FCC ID: 2ANQE-TAPS1L IC:23216-TAPS1L

7. FREQUENCY SEPARATION

7.1. Limits

According to FCC Section 15.247(a)(1)& RSS-247 §5.1(2), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

7.2. Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode .

2. Set the spectrum analyzer:

Span: wide enough to capture the peaks of two adjacent channels

RBW $\geq 1\%$ of the span(30KHz)

 $VBW \ge RBW(100KHz)$

Sweep=auto

Detector function=peak

Trace=max hold

7.3. Test Setup



7.4. Test Results

EUT:	Powered speaker system	Model Name :	TAPS1L
Temperature:	20 ℃	Relative Humidity:	58%
Pressure:	1010hPa	Test Voltage :	AC 120V
Test Mode :	CH00 / CH39 /CH78 (1Mbps)		

Frequency	Ch. Separation (MHz)	Limit (KHz)	Result
2402 MHz	1.000	904.8	Complies
2441 MHz	0.986	878.9	Complies
2480 MHz	1.010	874.1	Complies

Ch. Separation Limits: > 20dB bandwidth





EUT:	Powered speaker system	Model Name :	TAPS1L
Temperature:	24 ℃	Relative Humidity:	58%
Pressure:	1010 hPa	Test Voltage :	AC 120V
Test Mode :	CH00 / CH39 /CH78 (2Mbps)		

Frequency	Ch. Separation (MHz)	Limit (KHz)	Result
2402 MHz	0.982	0.811	Complies
2441 MHz	1.006	0.810	Complies
2480 MHz	1.004	0.811	Complies

Ch. Separation Limits: >2/3 of 20dB bandwidth.





EUT:	Powered speaker system	Model Name :	TAPS1L
Temperature:	24 ℃	Relative Humidity:	58%
Pressure:	1010 hPa	Test Voltage :	AC 120V
Test Mode :	CH00 / CH39 /CH78 (3Mbps)		

Frequency	Ch. Separation (MHz)	Limit (KHz)	Result
2402 MHz	0.992	0.803	Complies
2441 MHz	1.000	0.805	Complies
2480 MHz	1.002	0.804	Complies

Ch. Separation Limits: >2/3 of 20dB bandwidth.





8. NUMBER OF HOPPING FREQUENCY

8.1. Limits

According to FCC Section 15.247(a)(1)(iii)& RSS-247 §5.1(4), Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

8.2. Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode .

2. Set the spectrum analyzer:

Span: the frequency band of operation

RBW =100KHz

VBW=300KHz

Sweep=auto

Detector function=peak

Trace=max hold

8.3. Test Setup



8.4. Test Results

EUT:	Powered speaker system	Model Name :	TAPS1L
Temperature:	20 ℃	Relative Humidity:	58%
Pressure:	1010 hPa	Test Voltage :	AC 120V
Test Mode :	GFSK		

Test data:

Measured channel numbers	Limit	Result
79	≥15	PASS



9. DWELL TIME

9.1. Limits

According to FCC Section 15.247(a)(1)(iii)& RSS-247 §5.1(4), Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

9.2. Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode power.

2. Set the spectrum analyzer:

Span= 0Hz, RBW =1000 kHz, VBW = 3000 kHz

Use a video trigger with the trigger level set to enable triggering only on full pulses.

Detector function=peak, Sweep Time is more than once pulse time.

Set the EUT for DH5, DH3 and DH1 packet transmitting

Measure the maximum time duration of one single pulse.

A Period Time = (channel number)*0.4 DH1 Time Slot: Reading * (1600/2)*31.6/(channel number) DH3 Time Slot: Reading * (1600/4)*31.6/(channel number) DH5 Time Slot: Reading * (1600/6)*31.6/(channel number) For Example: BT hopping rate is 1600 hops/s with 6 slots in 79 hopping channels. With channel hopping rate (1600 / 6 / 79) in Occupancy Time Limit (0.4×79) (s), Hops Over Occupancy Time comes to $(1600 / 6 / 79) \times (0.4 \times 79) = 106.67$ hops. Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

9.3. Test Setup



9.4. Test Results

Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
		(ms)	(S)	(S)
DH1	2441 MHz	0.435	0.14	0.4
2DH1	2441 MHz	0.450	0.14	0.4
3DH1	2441 MHz	0.450	0.14	0.4





Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
		(ms)	(S)	(S)
DH3	2441 MHz	1.69	0.27	0.4
2DH3	2441 MHz	1.70	0.27	0.4
3DH3	2441 MHz	1.70	0.27	0.4





Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
		(ms)	(S)	(S)
DH5	2441 MHz	2.95	0.31	0.4
2DH5	2441 MHz	2.96	0.32	0.4
3DH5	2441 MHz	2.97	0.32	0.4

Keysight Spectrum Analyzer - Swept SA X RL RF 50 Ω AC	SENSE:INT	ALIGN AUTO	
Marker 1 ∆ 2.95000 ms	PNO: Fast +++ Trig: Free Run IFGain:Low Atten: 30 dB	Avg Type: Log-Pwr TRACE 2 34 5 TYPE W	Select Marker
Ref Offset 1 dB 10 dB/div Ref 21.00 dBm		ΔMkr1 2.950 ms -0.17 dE	5 1
11.0			Norma
1.00			-
-9.00			Delt
-19.0			
-29.0			Fixed
-39.0			Of
-49.0		142	
-59.0	Marina X2		Properties
-69.0			
Start 2.441000000 GHz		Stop 2.441000000 GH	Z Mor
Res BW 1.0 MHz	#VBW 3.0 MHz	Sweep 10.00 ms (1001 pts	



10. BAND EDGE COMPLIANCE TEST

10.1. Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated 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) (see §15.205(c)).

10.2. Test Setup



10.3. Test Procedure

a) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

b) Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.

c) Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.

d) Measure the highest amplitude appearing on spectral display and set it as a reference level.Plot the graph with marking the highest point and edge frequency.

e) Repeat above procedures until all measured frequencies were complete.

10.4. Test Results

For conducted test:

Frequency Band	Delta Peak to band emission (dBc)	> Limit (dBc)	Result								
GFSK Non-hopping											
Left Band	Left Band 52.638 20										
Right Band	61.654	20	Pass								
π/4-DQPSK Non-hopping											
Left Band	38.913	20	Pass								
Right Band	56.494	56.494 20									
8DPSK Non-hopping											
Left Band	38.514	20	Pass								
Right Band	56.573	20	Pass								
	GFSK hopping	3									
Left Band	50.779	20	Pass								
Right Band	62.704	62.704 20									
	π/4-DQPSK hopp	bing									
Left Band	41.946	41.946 20									
Right Band	58.733	20	Pass								
8DPSK hopping											
Left Band	40.431	20	Pass								
Right Band	60.129	20	Pass								



EDR mode (GFSK): Band Edge-Left Side



- Ke	ysight	Spect	rum A	Analyzer - S	wept SA														~		a 🔀
Star	t Fi	req	RF 2.4	50 17500	Ω AC	GHz		. –	SE Trig: Fre	NSE:IN	T	Avg	Type lold:	LIGN AUTO		TRA TY	DE 1 2 3 4	4 5 6	F	requen	су
10 d	B/div	/	Ref Ref	Offset 1 f 21.00	dB dBm	IF(Gain:Lo	w .	Atten: 3	0 dB				Mkr	2.4	79 8 4.3	25 G	Hz Bm		Auto	Tune
11.00 1.00 -9.00																			2.4	Cente 3750000	r Freq 00 GHz
-19.0 -29.0 -39.0			A			^α γ Λ											DL1 -15.66	dBm	2.4	Star 7500000	t Freq 00 GHz
-49.0 -59.0 -69.0	مىمدر ا	المرارية	/			VV	N.S.	2 •••••••	withthe sport	u.,		talle-show		gan dalaya saya saya saya saya saya saya saya		וניי <i>ראייני</i> אין	-commente	for times	2.5	Stop	Freq 00 GHz
Star #Re	t 2.4 s Bi	475 W 1	00 00	GHz kHz		4	#\	VBW	300 kHz		FUNC		S	Sweep	Sto 2.400	o 2.5 ms (0000 G 1001 p	Hz ts)	Auto	CF 2.50000	Step 0 MHz Man
MKR 2 3 4 5 6 7 8 9	N N		f		2.	4 <u>79 82</u> 483 50	5 GHz 0 GHz		4.344 d -57.310 d	Bm Bm	FUNC		FUN			FUNCT	ON VALUE			Freq (Offset 0 Hz • Type
10									Ш									•	Log		Lin
MSG														STAT	JS						

EDR mode (GFSK): Band Edge-Right Side



🔤 Kej	ysight Sp	ctrum A	nalyzer - Si	wept SA					-	-				
Star	t Fre	₀RF q 2.3	50000	2 AC		: Fast C	S Trig: Fr	ee Run	Avg Avg	ALIGN AUTO Type: Log-Pwr Hold:>100/100	TR/		F	requency
10 dl	B/div	Ref (Ref	Offset 1 21.00	dB dBm	IFGai	n:Low	Atten: 3	30 dB		Mk	r1 2.402 0.7	02 GHz 52 dBm		Auto Tune
Log 11.0 1.00											1		2.3	Center Freq B0000000 GHz
-19.0 -29.0 -39.0											₹ ²	DL1 -19.25 dBm	2.3	Start Freq 50000000 GHz
-49.0 -59.0 -69.0	ehelessee	ماريوريهم	-	n,, doran e da	Manama	مورد المراجع	ayan ya da wa anga anga anga anga anga anga anga	un terrent and	intra-courter	an and the group of) ⁹⁴	ha hanne war	2.4	Stop Freq 10000000 GHz
Star #Re:	t 2.35 s BW	000 0 100 F	GHz (Hz	x		#VB	W 300 kH	z	FUNCTION	Sweep	Stop 2.4 5.800 ms	1000 GHz (1001 pts	Auto	CF Step 6.000000 MHz Man
1 2 3 4 5	N 1	f		2.4	402 02 0 400 00 0	SHz SHz	0.752 c -38.161 c	IBm IBm						Freq Offset 0 Hz
789														Scale Type
10												_	Log	Lin
MSG										STAT	us			

EDR mode (π /4-DQPSK): Band Edge-Left Side



🔤 Keysight :	Spectrum Analyzer - Si	wept SA			-					
Start Fr	req 2.475000	DOOD GHz	IO: Fast	Trig: Free	E:INT AN Run Av	ALIGN AUTO rg Type: Log-Pwr g Hold:>100/100	TRACI	123456 M	Fr	equency
10 dB/div	Ref Offset 1 Ref 21.00	dB dBm	ain:Low	Atten: 30	dB	Mkr1	2.480 0 1.04	00 GHz 6 dBm		Auto Tune
11.0		1							C 2.487	enter Freq 7500000 GHz
-19.0 -29.0 -39.0	a n had							DL1 -18.95 dBm	2.475	Start Freq 5000000 GHz
-49.0 -59.0	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	- Ung	~2 ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	guyllwazikkuyðuszfigðy	ะสะเท ^ม พุทธ์โประวั <mark>ท</mark> รมาทหา	ⁿ ernennedjyerfinikalanselala	mulaning	nheftur:manyslaper	2.500	Stop Freq
Start 2.4 #Res Bi	47500 GHz N 100 kHz	x	#VBW	/ 300 kHz	FUNCTION	Sweep 2	Stop 2.50 .400 ms (1	000 GHz 1001 pts)	2 <u>Auto</u>	CF Step 500000 MHz Man
1 N 2 N 3 4 5 6	1 f 1 f	2.480 000 2.483 500) GHz) GHz	1.046 dB -55.448 dB	m 			E	'	Freq Offset 0 Hz
7 8 9 10									Log	Scale Type Lin
MSG				ш		STATU	3	- F		

EDR mode (π /4-DQPSK): Band Edge- Right Side



Keysight Spectrum Analyzer - Swept SA				
M RL RF 50 Ω AC Start Freq 2.350000000 G	HZ SENSE:	INT ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 1 2 3 4 5 6	Frequency
Ref Offset 1 dB	IFGain:Low Atten: 30 dE	Mk	1 2.402 02 GHz 0.734 dBm	Auto Tune
11.0 1.00				Center Freq 2.380000000 GHz
-19.0			DL1 -19.27 dBm	Start Freq 2.35000000 GHz
-49.0 -59.0	มรู้สู่สุดการการการการการการการการการการการการการก	nghyanuð muðurkurur yf Viluta heðuruð fræðinsk máðinarið mandd ma	hanne hanne	Stop Freq 2.410000000 GHz
Start 2.35000 GHz #Res BW 100 kHz	#VBW 300 kHz		Stop 2.41000 GHz 5.800 ms (1001 pts)	CF Step 6.000000 MHz <u>Auto</u> Man
I I f 2.40 1 N 1 f 2.40 3 4 5 6 6	02 02 GHz 0.734 dBm 00 00 GHz -37.780 dBm		E	Freq Offset 0 Hz
7 8 9 10				Scale Type
11			-	
MSG		STATU	IS	

EDR mode(8DPSK): Band Edge-Left Side



Keysight Spectrum Analyzer - Swept SA						
M RL RF 50 Ω AC Start Freq 2.475000000 GI	lz	SENSE:INT		ALIGN AUTO e: Log-Pwr	TRACE 1 2 3 4 5	6 Frequency
Ref Offset 1 dB 10 dB/div Ref 21.00 dBm	IFGain:Low	Atten: 30 dB	Aughord	Mkr1	2.479 825 GH 1.198 dBr	Auto Tune
11.0 1.00 -9.00						Center Freq 2.487500000 GHz
-19.0 -29.0 -38.0					DL1 -18.81 dB	Start Freq 2.475000000 GHz
-49.0 -59.0	Vhy 2	- good af my selle france from the me	what the and the second	a	ndar dalar selara ndra sumar sina sina se	Stop Freq 2.50000000 GHz
Start 2.47500 GHz #Res BW 100 kHz	#VBW:	300 kHz	FUNCTION FUI	Sweep 2.	Stop 2.50000 GH 400 ms (1001 pts	Z CF Step 2.500000 MHz Auto Man
1 N 1 f 2.479 2 N 1 f 2.483 3 - - - 4 - - - 5 - - - 6 - - -	825 GHz 500 GHz -	1.198 dBm 55.375 dBm				Freq Offset
7 8 9 10 11						Scale Type
MSG				STATUS	•	

EDR mode(8DPSK): Band Edge-Right Side



NOTE: Hopping enabled and disabled have evaluated, and the worst data was reported.

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11. ANTENNA REQUIREMENTS

11.1.Limits

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

According to RSS-Gen§8.3

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall 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 manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

11.2. Test Result

The antennas used for this product is PCB antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 0dBi.

12. PHOTOGRAPHS OF TEST SET-UP

Radiated Emission Test

Below 1GHz



Above 1GHz



Conducted Emission



13. PHOTOGRAPHS OF THE EUT













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*** the end of report ***