

# **FCC Test Report**

Report No.: AGC01559210205FE03

FCC ID	:	2AANZUSBL
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	2-IN-1 SPEAKER & LED LAMP
BRAND NAME	÷	N/A
MODEL NAME	:	SA-USBL-WHT, SA-USBL, SA-USBL-XXX, HY-USBL, VE-USBL
APPLICANT	:	DGL Group, Ltd.
DATE OF ISSUE	:	Mar. 03, 2021
STANDARD(S)	;	FCC Part 15.247
REPORT VERSION	:	V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd

AGC CO



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# **REPORT REVISE RECORD**

Re	port Version	Revise Time	Issued Date	Valid Version	Notes
	V1.0	. /	Mar. 03, 2021	Valid	Initial Release

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# **1. VERIFICATION OF CONFORMITY**

Applicant	DGL Group,Ltd.
Address	195 Raritan Center Parkway Edison, NJ 08837
Manufacturer	DGL Group,Ltd.
Address	195 Raritan Center Parkway Edison, NJ 08837
Factory	DGL Group,Ltd.
Address	195 Raritan Center Parkway Edison, NJ 08837
Product Designation	2-IN-1 SPEAKER & LED LAMP
Brand Name	N/A
Test Model	SA-USBL-WHT
Series Model	SA-USBL, SA-USBL-XXX, HY-USBL, VE-USBL
Difference Description	All the same except for the appearance color.
Date of test	Feb. 18, 2021 to Mar. 03, 2021
Deviation	No any deviation from the test method
Condition of Test Sample	Normal
Test Result	Pass
Report Template	AGCRT-US-BR/RF

We hereby certify that:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of FCC PART 15.247.

Prepared By

Eddy Lin

Eddy Liu (Project Engineer)

Mar. 03, 2021

Max Zhan

Reviewed By

Max Zhang (Reviewer)

Mar. 03, 2021

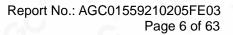
Approved By

Forrest Lei (Authorized Officer)

Mar. 03, 2021

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# 2. GENERAL INFORMATION

# 2.1. PRODUCT DESCRIPTION

The EUT is designed as "2-IN-1 SPEAKER & LED LAMP". It is designed by way of utilizing the GFSK, Pi/4 DQPSK technology to achieve the system operation.

A major technical description of EUT is described as following

Operation Frequency	2.402 GHz to 2.480 GHz
RF Output Power	-14.051dBm (Max)
Bluetooth Version	V5.0
Modulation	BR ⊠GFSK, EDR ⊠π /4-DQPSK, □8DPSK BLE □GFSK 1Mbps □GFSK 2Mbps
Number of channels	79
Hardware Version	V1.0
Software Version	V1.0
Antenna Designation	PCB Antenna (Comply with requirements of the FCC part 15.203)
Antenna Gain	0.68dBi
Power Supply	DC 5V by USB
Note: The EUT doesn't suppo	t 8DPSK and BLE.

# 2.2. TABLE OF CARRIER FREQUENCYS

Frequency Band	Channel Number	Frequency
	0	2402 MHz
	1 0	2403 MHz
C CC	38	2440 MHz
2402~2480MHz	39	2441 MHz
C 2	40	2442 MHz
	77	2479 MHz
- C	78	2480 MHz

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# 2.3. RECEIVER INPUT BANDWIDTH

The input bandwidth of the receiver is 1.3MHz, in every connection one Bluetooth device is the master and the other one is slave. The master determines the hopping sequence. The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally, the type of connection (e.g. single of multi slot packet) is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing according to the packet type of the connection. Also, the slave of the connection will use these settings. Repeating of a packet has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence.

#### 2.4. EXAMPLE OF A HOPPING SEQUENCY IN DATA MODE

Example of a hopping sequence in data mode: 40, 21, 44, 23, 04, 15, 66, 56, 19, 78, 07, 28, 69, 55, 36, 45, 05, 13, 43, 74, 57, 35, 67, 76, 02, 34, 54, 63, 42, 11, 30, 06, 64, 25, 75, 48, 17, 33, 58, 01, 29, 14, 51, 72, 03, 31, 50, 61, 77, 18, 10, 47, 12, 68, 08, 49, 20, 00, 73, 09, 16, 60, 71, 41, 24, 53, 38, 26, 46, 37, 65, 32, 70, 52, 27, 59, 22, 62, 39

# 2.5. EQUALLY AVERAGE USE OF FREQUENCIES AND BEHAVIOUR

The generation of the hopping sequence in connection mode depends essentially on two input values:

1. LAP/UAP of the master of the connection.

2. Internal master clock.

The LAP (lower address part) are the 24 LSB's of the 48 BD\_ADDRESS. The BD\_ADDRESS is an unambiguous number of every Bluetooth unit. The UAP (upper address part) are the 24MSB's of the 48BD\_ADDRESS

The internal clock of a Bluetooth unit is derived from a free running clock which is never adjusted and is never turned off. For behavior action with other units only offset is used. It has no relation to the time of the day. Its resolution is at least half the RX/TX slot length of 312.5us. The clock has a cycle of about one day(23h30). In most case it is implemented as 28 bits counter. For the deriving of the hopping sequence the entire. LAP (24 bits),4LSB's(4bits) (Input 1) and the 27MSB's of the clock (Input 2) are used. With this input values different mathematical procedures (permutations, additions, XOR-operations) are performed to generate the Sequence. This will be done at the beginning of every new transmission.

Regarding short transmissions the Bluetooth system has the following behavior:

The first connection between the two devices is established, a hopping sequence was generated. For Transmitting the wanted data the complete hopping sequence was not used. The connection ended.

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The second connection will be established. A new hopping sequence is generated. Due to the fact the Bluetooth clock has a different value, because the period between the two transmission is longer (and it Cannot be shorter) than the minimum resolution of the clock(312.5us). The hopping sequence will always differ from the first one.

# 2.6. RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID: 2AANZUSBL** filing to comply with the FCC PART 15.247 requirements.

# 2.7. TEST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10 (2013). Radiated testing was performed at an antenna to EUT distance 3 meters.

# 2.8. SPECIAL ACCESSORIES

Refer to section 5.2.

# 2.9. EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

# 2.10. ANTENNA REQUIREMENT

This intentional radiator is designed with a permanently attached antenna of an antenna to ensure that no antenna other than that furnished by the responsible party shall be used with the device. For more information of the antenna, please refer to the APPENDIX B: PHOTOGRAPHS OF EUT.

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# **3. MEASUREMENT UNCERTAINTY**

The reported uncertainty of measurement y  $\pm$ U, where expended uncertainty U is based on a standard

uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

- Uncertainty of Conducted Emission, Uc = ±3.1 dB
- Uncertainty of Radiated Emission below 1GHz, Uc = ±4.0 dB
- Uncertainty of Radiated Emission above 1GHz, Uc = ±4.8 dB
- Uncertainty of total RF power, conducted,  $Uc = \pm 0.8$ dB
- Uncertainty of spurious emissions, conducted, Uc = ±2.7dB
- Uncertainty of Occupied Channel Bandwidth: Uc = ±2 %
- Uncertainty of Dwell Time:  $Uc = \pm 2\%$
- Uncertainty of Frequency:  $Uc = \pm 2 \%$

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# **4. DESCRIPTION OF TEST MODES**

NO.	TEST MODE DESCRIPTION
1	Low channel GFSK
2	Middle channel GFSK
3	High channel GFSK
4	Low channel π/4-DQPSK
5	Middle channel π/4-DQPSK
6	High channel π/4-DQPSK
7	Hopping mode GFSK
8	Hopping mode π/4-DQPSK

Note:

- 1. Only the result of the worst case was recorded in the report, if no other cases.
- 2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.
- 3. For Conducted Test method, a temporary antenna connector is provided by the manufacture.

# Software Setting

FCCAssist 2.4	
BR/EDR BLE	
MODE TX -	
Channel 0   Packet type 1-DH5	Data Types Pn9 🔻
Transmit Power 10   Hopping OFF	
2020-12-04_13:38:08 Channel: 0 Data Types: Pn9 Transmit Power : 10 Packet type: 1-DH5 Send configuration information successfully	▲ Serial Port COM2
2020-12-04_13:38:45 Channel: 0 Data Types: Pn9 Transmit Power: 10 Packet type: 2-DH5 Send configuration information successfully 2020-12-04_13:40:50 Channel: 0 Data Types: Pn9 Transmit Power: 10 Packet type: 1-DH5 Send configuration information successfully	Description: 1 Channel: range 0-78, corresponding frequency 2.402GHz-2.480GHZ 2 Transmit Power range 0-10, 0 is the minimum, maximum 10

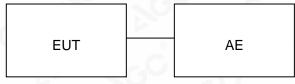
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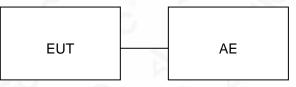
# **5. SYSTEM TEST CONFIGURATION**

**5.1. CONFIGURATION OF EUT SYSTEM** 

Radiated Emission Configure:



Conducted Emission Configure:



# 5.2. EQUIPMENT USED IN TESTED SYSTEM

ltem	Equipment	Model No.	ID or Specification	Remark
1	2-IN-1 SPEAKER & LED LAMP	SA-USBL-WHT	2AANZUSBL	EUT
2	Control Box	N/A	USB-TTL	AE

# **5.3. SUMMARY OF TEST RESULTS**

FCC RULES	DESCRIPTION OF TEST	RESULT
15.247 (b)(1)	Peak Output Power	Compliant
15.247 (a)(1)	20 dB Bandwidth	Compliant
15.247 (d)	Conducted Spurious Emission	Compliant
15.209	Radiated Emission	Compliant
15.247 (a)(1)(iii)	Number of Hopping Frequency	Compliant
15.247 (a)(1)(iii)	Time of Occupancy	Compliant
15.247 (a)(1)	Frequency Separation	Compliant
15.207	Conducted Emission	Compliant

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# 6. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd	
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China	
Designation Number	CN1259	
FCC Test Firm Registration Number	975832	
A2LA Cert. No.	5054.02	
Description	Attestation of Global Compliance (Shenzhen) Co., Ltd is accredited by A2LA	

# TEST EQUIPMENT OF CONDUCTED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESPI	101206	May 15, 2020	May 14, 2021
LISN	R&S	ESH2-Z5	100086	Jul. 03, 2020	Jul. 02, 2021
Test software	R&S	ES-K1(Ver.V1.71)	N/A	N/A	N/A

# TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	May 15, 2020	May 14, 2021
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Dec. 07, 2020	Dec. 06, 2021
2.4GHz Filter	EM Electronics	2400-2500MHz	N/A	Mar. 23, 2020	Mar. 22, 2022
Attenuator	ZHINAN	E-002	N/A	Sep. 03, 2020	Sep. 02, 2022
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Sep. 21, 2019	Sep. 20, 2021
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	May 22, 2020	May 21, 2022
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	May 17, 2019	May 16, 2021
Broadband Preamplifier	ETS LINDGREN	3117PA	00225134	Sep. 03, 2020	Sep. 02, 2022
ANTENNA	SCHWARZBECK	VULB9168	494	Jan. 08, 2021	Jan. 07, 2023
Test software	Tonscend	JS32-RE (Ver.2.5)	N/A	N/A	N/A

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# 7. PEAK OUTPUT POWER

# 7.1. MEASUREMENT PROCEDURE

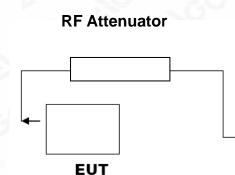
For peak power test:

- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2. Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
- 3. RBW > 20 dB bandwidth of the emission being measured.
- 4. VBW  $\geq$ RBW.
- 5. Sweep: Auto.
- 6. Detector function: Peak.
- 7. Trace: Max hold.

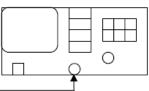
Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

# 7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

# PEAK POWER TEST SETUP







RF Cable

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#### 7.3. LIMITS AND MEASUREMENT RESULT

PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MOUDULATION							
Frequency (GHz)	Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail				
2.402	-16.428	21	Pass				
2.441	-15.553	21	Pass				
2.480	-14.799	21	Pass				





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PEAK OUTPUT POWER MEASUREMENT RESULT FOR Π/4-DQPSK MODULATION								
Frequency (GHz)Peak Power (dBm)Applicable Limits (dBm)Pass or Fa								
2.402	-15.792	21	Pass					
2.441	-14.848	21	Pass					
2.480	-14.051	21	Pass					

CH0

08 PM Feb 26, 2021 Frequency Avg Type: Log-Pwi Avg|Hold: 100/100 Cen 02000000 GHz Trig: Free Run Atten: 30 dB PNO: Fast IFGain:Low Auto Tune Mkr1 2.401 780 -15.792 dBm Ref 20.00 dBm 10 dB/div **Center Freq** 2.402000000 GHz Start Freq 2.399500000 GHz **♦**<sup>1</sup> Stop Freq 2.404500000 GH CF Step 500.000 kHz Man <u>Auto</u> **Freq Offset** 0 Hz Span 5.000 MHz Sweep 1.000 ms (1001 pts) Center 2.402000 GHz #Res BW 1.5 MHz #VBW 5.0 MHz

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CH39



CH78



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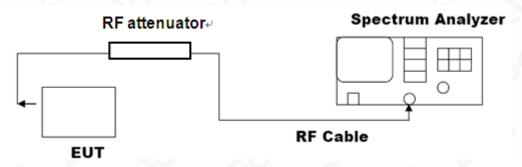


# 8. 20DB BANDWIDTH

### **8.1. MEASUREMENT PROCEDURE**

- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2, Set the EUT Work on the top, the middle and the bottom operation frequency individually.
- 3. Set Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hoping channel The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW; Sweep = auto; Detector function = peak
- 4. Set SPA Trace 1 Max hold, then View.

# 8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



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#### **8.3. LIMITS AND MEASUREMENT RESULTS**

MEASUREMENT RESULT FOR GFSK MOUDULATION							
Angliachte Limite		Measurement Result					
Applicable Limits	Test Data	(MHz)	Criteria				
	Low Channel	0.956	PASS				
N/A	Middle Channel	0.952	PASS				
	High Channel	0.954	PASS				

#### 05:40:05 PM Feb 26, 2021 SENSE:INT Center Freq: 2.402000000 GHz Trig: Free Run Avg|Hol #Atten: 30 dB Frequency 102000000 GHz Radio Std: None Avg|Hold: 100/100 #IFGain:Low Radio Device: BTS Ref 20.00 dBm **Center Freq** 2.402000000 GHz Center 2.402 GHz #Res BW 30 kHz Span 3 MHz Sweep 3.2 ms CF Step 300.000 kHz #VBW 100 kHz <u>Auto</u> **Occupied Bandwidth Total Power** -9.31 dBm 848.32 kHz Freq Offset 0 Hz Transmit Freq Error -17.807 kHz **OBW Power** 99.00 % x dB Bandwidth 956.4 kHz x dB -20.00 dB

#### TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

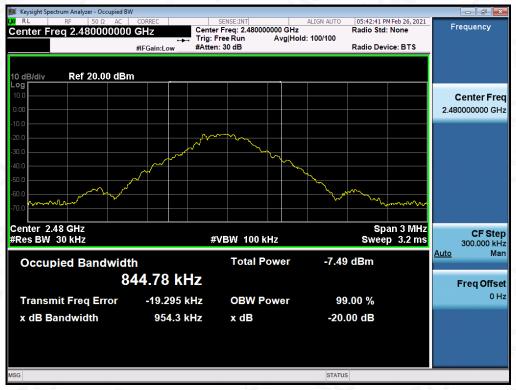
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#### TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

#### TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



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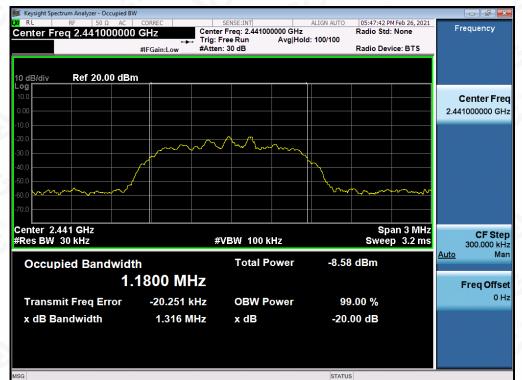
MEASUREMENT RESULT FOR II /4-DQPSK MODULATION							
Annliachta Limita		Measurement Resu	lt				
Applicable Limits	Test Data	(MHz)	Criteria				
	Low Channel	1.312	PASS				
N/A	Middle Channel	1.316	PASS				
	High Channel	1.323	PASS				

#### TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



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#### TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

#### TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



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# 9. CONDUCTED SPURIOUS EMISSION

# 9.1. MEASUREMENT PROCEDURE

- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2. Set the EUT Work on the top, the Middle and the bottom operation frequency individually.
- Set the Span = wide enough to capture the peak level of the in-band emission and all spurious emissions from the lowest frequency generated in the EUT up through the 10th harmonic.
   RBW = 100 kHz; VBW= 300 kHz; Sweep = auto; Detector function = peak.
- 4. Set SPA Trace 1 Max hold, then View.

# 9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 8.2

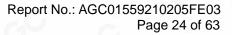
# 9.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

# 9.4. LIMITS AND MEASUREMENT RESULT

LIMITS AND MEAS	LIMITS AND MEASUREMENT RESULT										
Annlinghta Limita	Measurement Resu	ult									
Applicable Limits	Test Data	Criteria									
In any 100 kHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency	At least -20dBc than the limit Specified on the BOTTOM Channel	PASS									
power that is produce by the intentional radiator shall be at least 20 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power. In addition, radiation emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in§15.209(a))	At least -20dBc than the limit Specified on the TOP Channel	PASS									

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#### TEST RESULT FOR ENTIRE FREQUENCY RANGE TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE

OF π /4-DQPSK MODULATION IN LOW CHANNEL



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## Report No.: AGC01559210205FE03 Page 25 of 63



🊺 Kej	ysight Sp	ectrum	Analyze	er - Swep	pt SA										
LXI RI	L	R	F	50 Ω	AC	CORREC		SE	NSE:INT		ALIGN AUTO		M Feb 26, 2021		Frequency
Cen	ter F	req	13.7	417	5000	)0 GHz	z	Trig: Free	e Dun	Avg Ty Avg Hol	pe: Log-Pwr	TRAC	CE 1 2 3 4 5 ( PE MWWWW		riequency
						PNO: IFGair	:Fast ↔ n:low	Atten: 30		Avginor	a: 10/10	D	PNNNN		
							I.Low					-4.4.00		ī	Auto Tune
											IVIK	r1 4.80			
10 di	B/div	Re	f 20.	.00 d	Bm							-47.7	60 dBm		
Log															
10.0															Center Freq
0.00														1	13.741750000 GHz
-10.0						ر کھ									
-20.0															Start Freq
-30.0															2.483500000 GHz
-40.0			1			و کک							-36.76 dBm		2.400000000
-50.0											and a self of the second second	define a second a			Stop Freq
-60.0	a mport facilit	and any other	and the second	Not start of	day lines		a designed a set	also the design of the	A Designation	and the second se	and a station of the same	and a second second	10-		
-70.0	and the second	1000	and the second	تتشت		کريندو								4	25.000000000 GHz
-1-0.0															
Star	t 2.4	R CH	7			~						Stop 2	5.00 GHz		CF Step
	s BW						#\/B\A	/ 300 kHz			Sween	2.152 s (3			2.251650000 GHz
								300 KHZ			Sweep -	,	- /		uto Man
	MODE T				Х			Y		CTION FI	UNCTION WIDTH	FUNCTION	DN VALUE		
1	N	1 f			4	.804 3 G	<u>iHz</u>	-47.760 dl	Bm						
2															Freq Offset
4							ک ک								0 Hz
5							کر بھ						E		
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9															
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MSG											STATUS	\$			

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# TEST PLOT OF OUT OF BAND EMISSIONS OF $\pi$ /4-DQPSK MODULATION IN MIDDLE CHANNEL

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## Report No.: AGC01559210205FE03 Page 27 of 63



	ght Spec		Analyzer -											
(X) RL Centr	ər Er	RF		οΩ AC	CORREC		SEN	NSE:INT	Avg T	ALIGN AUTO	TRAC	M Feb 26, 2021	Fr	equency
Genu		94		17500		ast ↔	Trig: Free Atten: 30			old: 10/10	TYF			
10 dB/	div	Re	f 20.0	0 dBm						M		1 6 GHz 46 dBm		Auto Tune
Log - 10.00 - -10.00 -														<b>Center Freq</b> 1750000 GHz
-20.0 - -30.0 - -40.0 -			1									-35.87 dBm	2.483	Start Freq 3500000 GHz
-50.0 - -60.0 - -70.0 -	ente <sup>te</sup>								a los sur a	Lorgenia, <sup>della</sup> post des energi (della Lorgenia Lorgenia des des energia della			25.000	Stop Freq 0000000 GHz
Start #Res	BW	100	kHz		X	#VBW	300 kHz			Sweep :	2.152 s (3	25.00 GHz 30000 pts)	2.251 <u>Auto</u>	<b>CF Step</b> 1650000 GHz Man
					<sup>∧</sup> 4.881 6 GF		-47.446 dE						F	Freq Offset 0 Hz
MSG										STATU	s			

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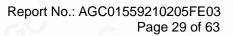
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# TEST PLOT OF OUT OF BAND EMISSIONS OF $\pi$ /4-DQPSK MODULATION IN HIGH CHANNEL

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🊺 Key	/sight Spec	trum A	nalyzer - Sw	rept SA								
LXI RI	-	RF	50 Ω	AC C		SE	NSE:INT	Ava	ALIGN AUTO Type: Log-Pwr		M Feb 26, 2021	Frequency
Cer		eq	3.7500		PNO: Fast FGain:Low	Trig: Fre Atten: 3			Hold: 10/10	TY		
10 dE	3/div	Ref	20.00	dBm					М	kr1 4.96 -47.8	01GHz 36dBm	Auto Tune
Log 10.0 0.00 -10.0												Center Freq 13.750000000 GHz
-20.0 -30.0 -40.0			1								-35.10 dBm	Start Freq 2.50000000 GHz
-50.0 -60.0 -70.0	er teles <sup>dire</sup>											<b>Stop Freq</b> 25.00000000 GHz
#Re:	t 2.50 s BW	100     SCL		X		W 300 kHz Y	FUI	NCTION		2.152 s (3	5.00 GHz 0000 pts)	CF Step 2.25000000 GHz <u>Auto</u> Man
2 3 4 5 6 7 8 9 10	N 1			4.96	0 1 GHz	-47.836 di	Bm					Freq Offset 0 Hz
≺ MSG						m			STATU	JS	•	

Note: The  $\pi$  /4-DQPSK modulation is the worst case and only those data recorded in the report.

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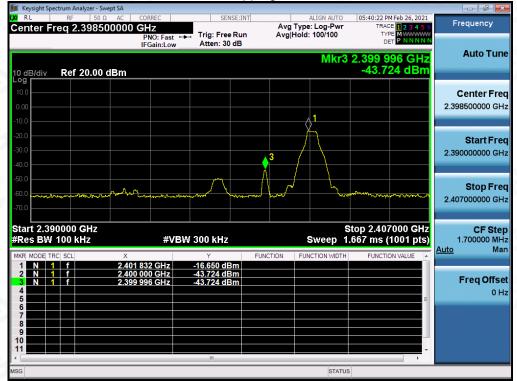
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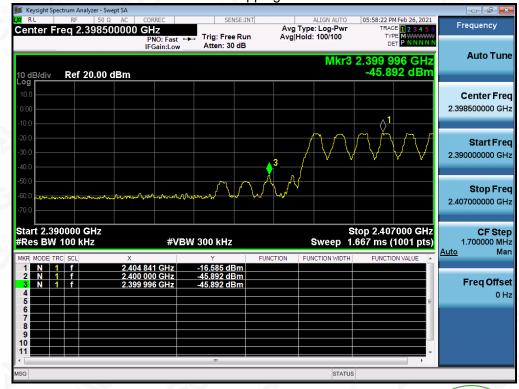
### TEST RESULT FOR BAND EDGE

#### GFSK MODULATION IN LOW CHANNEL

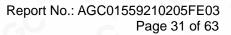
Hopping off



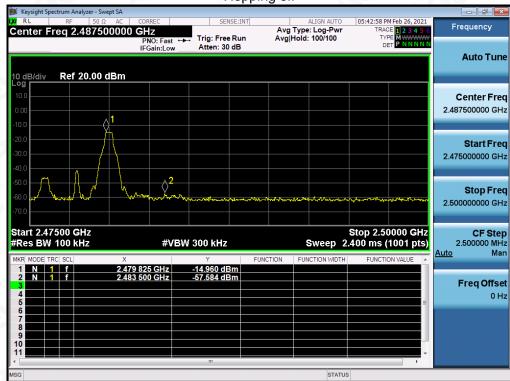
Hopping on



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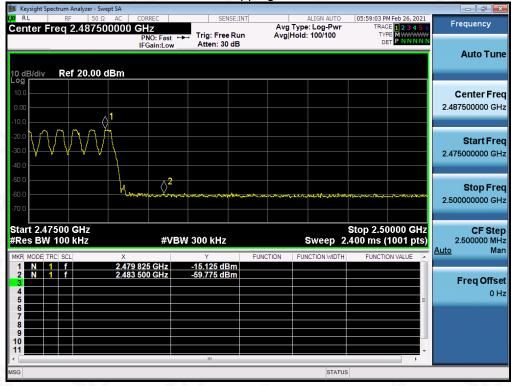




# GFSK MODULATION IN HIGH CHANNEL

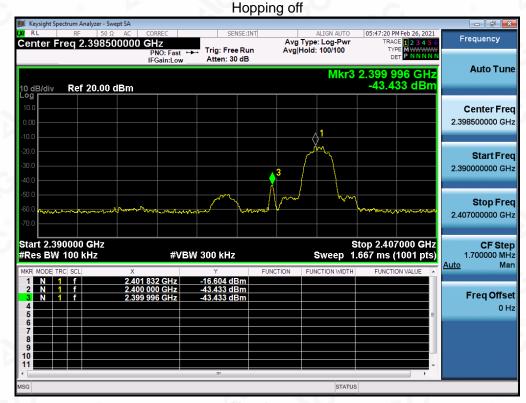
Hopping off

Hopping on



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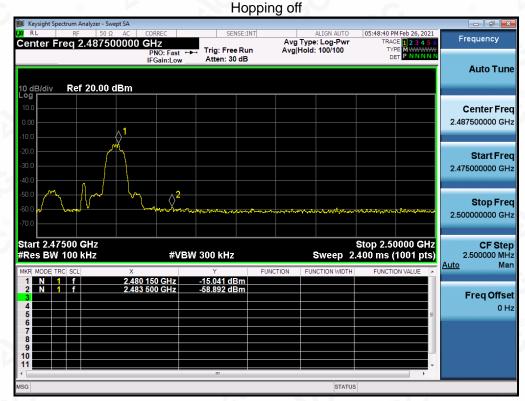
# $\pi$ /4-DQPSK MODULATION IN LOW CHANNEL

Hopping on



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# $\pi$ /4-DQPSK MODULATION IN HIGH CHANNEL

Hopping on



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# **10. RADIATED EMISSION**

### **10.1. MEASUREMENT PROCEDURE**

- 1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
- 2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
- 3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
- 4. For each suspected emission, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
- 5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
- 6. For emissions above 1GHz, use 1MHz RBW and 3MHz VBW for peak reading. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- 7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
- 8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
- 9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
- 10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High Low scan is not required in this case.

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The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP
Start ~Stop Frequency	1GHz~26.5GHz 1MHz/3MHz for Peak, 1MHz/3MHz for Average

Receiver Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP

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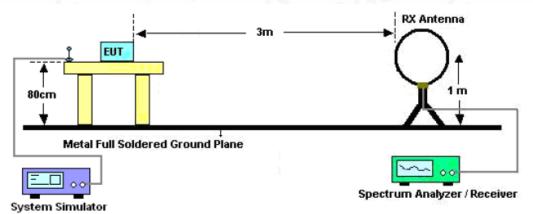
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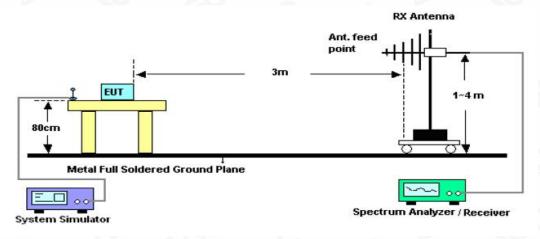


# 10.2. TEST SETUP

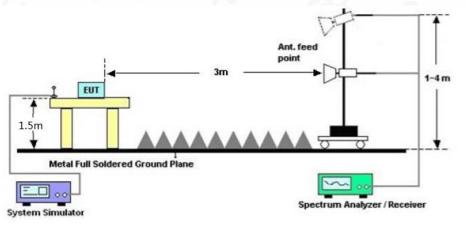
Radiated Emission Test-Setup Frequency Below 30MHz



# RADIATED EMISSION TEST SETUP 30MHz-1000MHz



# RADIATED EMISSION TEST SETUP ABOVE 1000MHz



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## **10.3. LIMITS AND MEASUREMENT RESULT**

#### 15.209 Limit in the below table has to be followed

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
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

Note: All modes were tested for restricted band radiated emission, the test records reported below are the worst result compared to other modes.

## **10.4. TEST RESULT**

## **RADIATED EMISSION BELOW 30MHz**

The amplitude of spurious emissions from 9kHz to 30MHz which are attenuated more than 20 dB below the permissible value need not be reported.

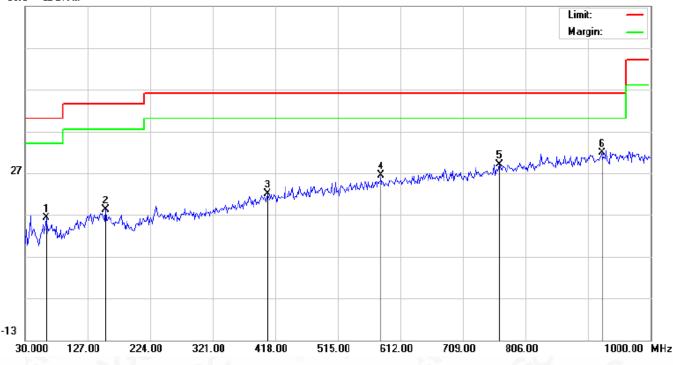
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### **RADIATED EMISSION BELOW 1GHz**

EUT	2-IN-1 SPEAKER & LED LAMP	Model Name	SA-USBL-WHT
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 6	Antenna	Horizontal

#### 66.9 dBuV/m



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		62.3333	-0.04	16.16	16.12	40.00	-23.88	peak
2		154.4832	-1.08	19.20	18.12	43.50	-25.38	peak
3	4	405.0667	-1.11	23.08	21.97	46.00	-24.03	peak
4	;	581.2833	-0.13	26.58	26.45	46.00	-19.55	peak
5		765.5833	-0.62	29.63	29.01	46.00	-16.99	peak
6	* (	924.0167	-0.09	31.91	31.82	46.00	-14.18	peak

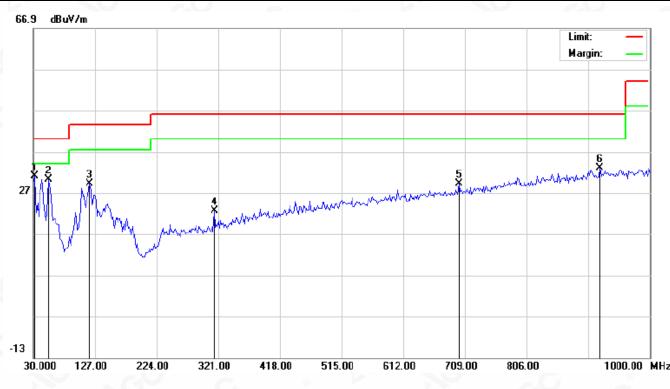
## **RESULT: PASS**

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EUT	2-IN-1 SPEAKER & LED LAMP	Model Name	SA-USBL-WHT
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 6	Antenna	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1	*	31.6167	18.83	12.22	31.05	40.00	-8.95	peak
2		54.2500	15.51	14.64	30.15	40.00	-9.85	peak
3		118.9167	11.30	17.86	29.16	43.50	-14.34	peak
4		314.5333	2.65	19.98	22.63	46.00	-23.37	peak
5		699.3000	1.01	28.14	29.15	46.00	-16.85	peak
6		920.7833	1.17	31.88	33.05	46.00	-12.95	peak

# **RESULT: PASS**

Note: 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2. All test modes had been pre-tested. The mode 6 is the worst case and recorded in the report.

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# **RADIATED EMISSION ABOVE 1GHz**

EUT	2-IN-1 SPEAKER & LED LAMP	Model Name	SA-USBL-WHT
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 4	Antenna	Horizontal

(dBµV/m) 74	(dB)	Value Type
74	00.74	
	-28.71	peak 💿
54	-16.26	AVG
74	-31.61	peak
54	-19.04	AVG
	20	
		C.V

EUT	2-IN-1 SPEAKER & LED LAMP	Model Name	SA-USBL-WHT
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 4	Antenna	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	○ (dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4804.000	44.49	0.08	44.57	74	-29.43	peak
4804.000	36.28	0.08	36.36	54	-17.64	AVG
7206.000	39.36	2.21	41.57	74	-32.43	peak
7206.000	31.84	2.21	34.05	54	-19.95	AVG
					0	
emark:						

-amplifier Factor Antenna Factor + Cable Loss

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EUT	2-IN-1 SPEAKER & LED LAMP	Model Name	SA-USBL-WHT
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 5	Antenna	Horizontal

Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
45.71	0.14	45.85	74	-28.15	peak
38.95	0.14	39.09	54	-14.91	AVG
41.12	2.36	43.48	74	-30.52	peak
34.58	2.36	36.94	54	-17.06	AVG
			0	©.	
	8			- 6	8
	(dBµV) 45.71 38.95 41.12	(dBµV)         (dB)           45.71         0.14           38.95         0.14           41.12         2.36	(dBµV)         (dB)         (dBµV/m)           45.71         0.14         45.85           38.95         0.14         39.09           41.12         2.36         43.48	(dBµV)         (dB)         (dBµV/m)         (dBµV/m)           45.71         0.14         45.85         74           38.95         0.14         39.09         54           41.12         2.36         43.48         74	(dBµV)         (dB)         (dBµV/m)         (dBµV/m)         (dB)           45.71         0.14         45.85         74         -28.15           38.95         0.14         39.09         54         -14.91           41.12         2.36         43.48         74         -30.52

EUT	2-IN-1 SPEAKER & LED LAMP	Model Name	SA-USBL-WHT
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 5	Antenna	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4882.000	45.32	0.14	45.46	74	-28.54	peak
4882.000	37.41	0.14	37.55	54	-16.45	🛛 AVG
7323.000	40.79	2.36	43.15	74	-30.85	peak
7323.000	31.86	2.36	34.22	54	-19.78	AVG
emark:	0			0		

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#### Report No.: AGC01559210205FE03 Page 42 of 63

EUT	2-IN-1 SPEAKER & LED LAMP	Model Name	SA-USBL-WHT
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 6	Antenna	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4960.000	46.53	0.22	46.75	74	-27.25	peak
4960.000	38.19	0.22	38.41	54	-15.59	AVG
7440.000	41.84	2.64	44.48	74	-29.52	peak
7440.000	32.11	2.64	34.75	54	-19.25	AVG
8	6			8	8	
emark:	- 6	8			- 6	®
ctor = Anter	na Factor + Cable	Loss - Pre-	amplifier.			- 6

EUT 2-IN-1 SPEAKER & LED LAMP SA-USBL-WHT **Model Name** 25°C Temperature **Relative Humidity** 55.4% Pressure 960hPa **Test Voltage** Normal Voltage **Test Mode** Mode 6 Antenna Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4960.000	45.96	0.22	46.18	74	-27.82	peak
4960.000	38.65	0.22	38.87	54	-15.13	AVG
7440.000	41.44	2.64	44.08	74	-29.92	peak
7440.000	33.72	2.64	36.36	54	-17.64	AVG
emark:		20U		© 1		

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

# **RESULT: PASS**

Note:

The amplitude of other spurious emissions from 1G to 25 GHz which are attenuated more than 20 dB below the permissible value need not be reported.

Factor = Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

The "Factor" value can be calculated automatically by software of measurement system.

All test modes had been tested. The  $\pi$  /4-DQPSK modulation is the worst case and recorded in the report.

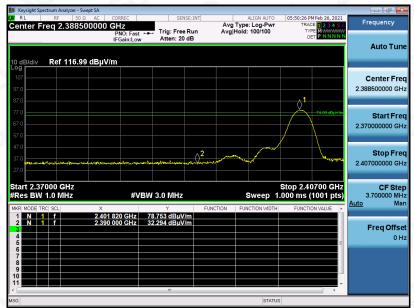
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### TEST RESULT FOR RESTRICTED BANDS REQUIREMENTS

EUT	2-IN-1 SPEAKER & LED LAMP	Model Name	SA-USBL-WHT
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 4	Antenna	Horizontal

ΡK



AV



# **RESULT: PASS**

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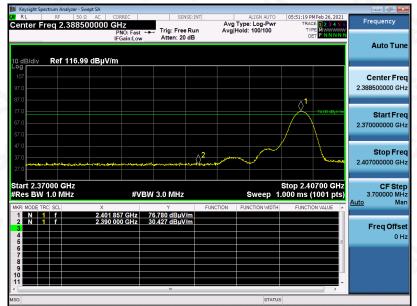
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 E-mail: agc@agc-cert.com



#### Report No.: AGC01559210205FE03 Page 44 of 63

EUT	EUT 2-IN-1 SPEAKER & LED LAMP		SA-USBL-WHT
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 4	Antenna	Vertical

PK



AV



**RESULT: PASS** 

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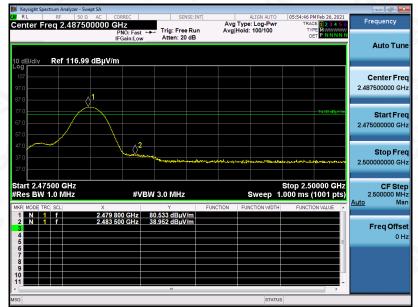
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#### Report No.: AGC01559210205FE03 Page 45 of 63

EUT	EUT 2-IN-1 SPEAKER & LED LAMP		SA-USBL-WHT
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 6	Antenna	Horizontal

PK



AV



**RESULT: PASS** 

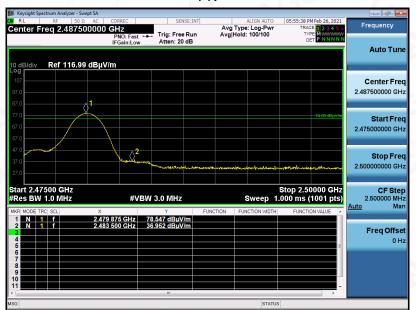
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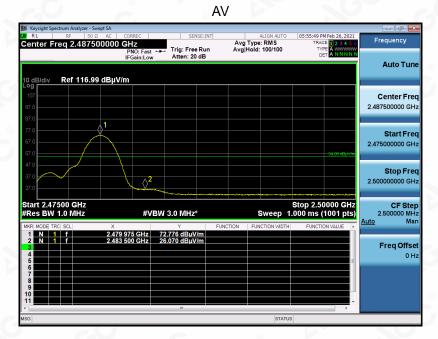


#### Report No.: AGC01559210205FE03 Page 46 of 63

EUT	2-IN-1 SPEAKER & LED LAMP	-1 SPEAKER & LED LAMP Model Name	
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 6	Antenna	Vertical



PK



**RESULT: PASS Note**: The factor had been edited in the "Input Correction" of the Spectrum Analyzer. The  $\pi$  /4-DQPSK modulation is the worst case and recorded in the report.

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# **11. NUMBER OF HOPPING FREQUENCY**

# **11.1. MEASUREMENT PROCEDURE**

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.

2. RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.

3. VBW ≥ RBW. Sweep: Auto. Detector function: Peak. Trace: Max hold.

4. Allow the trace to stabilize.

# 11.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

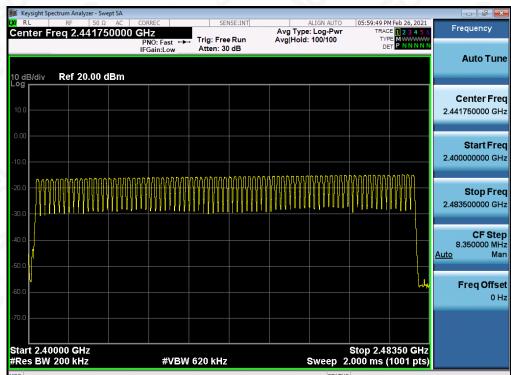
Same as described in section 8.2

# **11.3. MEASUREMENT EQUIPMENT USED**

The same as described in section 6

# **11.4. LIMITS AND MEASUREMENT RESULT**

TOTAL NO. OF	LIMIT (NO. OF CH)	MEASUREMENT (NO. OF CH)	RESULT	
HOPPING CHANNEL	>=15	79	PASS	



TEST PLOT FOR NO. OF TOTAL CHANNELS

Note: The GFSK modulation is the worst case and recorded in the report.

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# 12. TIME OF OCCUPANCY (DWELL TIME)

# **12.1. MEASUREMENT PROCEDURE**

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span: Zero span, centered on a hopping channel.

2. RBW shall be  $\leq$  channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.

3. Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.

4. Detector function: Peak. Trace: Max hold.

5. Use the marker-delta function to determine the transmit time per hop.

6. Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

(Number of hops in the period specified in the requirements) = (number of hops on spectrum analyzer)  $\times$  (period specified in the requirements / analyzer sweep time)

7. The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements.

# 12.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 8.2

# 12.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

# **12.4. LIMITS AND MEASUREMENT RESULT**

Channel	Time of Pulse for DH5 (ms)	Number of hops in the period specified in the requirements	Sweep Time (ms)	Limit (ms)
Low	2.879	26*4	299.416	400
Middle	2.879	27*4	310.932	400
High	2.879	26*4	299.416	400

Note: The GFSK modulation is the worst case and recorded in the report.

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