н	Z	PK	49.39	1.87	N/A	N/A	51.26	74.00	22.74
4960.22	Н	Z	AV	39.00	1.87	0.69	N/A	41.56	54.00	12.44

#### Note.

1. The radiated emissions were investigated 9kHz to 25GHz. And no other spurious and harmonic emissions were found above listed frequencies.

2. Information of Distance Factor

For finding emissions, the test distance might be reduced from 3 m to 1 m. In this case, the distance factor (-9.54 dB) is applied to the result.

- Calculation of distance factor = 20 log( applied distance / required distance ) = 20 log( 1 m / 3 m ) = -9.54 dB

When distance factor is "N/A", the distance is 3 m and distance factor is not applied.

3. Sample Calculation.

Margin = Limit - Result / Result = Reading + T.F + D.C.F / T.F = AF + CL - AG

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,

DCF = Duty Cycle Correction Factor.



## Frequency Range : 9 kHz ~ 25 GHz \_ TM 2

## Lowest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2389.75	V	Z	PK	51.87	2.70	N/A	N/A	54.57	74.00	19.43
2389.40	V	Z	AV	41.34	2.70	2.42	N/A	46.46	54.00	7.54
4803.82	Н	Z	PK	49.82	1.44	N/A	N/A	51.26	74.00	22.74
4804.54	Н	Z	AV	39.51	1.44	2.42	N/A	43.37	54.00	10.63

## Middle Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4878.71	Н	Z	PK	49.38	1.63	N/A	N/A	51.01	74.00	22.99
4878.68	Н	Z	AV	39.20	1.63	2.42	N/A	43.25	54.00	10.75

## Highest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.51	V	Z	PK	56.03	3.10	N/A	N/A	59.13	74.00	14.87
2483.51	V	Z	AV	41.99	3.10	2.42	N/A	47.51	54.00	6.49
4961.78	Н	Z	PK	49.54	1.88	N/A	N/A	51.42	74.00	22.58
4962.17	Н	Z	AV	38.91	1.88	2.42	N/A	43.21	54.00	10.79

#### Note.

1. The radiated emissions were investigated 9kHz to 25GHz. And no other spurious and harmonic emissions were found above listed frequencies.

2. Information of Distance Factor

For finding emissions, the test distance might be reduced from 3 m to 1 m. In this case, the distance factor (-9.54 dB) is applied to the result.

- Calculation of distance factor = 20 log( applied distance / required distance ) = 20 log( 1 m / 3 m ) = -9.54 dB

When distance factor is "N/A", the distance is 3 m and distance factor is not applied.

3. Sample Calculation.

Margin = Limit - Result / Result = Reading + T.F + D.C.F / T.F = AF + CL - AG

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,

DCF = Duty Cycle Correction Factor.



## 3.6 Power line Conducted Emissions

## Test Requirements and limit, §15.207 & RSS-Gen [8.8]

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN).

	Conducted Limit (dBuV)						
Frequency Range (MHz)	Quasi-Peak	Average					
0.15 ~ 0.5	66 to 56 *	56 to 46 *					
0.5 ~ 5	56	46					
5 ~ 30	60	50					

\* Decreases with the logarithm of the frequency

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

## 3.6.1 Test Setup

See test photographs for the actual connections between EUT and support equipment.

## 3.6.2 Test Procedures

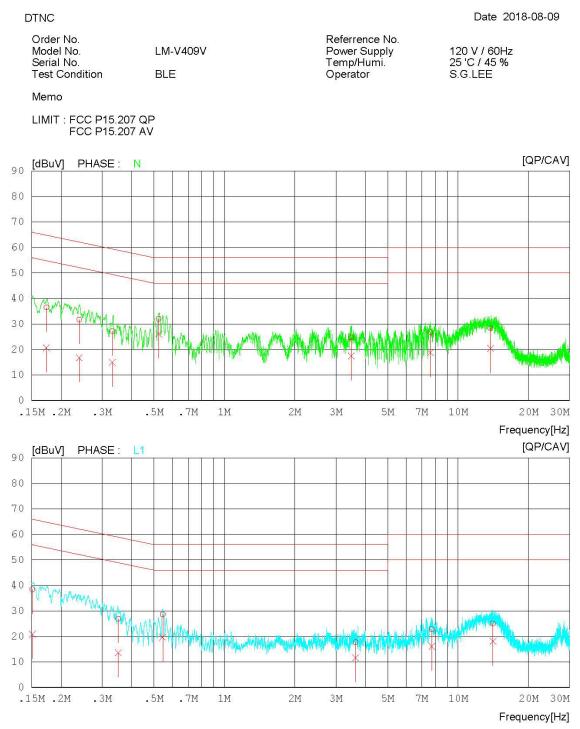
Conducted emissions from the EUT were measured according to the ANSI C63.10-2013.

- The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
- 2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
- 3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
- 4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

## 3.6.3 Test Results

## AC Line Conducted Emissions (Graph) TM 2 & Test Channel : Lowest

## **Results of Conducted Emission**



DTNC

6 7.60840 16.60 8.65 7 13.76160 17.99 10.09

 7
 13.76160
 17.99
 10.09
 10.28

 8
 0.15096
 28.41
 10.85
 9.99

 9
 0.35152
 16.96
 3.57
 9.97

 10
 0.54517
 18.64
 9.64
 9.98

 11
 3.64080
 7.60
 1.50
 10.06

 12
 7.72340
 12.61
 5.85
 10.15

 13
 14.07860
 14.64
 7.78
 10.29

## AC Line Conducted Emissions (List) TM 2 & Test Channel : Lowest

10.15

10.28

## **Results of Conducted Emission**

 26.75
 18.80
 60.00
 50.00
 33.25
 31.20

 28.27
 20.37
 60.00
 50.00
 31.73
 29.63

38.4020.84 65.95 55.95 27.5535.11

 26.93
 13.54
 58.93
 48.93
 32.00
 35.39

 28.62
 19.62
 56.00
 46.00
 27.38
 26.38

 17
 66
 11
 56
 56.00
 46.00
 27.38
 26.38

17.6611.56 56.00 46.00 38.34 34.44

22.7616.00 60.00 50.00 37.2434.00 24.9318.07 60.00 50.00 35.0731.93

Date 2018-08-09

Ν

N

T.1

L1 L1

L1

L1L1

Order No. Model No. Serial No. Test Condition		LM-V409V BLE	F	Referrence No. Power Supply Femp/Humi. Dperator		120 V / 60Hz 25 'C / 45 % S.G.LEE	
Memo							
LIMIT	: FCC P15.207 FCC P15.207						
NO	ç	READING C.FACTOR QP CAV BuV][dBuV] [dB]	RESULT QP CAV [dBuV][dBuV	LIMIT QP CAV /] [dBuV][dBuV]	MARGIN QP CAV [dBuV][dBuV	PHASE ]	
1 2 3	0.17336 26. 0.23965 21. 0.33220 17.	.77 6.79 9.95	36.5320.59 31.7216.74 27.1614.90	64.80 54.80 62.11 52.11 59.40 49.40	28.2734.21 30.3935.37 32.2434.51	N N N	
4 5	0.52414 22. 3.48760 14	.0616.04 9.99 .55 7.35 10.06	32.05 26.03 24.61 17.41	56.00 46.00 56.00 46.00	23.95 19.97 31.39 28.59	N N	

## 3.7 Occupied Bandwidth

## Test Requirements, RSS-Gen [6.7]

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99 % emission bandwidth, as calculated or measured.

## 3.7.1 Test Setup

## 3.7.2 Test Procedures

The 99 % power bandwidth was measured with a calibrated spectrum analyzer.

The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3 × RBW.

Spectrum analyzer plots are included on the following pages.

## 3.7.3 Test Results

-NA

## 4. ANTENNA REQUIREMENTS

## According to FCC 47 CFR §15.203

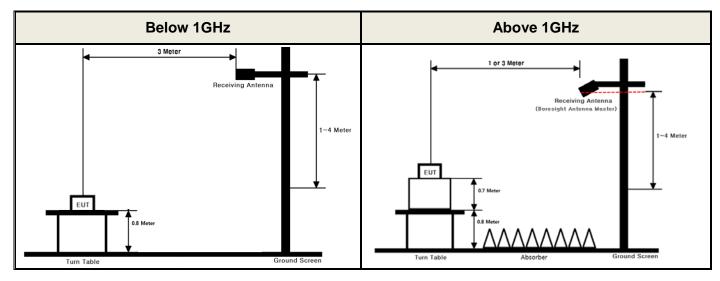
"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient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

The antenna is attached on the device by means of unique coupling method (Spring Tension). Therefore this E.U.T Complies with the requirement of §15.203

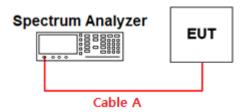
## **APPENDIX I**

## Test set up diagrams

## Radiated Measurement



## Conducted Measurement



## Path loss information

Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)
0.03	0.46	15	2.64
1	0.66	20	4.16
2.402 & 2.440 & 2.480	1.05	25	4.97
5	1.80	-	-
10	2.00	-	-

Note 1: The path loss from EUT to Spectrum analyzer was measured and used for test. Path loss (S/A's correction factor) = Cable A (Attenuator, Applied only when it was used externally)

## **APPENDIX II**

## **Duty cycle plots**

## Test Procedure

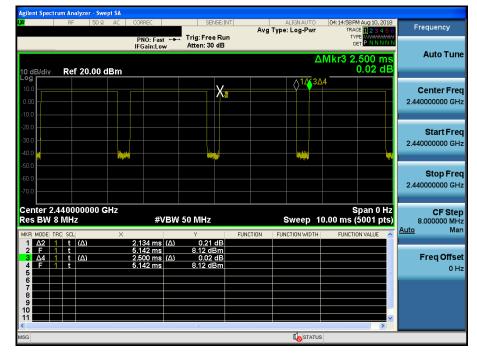
## Duty Cycle was measured using Section 6.0 b) of KDB558074 D01v04 :

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.)

## **Duty Cycle**

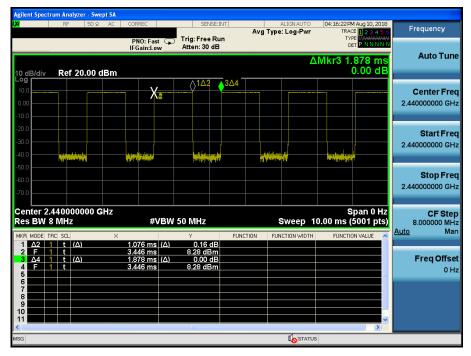
## TM 1 Test Channel : Middle





**Duty Cycle** 

## TM 2 Test Channel : Middle

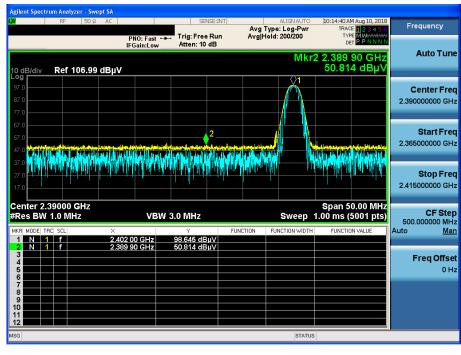


## **APPENDIX III**

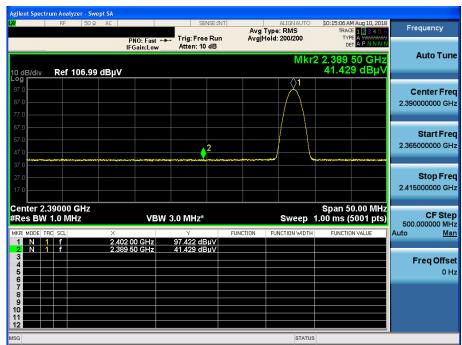
## **Unwanted Emissions (Radiated) Test Plot**







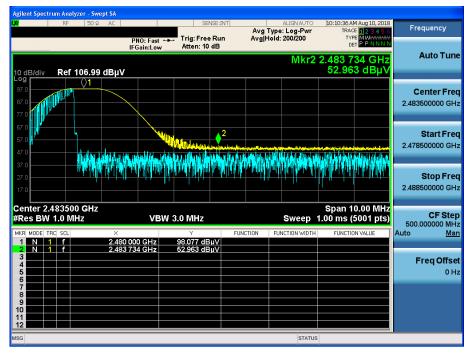
## TM1 & Lowest & Z & Ver



# **Dt&C**

## TM1 & Highest & Z & Ver

## **Detector Mode : PK**



## TM1 & Highest & Z & Ver





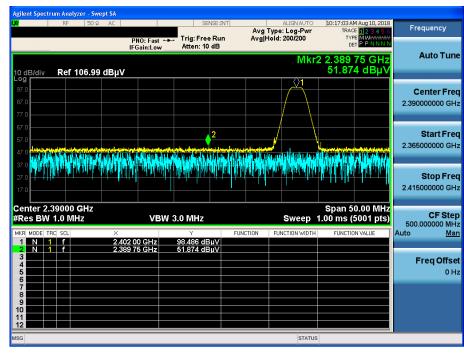
## TM1 & Lowest & Z & Hor



#### FCC ID: ZNFV409V

## TM2 & Lowest & Z & Ver

## **Detector Mode : PK**



#### TM2 & Lowest & Z & Ver

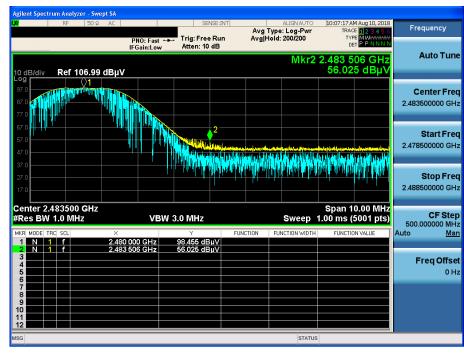
#### lent Spectrum Anal Swent SA Frequency Avg Type: RMS Avg|Hold: 200/200 Trig: Free Run Atten: 10 dB A WARA IYPE DE1 PNO: Fast +++ IFGain:Low Auto Tune Mkr2 2.389 40 GHz 41.343 dBµ\ Ref 106.99 dBµV 10 dB/div $\wedge$ Center Freq 2.390000000 GHz Start Freq 2.365000000 GHz 12 Stop Freq 2.415000000 GHz Center 2.39000 GHz #Res BW 1.0 MHz Span 50.00 MHz 1.00 ms (5001 pts) CF Step 500.000000 MHz VBW 3.0 MHz\* Sweep Man uto 2.402 00 GHz 2.389 40 GHz N 1 f 94.935 dBµV 41.343 dBµV Freq Offset 0 Hz STATUS



## **Dt&C**

## TM2 & Highest & Z & Ver

## **Detector Mode : PK**



## TM2 & Highest & Z & Ver





## TM2 & Lowest & Z & Hor

	RF	50Ω AC		SE	NSE:INT		ALIGN AUTO	11:08:00 AM Aug 10, 2018	Francisco
			PNO: Fast ← IFGain:High	Trig: Fre #Atten: 0			ype: RMS old: 200/200	TRACE 123456 TYPE A WWWWW DET A P N N N N	
og	Ref 71	.99 dBµV					Mkr1	4.804 544 GHz 39.511 dBµV	Auto Tu
67.0									<b>Center Fr</b> 4.804000000 G
62.0									<b>Start Fr</b> 4.799000000 G
52.0									Stop Fr 4.809000000 G
47.0					1-				CF St 2.402000000 G
37.0	rey-valle-y-dayla	Harrisovensa	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	<b>1905 in 1</b> 00 in 100 in	tiferi/entiqueist	elisik, shiike	ttatt gölde side of the constant	inner frankriger fin frankriger og som en som e Som en som en	Auto <u>M</u>
32.0									Freq Offs 0
	.804000 (	GHz						Span 10.00 MHz	
	1.0 MHz		VBW	3.0 MHz*			Sweep	1.00 ms (5001 pts)	