# **TEST REPORT**



**CTK Co., Ltd.** (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea Tel: +82-31-339-9970 Fax: +82-31-624-9501

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## 1. Client

- ${}_{\circ}$  Name : Sony Corporation
- Address : 1-7-1 Konan Minato-ku Tokyo, 108-0075, Japan
- $^{\circ}$  Date of Receipt : 2019-10-26

## 2. Manufacturer

- Name : Sony Corporation
- Address : 1-7-1 Konan, Minato-ku, Tokyo 108-0075, Japan
- 3. Use of Report : For FCC Certification & Canadian Certification
- 4. Test Sample / Model: WIRELESS NOISE CANCELING STEREO HEADSET

#### / WH-CH710N

- 5. Date of Test : 2019-10-30 to 2019-11-15
- 6. Test Standard(method) used : FCC 47 CFR part 15 subpart C 15.247

ISED RSS-247 & RSS-Gen

- **7. Testing Environment:** Temp.: (25 ± 1) °C, Humidity: (40 ± 3) % R.H.
- 8. Test Results : Compliance

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This Test Report cannot be reproduced, except in full.

Affirmation	Tested by Ji-Hye, Kim: (Signature)	Technical Manager Won-Jae, Hwang: (Signature)
		2019-11-29
Republic of KOREA CTK Co., Ltd.		



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## **REPORT REVISION HISTORY**

Date	Revision	Page No
2019-11-29	Issued (CTK-2019-04710)	all

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## **1. General Product Description**

## **1.1 Client Information**

Company	Sony Corporation
Contact Point	1-7-1 Konan, Minato-ku, Tokyo, 108-0075, Japan
Contact Person	Name : Ryo Takata E-mail : Ryo.Takata@sony.com Tel : +81-50-3750-9613

## **1.2 Product Information**

FCC ID	AK8WHCH710N
IC	409B-WHCH710N
Product Description	WIRELESS NOISE CANCELING STEREO HEADSET
Model name	WH-CH710N
Operating Frequency	2 402 MHz - 2 480 MHz
RF Output Power	GFSK : 1.93 dBm (1.56 mW) 8-DPSK : 2.40 dBm (1.74 mW)
Antenna Specification	Antenna type : Chip antenna Peak Gain : 0.26 dBi
Number of channels	79
Channel Spacing	1 MHz
Type of Modulation	GFSK(1Mbps), $\pi/4$ DQPSK(2Mbps), 8DPSK(3Mbps)
Power Source	DC 3.7 V (Battery)
Hardware Rev	V1.0
Software Rev	V1.0

## **1.3 Peripheral Devices**

Device	Manufacturer	Model No.	Serial No.
Note Computer	HP	15-bs563TU	CND7253R6N
AC/DC Adapter	HP	HSTNN-CA40	-



## 2. Facility and Accreditations

## 2.1 Test Facility

The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yong-in-si, Gyeonggi-do, Korea.

## 2.2 Laboratory Accreditations and Listings

Country	Agency	Registration Number
USA	FCC	805871
CANADA	ISED	8737A-2
KOREA	NRRA	KR0025

## 2.3 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.



## 3. Test Specifications

## 3.1 Standards

Section in FCC	Section in RSS	Requirement(s)	Status (Note 1)	Test Condition
15.247(a)	RSS-247 5.1(b)	Carrier Frequency Separation	С	
15.247(a)	RSS-247 5.1(d)	Number of Hopping Frequencies	С	
15.247(a)	RSS-247 5.1(a)	20 dB Bandwidth	С	Conducted
15.247(a)	RSS-247 5.1(d)	Time of occupancy (Dwell Time)	С	Conducted
15.247(b)	RSS-247 5.4(b)	Maximum peak conducted output power	С	
15.247(d)	RSS-247 5.5	Unwanted emission	С	
15.209	RSS-Gen 6.13	Transmitter emission	С	Radiated
15.207(a)				-
Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable				
Note 2: The data in this test report are traceable to the national or international standards.				
Note 3: The sample was tested according to the following specification: FCC Part 15.247, ANSI C63.10-2013, RSS-247 Issue 2, RSS-GEN Issue 5				

## 3.2 Mode of operation during the test

The EUT is operated in a manner representative of the typical of the equipments. During at testing, system components were manipulated within the confines of typical usage to maximize each emission. All modulation modes were tests. The results are only attached worst cases.

#### **Test Frequency**

Lowest channel	Middle channel	Highest channel
2 402 MHz	2 441 MHz	2 480 MHz

#### Test mode

Modulation	Packet type	Data rate	Duty Cycle
GFSK	DH5	1 Mbps	77.8%
8-DPSK	3-DH5	3 Mbps	78.1%



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## **3.3 Maximum Measurement Uncertainty**

The value of the measurement uncertainty for the measurement of each parameter. Coverage factor k = 2, Confidence levels of 95 %

Description	Uncertainty
Conducted RF Output Power	1.5 dB
Occupied Bandwidth	0.1 MHz
Unwanted Emission(conducted)	3.0 dB
Radiated Emissions (f $\leq$ 1 GHz)	4.0 dB
Radiated Emissions (f > 1 GHz)	5.0 dB

#### 3.4 Test Software

Conducted Test	Ics Pro Ver. 6.0.3	
Radiated Test	TOYO EMI software EP5RE Ver. 6.0.1.0	
Line Conducted Test	ESCI7, ESCI3 : EMC32 Ver. 8.50.0	
	ESR7 : EMC32 Ver. 8.53.0	



## 4. Technical Characteristic Test

## 4.1 Carrier Frequency Separation

#### **Test Procedures**

ANSI C63.10-2013 - Section 7.8.2

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function enabled. After the trace being stable, the reading value between the peaks of the adjacent channels using the marker-delta function was recorded as the measurement results.

#### The spectrum analyzer is set to:

- a) Span = 5 MHz (wide enough to capture the peaks of two adjacent channels)
- b) RBW = 30 kHz (Start with the RBW set to approximately 30% of the channel spacing;

adjust as necessary to best identify the center of each individual channel)

- c) VBW = 30 kHz ( $\geq$  RBW) d) Sweep = auto
- e) Detector function = peak
- f) Trace = max hold

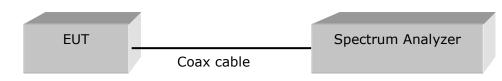


Figure 1 : Measurement setup for the carrier frequency separation

#### Limit

FHSS operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two thirds of the -20 dB bandwidth of the hopping channel, whichever is greater.

#### **Test Results**

Test mode : GFSK

Channel	Adjacent Hopping Channel Separation [kHz]	Two-third of 20dB bandwidth [kHz]	Minimum Bandwidth [kHz]	Result
Middle	1005	618.1	25	Complies

#### Test mode : 8-DPSK

Channel	Adjacent Hopping Channel Separation [kHz]	Two-third of 20dB bandwidth [kHz]	Minimum Bandwidth [kHz]	Result
Middle	995	838	25	Complies

See next pages for actual measured spectrum plots.



		<u>est mode</u>	S : GFSK		
Agilent Spectrum Analyzer - Swept SA					
X L RF 50 Ω AC Marker 1 1.005000000 M	PNO: Wide 😱 Tr	ig: Free Run	ALIGN AUTO Avg Type: Log-Pwr Avg Hold>100/100	05:03:38 PM Oct 30, 2019 TRACE 1 2 3 4 5 6 TYPE M	Peak Search
10 dB/div Ref 10.00 dBm	IFGain:Low #A	atten: 20 dB	Ext Gain: -0.86 dB	1kr1 1.005 MHz 0.177 dB	Next Peak
	Mh	2 .1 <sup>1</sup> 2	1∆2 س <sup>ا</sup> لس	, Mr. M	Next Pk Right
10.0 V Wayner	ar' M		AM My	Mar My	Next Pk Lef
40.0					Marker Delta
50.0 					Mkr→CF
0.0					Mkr→RefLv
80.0 Center 2.441000 GHz Res BW 30 kHz	#VBW 30	kH7	Sween	Span 5.000 MHz .733 ms (1001 pts)	More 1 of 2
ISG	##844.30	R112	Sweep o		

#### Test mode : GFSK

#### Test mode : 8-DPSK

	:28:34 PM Oct 30, 2019	GNAUTO		SENSE:INT			<mark>Analyzer - Swe</mark> j RF 50 Ω	ent Spectrum /
Frequency	TRACE 1 2 3 4 5 6	og-Pwr	Avg Type Avg Hold:	: Free Run	Z	00000 GH		enter Fred
Auto Tune	ьет РРРРРР kr1 995 kHz -0.304 dB	86 dB	Ext Gain:	ten: 20 dB		IFG	ef 10.00 d	
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Start Fred 2.438500000 GHz		"howhy	July Mra	with the form			1 minung	.0
Stop Fred 2.443500000 GHz								.0
CF Step 500.000 kHz <u>Auto</u> Mar								.0
Freq Offse 0 H:								.0
	pan 5.000 MHz 3 ms (1001 pts)	veep 6.7		(Hz	#VBW 30 kHz			nter 2.441 es BW 30



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## **4.2 Number of Hopping Frequencies**

#### **Test Procedures**

ANSI C63.10-2013 - Section 7.8.3

The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

The spectrum analyzer is set to:

a) Frequency range	1: Start = 2389.5 MHz, Stop = 2439.5 MHz
	2: Start = 2439.5 MHz, Stop = 2489.5 MHz

b) RBW = 300 kHz (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)

c) VBW = 300 kHz ( $\geq$ RBW)	d) Sweep = auto
e) Detector function = peak	f) Trace = max hold



#### Limit

FHSs operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels.

#### **Test Results**

Test mode : GFSK

Total number of Hopping Channels	Result
79	Complies

Test mode : 8-DPSK

Total number of Hopping Channels	Result
79	Complies

See next pages for actual measured spectrum plots.



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05:03:53PM Oct 30, 2019 TRACE 1 2 3 4 5 6 TYPE M WWWW DET P P P P P P SENSE:INT Frequency Start Freq 2.3900000000 GHz Avg Type: Log-Pwr Avg|Hold:>100/100 Ext Gain: -0.86 dB Trig: Free Run #Atten: 20 dB PNO: Fast 🖵 IFGain:Low ΔMkr1 37.000 0 MHz 0.368 dB Auto Tune 10 dB/div Ref 10.00 dBm 1∆<mark>2</mark> **Center Freq** 0.00 2.414750000 GHz Start Freq 2.390000000 GHz 20.0 30.0 Stop Freq 2.439500000 GHz 40.C **CF Step** 4.950000 MHz Man 50.1 M Auto 60.0 N. Anderewill Freq Offset 0 Hz RD. Start 2.39000 GHz #Res BW 300 kHz Stop 2.43950 GHz Sweep 1.000 ms (1001 pts) #VBW 300 kHz STATUS



gilent Spectrum Analyzer - Swept SA RL RF 50 Ω AC		SENSE:	INT	A	LIGN AUTO	05:04:05 PM	l Oct 30, 2019	E
itart Freq 2.439500000 GF	Z PNO: Fast 😱 IFGain:Low	Trig: Free R #Atten: 20 dl	un	Avg Type: Avg Hold> Ext Gain: -	100/100	TRAC TYP DE	E 1 2 3 4 5 6 E M WWWWW T P P P P P P	Frequency
0 dB/div Ref 10.00 dBm					ΔN	/lkr1 40. 0.	00 MHz 143 dB	Auto Tun
	MMM	WWW		MM	MM	1∆2		<b>Center Fre</b> 2.464500000 GH
								Start Fre 2.439500000 GH
0.0								<b>Stop Fre</b> 2.489500000 GH
0.0						- L	ARGE	CF Ste 5.000000 Mi <u>Auto</u> Ma
0.0							"IPUMAnov"	Freq Offs 0 ⊦
30.0						Stop 2.48	950 CH2	
Res BW 300 kHz	#VBW	300 kHz		s		.000 ms (		



Test	Mode	:	8-DPSK
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) dB/div	Ref 10.00 d	Bm	IFGain:Low	#Atten: 20	∣dB	Ext Gain:		1 37.000	0 MHz 878 dB	Auto Tun
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0.0										<b>Stop Fro</b> 2.439500000 Gi
0.0	under the second									CF Ste 4.950000 Mi <u>Auto</u> M
	uning mark									Freq Offs
	9000 GHz / 300 kHz		-#\/P\M	300 kHz			Suson 4	Stop 2.43 .000 ms (	950 GHz	
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tart F	req 2.439500		Z PNO: Fast 😱 FGain:Low	Trig: Free #Atten: 20		Avg Type Avg Hold: Ext Gain:		TY	CE 1 2 3 4 5 6 PE M WWWWWW ET P P P P P P	Frequency
0 dB/div	Ref 10.00		FGain:Low	#Atten: 20	<b>u</b> D	Ext Gam.		/kr1 40	.00 MHz .859 dB	Auto Tui
og 1.00 X		atthe a	www	ለመፈገፖኒ	<del>ላ</del> .ብሊሞታ	ላፖኒፖኒሳታኒቶ		1Δ2		<b>Center Fr</b> 2.464500000 G
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0.0										Stop F 2.489500000 0
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).0									WWWWWW	Freq Off
0.0										
	43950 GHz W 300 kHz		#VBW	300 kHz			Sweep 1	Stop 2.4 .000 ms	8950 GHz (1001 pts)	
G							STATUS		· · · · · · · · · · · · · · · · · · ·	



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## 4.3 20 dB bandwidth & 99% Bandwidth

#### **Test Procedures**

ANSI C63.10-2013 - Section 6.9.2 RSS-GEN Issue 5 - Section 6.7

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

#### **Test Procedures**

ANSI C63.10-2013 - Section 6.9.3 RSS-GEN Issue 5 - Section 6.7

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

Use the 99% power bandwidth function of the instrument and report the measured bandwidth.

The spectrum analyzer is set to:

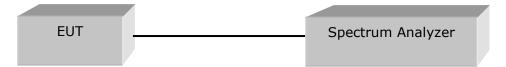
Center frequency = the highest, middle and the lowest channels

a) Span = 3 MHz (between 2 times and 5 times the OBW)

- b) RBW = 30 kHz (1% to 5% of the OBW)
- c) VBW = 100 kHz (approximately 3 times RBW)
- d) Sweep = auto

e) Detector function = peak

f) Trace = max hold



#### Limit

Limit : N/A



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## **Test Results**

#### Test mode : GFSK

Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]	Result
Low	2 402	0.923	0.867	Complies
Middle	2 441	0.927	0.862	Complies
High	2 480	0.866	0.862	Complies

#### Test mode : 8-DPSK

Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]	Result
Low	2 402	1.264	1.167	Complies
Middle	2 441	1.257	1.170	Complies
High	2 480	1.259	1.171	Complies

See next pages for actual measured spectrum plots.



#### 20 dB bandwidth & 99% Bandwidth - GFSK

gilent Spectrum Analyzer - O	occupied BW				
	Ω AC	SENSE:INT	ALIGNAUTO	04:52:39 PM Oct 30, 2019	Frequency
enter Freq 2.4020	000000 GHz	Center Freq: 2.4020 Trig: Free Run	00000 GHz Avg Hold: 10/10	Radio Std: None	Frequency
	⊶ #IFGain:Low	#Atten: 20 dB	Ext Gain: -0.86 dB	Radio Device: BTS	
0 dB/div Ref 10.	.00 dBm				
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.00		m			Center Fre
0.0					2.402000000 GH
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5.0					
enter 2.402 GHz				Span 3 MHz	CF Ste
Res BW 30 kHz		#VBW 91 k	Hz	Sweep 3.2 ms	300.000 kH
Occupied Ban	duuidth	Total F	Power 01	0 dBm	<u>Auto</u> Ma
Occupied Ball			0.10	o abiii	
	867.19 k	HZ			Freq Offse
Transmit Freq E	rror -2.179	kHz OBW I	ower 9	9.00 %	01
x dB Bandwidth		kHz xdB	20	.00 dB	
	923.2		-20	.00 UB	
G			STATU	JS	

#### [Low channel]

#### [Middle channel]

Agilent Spectrum Analyzer - Occupied	BW		lanner			
XIRL RF 50Ω AC Center Freq 2.44100000	0 GHz C	SENSE:INT enter Freq: 2.44100	0000 GHz	Radio Std:	Oct 30, 2019 None	Frequency
	i i i i i i i i i i i i i i i i i i i	ig: Free Run atten: 20 dB	Avg Hold: 10/ Ext Gain: -0.8		ce: BTS	
10 dB/div Ref 10.00 dB	m <u>,                                    </u>					
- <b>og</b> 0.00		~~~~			[	Center Fre
20.0			m			2.441000000 GH
30.0	$\sim$		- m	1		
40.0 <b>****</b>				An mark	manning	
70.0						-
80.0						
Center 2.441 GHz Res BW 30 kHz		#VBW 91 kF	Iz		un 3 MHz 3.2 ms	CF Ste
Occupied Bandwid	th	Total P	ower	9.35 dBm		300.000 kł <u>Auto</u> Ma
8	862.21 kHz					Freq Offse
Transmit Freq Error	-22.769 kHz	OBW P	ower	99.00 %		01
x dB Bandwidth	927.2 kHz	x dB		-20.00 dB		
SG				STATUS		
24				STATUS		



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[High channel]

gilent Spectrur	m Analyzer - Occupied E RF 50 Ω AC	BW .	CE.	NSE:INT		ALIGNAUTO	04:59:08 PM (	-+	
	eq 2.480000000	) GHz	Center F	req: 2.48000			Radio Std: N		Frequency
		↔ #IFGain:Low	Trig: Fre #Atten: 2			ld: 10/10 n: -0.86 dB	Radio Devid	e: BTS	
10 dB/div	Ref 10.00 dBr	n <u>.</u>							
0.00				h					Center Freq
10.0			$\sim$	V. (					2.48000000 GH
20.0					M				
30.0		$\mathcal{A}$				4			
10.0	- man					- Jam			
50.0	~~~~						- man	manorow	
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Res BW			#VE	3W 91 kH	łz				CF Stej 300.000 kH
Occup	ied Bandwidt	:h		Total P	ower	9.48	8 dBm		
	A48 GHz 30 KHz #VBW 91 KHz Span 3 MHz Sweep 3.2 ms pied Bandwidth 9.48 dBm 9.48 dBm	FreqOffse							
Transm	nit Freq Error	-23.739	kHz	OBW P	ower	99	9.00 %		он
x dB Ba	andwidth	866.1	kHz	x dB		-20.	.00 dB		
G						STATU	s		



#### 20 dB bandwidth & 99% Bandwidth - 8-DPSK [Low channel]

RL RF 50Ω AC		SENSE:INT	ALIGN AUTO	05:11:29 PM Oct 30, 2019	<b>F</b>
enter Freq 2.4020000		nter Freq: 2.40200 ig: Free Run	0000 GHz Avg Hold: 10/10	Radio Std: None	Frequency
		tten: 20 dB	Ext Gain: -0.86 dB	Radio Device: BTS	
dB/div Ref 10.00 dB	m <u>,                                    </u>				
9 <b>9</b> 00					Center Fre
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			3 mm		
.0 Annon I					
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enter 2.402 GHz				On on 2 Mile	
Res BW 30 kHz		#VBW 91 kH	z	Span 3 MHz Sweep 3.2 ms	CF Ste 300.000 kH
Occupied Bandwid	th	Total P	ower 7.9	3 dBm	<u>Auto</u> Ma
	.1665 MHz				
I	. 1005 10172				Freq Offs
Transmit Freq Error	-6.933 kHz	OBW P	ower 9	9.00 %	0 H
x dB Bandwidth	1.264 MHz	x dB	-20	.00 dB	
	1.204 10112	A GD	-20	.00 08	
G			STATU	JS	

#### [Middle channel]

Agilent Spectrum Analyzer - Occupi XI RL RF 50 Ω /					0
X RL   RF   50 Ω / Center Freg 2.4410000		SENSE:INT Center Freq: 2.4410	ALIGN AUTO	05:13:42 PM Oct 30, 2019 Radio Std: None	Frequency
		Frig: Free Run Atten: 20 dB	Avg Hold: 10/10 Ext Gain: -0.86 dB	Radio Device: BTS	
10 dB/div Ref 10.00 d	IBm				
-og 0.00					Center Fre
10.0		$\sim$	~~~		2.441000000 GH
20.0			- ~ <u>_</u>		
0.0					
0.0			- Win	m	
0.0				mum	
0.0					
0.0					
0.0					
enter 2.441 GHz Res BW 30 kHz		#VBW 91 k	Hz	Span 3 MHz Sweep 3.2 ms	CF Ste 300.000 kl
Occupied Bandw	idth	Total F	ower 8.32	2 dBm	<u>Auto</u> M
	1.1699 MHz	2			Freq Offs
Transmit Freq Error	-16.797 kH	z OBW F	ower 99	9.00 %	0
x dB Bandwidth	1.257 MH	z xdB	-20.	00 dB	
iG			STATU	S	



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[High channel]

	m Analyzer - Occupied E	3W					
LXIRL Center Er	RF 50 Ω AC		SENSE:INT Center Freq: 2.48	0000000 GHz	ALIGN AUTO	05:19:01 PM Oct 3 Radio Std: None	
	eq 2.40000000	#IFGain:Low	late of	Avg Hol	d: 10/10 1: -0.86 dB	Radio Device: B	-
		#IFGain:Low	#Atten: 20 db	Ext Gail	1. 40.00 GD	Radio Device. D	
10 dB/div	Ref 10.00 dBr	n <u>.</u>					
Log 0.00							Center Freq
-10.0		- Marine	~~~ ~ T	m			2.480000000 GHz
-20.0		$\bigwedge$		~			
-30.0	•••				$\parallel$		
-40.0	- month				have	m	2
-50.0							
-60.0							
-70.0							
-80.0							
Center 2.4 #Res BW			#VBW 91	kH7		Span 3 Sweep 3.	2 me CF Step
						•	Auto Man
Occup	ied Bandwidt			Power	8.54	l dBm	
	1.	1710 MH	Ιz				Freq Offset
Transm	nit Freq Error	-17.685 k	Hz OBW	Power	99	9.00 %	0 Hz
v dB Ba	andwidth	1.259 <b>№</b>	Hz xdB		-20	00 dB	
					20.		
ASG					STATUS	S	1



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### 4.4 Time of Occupancy

#### **Test Procedures**

ANSI C63.10-2013 - Section 7.8.4

The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function enabled.

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

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

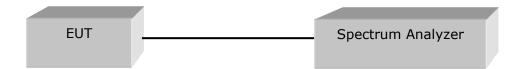
c) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system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

e) Trace: Max hold.

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

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



#### Limit

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.



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#### **Test Results**

Test mode : GFSK

Mode	Number of hops Channels	Transmit time per hop(msec)	Result (msec)	Limit (msec)
DH1	79	0.406	129.92	400
DH3	79	1.663	266.08	400
DH5	79	2.913	310.72	400

#### Test mode : 8-DPSK

Mode	Number of hops Channels	Transmit time per hop(msec)	Result (msec)	Limit (msec)
3-DH1	79	0.414	132.48	400
3-DH3	79	1.665	266.40	400
3-DH5	79	2.915	310.93	400

#### **\* Remark:**

Average time of occupancy = Transmit time per hop \* Number of hopping channels in 31.6s

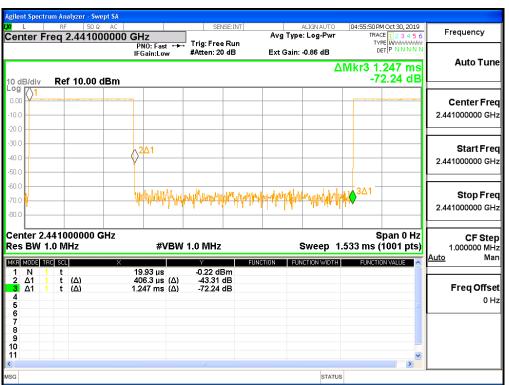
According the BLUETOOTH STANDARD SPECIFICATION, the nominal hop rate is 1600 hop/s. All bluetooth units participating in the piconet are time and hop synchronized to the channel. - The maximum number of hopping channels in 31.6s for DH1 = 1600 / 2 / 79 \* 31.6 = 320

- The maximum number of hopping channels in 31.6s for DH1 = 1600 / 2 / 79 \* 31.6 = 320- The maximum number of hopping channels in 31.6s for DH3 = 1600 / 4 / 79 \* 31.6 = 160

- The maximum number of hopping channels in 31.6s for DH5 = 1600 / 6 / 79 \* 31.6 = 107

See next pages for actual measured spectrum plots.





#### Transmit time for PACKET Type DH1(GFSK)

Transmit time for PACKET Type DH3(GFSK)

	Analyzer - Swept S								
	RF 50Ω A		SEN	ISE:INT	Avg Typ	ALIGNAUTO e: Log-Pwr	04:56:26 PM ( TRACE	Oct 30, 2019	Frequency
	2.1110000	PNO: Fast IFGain:Low	+++ Trig: Free #Atten: 20		Ext Gain:	-0.86 dB		WMMMM PNNNNN	
	ef 10.00 dBr	n					Mkr1 38 1.2	18.9 μs 1 dBm	Auto Tur
9	<b>1</b>								Center Fre
.0									2.441000000 GI
.0									Start Fr
.0						2∆1			2.441000000 G
.0 .0 <mark>m///////////////</mark> /	twn				4	Minina	elim the first state of the second state of th	201 //wh	Stop Fr
								- <b>1</b> · <b>1</b>	2.441000000 G
enter 2.441 es BW 1.0	000000 GHz MHz		SW 1.0 MHz			Sweep 3	Sp 000 ms (1		CF St 1.000000 M
R MODE TRC S	cu <b>de la cu</b> t	× 388.9 µs	Y 1.21 dE		NCTION FU	NCTION WIDTH	FUNCTION	VALUE	<u>Auto</u> M
δ Δ1 <u>1</u>	t (Δ) t (Δ)	1.663 ms () 2.489 ms ()							Freq Offs 0
i i								=	
) )									
								~	
						STATUS	;		1

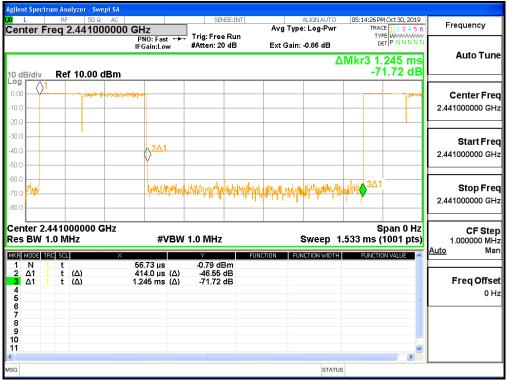


### Transmit time for PACKET Type DH5(GFSK)





#### Transmit time for PACKET Type 3-DH1(8-DPSK)



Transmit time for PACKET Type 3-DH3(8-DPSK)

Frequency	4 Oct 30, 2019 E 1 2 3 4 5 6 PE WWWWWWW	TRAC	ALIGN AUTO : Log-Pwr		se:INT	SEN	Hz PNO: Fast ↔⊷→	AC 0000 (	50 Ω 2.44100	RF Freq	ter
Auto Tu	3.73 μs 10 dBm	Mkr1 5	-0.86 dB	Ext Gain:		#Atten: 20	Gain:Low	Bm	f 10.00 d	Re	B/div
<b>Center Fr</b> 2.441000000 G	history						an series and an an an an an an	soletjele i se obel	<b>vj<sub>i</sub>sol<sup>an</sup>t-ny</b> -nyVia		
<b>Start Fr</b> 2.441000000 G				<u>\</u> 1	^2						
<b>Stop Fr</b> 2.441000000 G		3∆1 ₩₩	hurrandan an a	nfrinnnifwrwy	M						M
CF St 1.000000 M <u>Auto</u> M	pan 0 Hz 1001 pts)		Sweep 3.		FUN	1.0 MHz	#VBW	Hz		2.4410 1.0 M	BW
Freq Offs 0					B	-1.10 dE -45.26 -65.67	3.73 μs 365 ms (Δ) 496 ms (Δ)		(Δ) (Δ)	1 t 1 t 1 t	Ν Δ1 Δ1
			STATUS								



#### Transmit time for PACKET Type 3-DH5(8-DPSK)





## 4.5 Maximum peak Conducted Output Power

#### **Test Procedures**

ANSI C63.10-2013 - Section 7.8.5

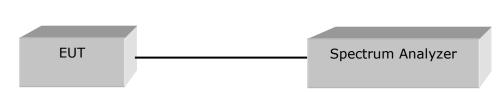
This is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation. The hopping shall be disabled for this test.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

- a) Span = 5 MHz (approximately 5 times of the 20 dB bandwidth)
- b) RBW = 3 MHz (greater than the 20 dB bandwidth of the emission being measured)
- c) VBW = 3 MHz ( $\geq$  RBW)
- e) Trace = max hold

d) Detector = peakf) Sweep = auto



#### Limit

For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W and the e.i.r.p. shall not exceed 4 W if the hopset uses 75 or more hopping channels.



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### **Test Results**

Test mode : GFSK

Frequency [MHz]	Channel No. Output Power [dBm]		Output power [mW]	Result
2 402	0	1.50	1.41	Complies
2 441	39	1.76	1.50	Complies
2 480	78	1.93	1.56	Complies

Test mode : 8-DPSK

Frequency [MHz]	Channel No.	Output Power [dBm]	Output power [mW]	Result
2 402	0	1.74	1.49	Complies
2 441	39	2.16	1.64	Complies
2 480	78	2.40	1.74	Complies

See next pages for actual measured spectrum plots.



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## Test Mode : GFSK

[Lowest channel]

	rum Analyzer - Swept SA					
XIRL Center F	RF 50 Ω AC	0 GHz PN0: Fast	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>30/30	04:52:25 PM Oct 30, 2019 TRACE 1 2 3 4 5 6 TYPE M WWWWW	Frequency
10 dB/div	Ref 20.00 dBm	IFGain:Low	#Atten: 30 dB	Ext Gain: -0.86 dB	2.402 015 GHz 1.502 dBm	Auto Tune
10.0			1			Center Fred 2.402000000 GH:
-10.0						Start Free 2.399500000 GH
-20.0						<b>Stop Fre</b> 2.404500000 GH
40.0						<b>CF Ste</b> 500.000 kH <u>Auto</u> Ma
60.0						Freq Offse 0 H
-70.0						
Center 2. #Res BW	402000 GHz 3.0 MHz	#VBW	3.0 MHz	Sweep 1	Span 5.000 MHz .000 ms (1001 pts)	
ISG				STATUS	3	

### [Middle channel]

Agilent Spectrum A						
	E 50 Ω AC 2.441000000	PNO: Fast 😱	SENSE:INT	ALIGNAUTO Avg Type: Log-Pwr Avg Hold>30/30	04:55:04 PM Oct 30, 2019 TRACE 1 2 3 4 5 6 TYPE M	Frequency
10 dB/div Re	ef 20.00 dBm	IFGain:Low	#Atten: 30 dB	Ext Gain: -0.86 dB Mkr1	2.440 720 GHz 1.764 dBm	Auto Tun
10.0			▲ <sup>1</sup>			Center Fre 2.441000000 G⊦
10.0						<b>Start Fre</b> 2.438500000 Gi
0.0						<b>Stop Fr</b> 2.443500000 G
0.0						<b>CF St</b> 500.000 k <u>Auto</u> M
0.0						Freq Offs 0
0.0						
enter 2.4410 Res BW 3.0		#VBW	3.0 MHz	Sweep 1	Span 5.000 MHz .000 ms (1001 pts)	
SG				STATUS	5	<u>[</u>



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[Highest channel]

Agilent Spectrum Analyzer - Swept SA XI RL RF 50 Ω AC		SENSE:INT	ALIGNAUTO	04:58:55 PM Oct 30, 2019	Frequency
Center Freq 2.4800000	PNO: Fast 😱	Trig: Free Run	Avg Type: Log-Pwr Avg Hold:>30/30	TRACE 1 2 3 4 5 6 TYPE MWWWW DET P P P P P P	,
0 dB/div Ref 20.00 dBm	IFGain:Low	#Atten: 30 dB	Ext Gain: -0.86 dB Mkr1	2.479 740 GHz 1.933 dBm	Auto Tune
10.0		▲ <sup>1</sup>			Center Fred 2.480000000 GH:
0.00		······································			Start Free 2.477500000 GH
20.0					<b>Stop Fre</b> 2.482500000 GH
40.0					<b>CF Ste</b> 500.000 kH <u>Auto</u> Ma
50.0					Freq Offse
70.0					
Center 2.480000 GHz Res BW 3.0 MHz	#VBW	3.0 MHz	Sweep 1	Span 5.000 MHz .000 ms (1001 pts)	
SG			STATUS	3	ц <u> </u>



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#### Test Mode : 8-DPSK

[Lowest channel]

RL RF 50Ω AC		SENSE:INT	ALIGNAUTO	05:11:16 PM Oct 30, 2019	
enter Freq 2.40200000	GHz PNO: Fast IFGain:Low	Trig: Free Run #Atten: 30 dB	Avg Type: Log-Pwr Avg Hold>30/30 Ext Gain: -0.86 dB	TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P P P P P P	Frequency
dB/div Ref 20.00 dBm			Mkr1	2.401 895 GHz 1.736 dBm	
3					
		<b>♦</b> <sup>1</sup>			2.402000000 G
.0					2.399500000 G
1.0					
.0					2.404500000 G
.0					CF Ste 500.000 k
.0					<u>Auto</u> M
.0					Freq Offs
1.0					01
enter 2.402000 GHz Res BW 3.0 MHz	#VBM	3.0 MHz	Sween 1	Span 5.000 MHz .000 ms (1001 pts)	

### [Middle channel]

					Analyzer - Swept SA	
Frequency	05:13:29 PM Oct 30, 2019 TRACE 1 2 3 4 5 6	ALIGNAUTO /pe: Log-Pwr Id:>30/30	SENSE:INT		RF 50Ω AC	X RL Center F
Auto Tune	2.441 010 GHz 2.158 dBm	in: -0.86 dB	#Atten: 30 dB	PNO: Fast 😱 IFGain:Low	ef 20.00 dBm	10 dB/div
Center Fred 2.441000000 GH:			1			10.0
<b>Start Free</b> 2.438500000 GH			· · · · · · · · · · · · · · · · ·			-10.0
<b>Stop Fre</b> 2.443500000 GH						-20.0
<b>CF Ste</b>   500.000 kH <u>Auto</u> Ma						-40.0
Freq Offse 0 ⊢						60.0
	Span 5.000 MHz				000 GHz	
	.000 ms (1001 pts)	Sweep 1	3.0 MHz	#VBW	JIVIMZ	#Res BW



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[Highest channel]

<mark>igilent Spectrum Analyzer - Swept SA</mark> V RL RF 50Ω AC		SENSE:INT	ALIGNAUTO	05:18:47 PM Oct 30, 2019	
Center Freq 2.4800000		Trig: Free Run	Avg Type: Log-Pwr Avg Hold:>30/30	TRACE 1 2 3 4 5 6 TYPE MMMMMM	Frequency
0 dB/div Ref 20.00 dBm	IFGain:Low	#Atten: 30 dB	Ext Gain: -0.86 dB	2.479 850 GHz 2.403 dBm	Auto Tune
00 10.0		1			Center Free 2.48000000 GH
0.00					Start Free 2.477500000 GH
20.0					<b>Stop Fre</b> 2.482500000 GH
10.0					CF Ste 500.000 k⊢ <u>Auto</u> Ma
50.0					Freq Offse 0 H
70.0				Spap 5 000 MHz	
Res BW 3.0 MHz	#VBW	3.0 MHz	Sweep 1	Span 5.000 MHz .000 ms (1001 pts)	
SG			STATUS	3	



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## 4.6 Unwanted Emissions (Conducted)

#### **Test Procedures**

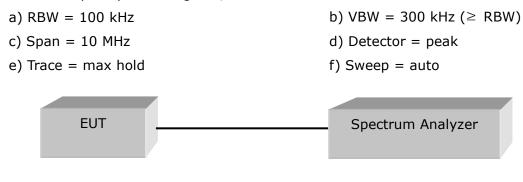
ANSI C63.10-2013 - Section 7.8.6, 7.8.8

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB.

The bandwidth at 20 dB down from the highest inband spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function disabled at the highest, middle and the lowest available channels.

#### The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels



#### Limit

> 20 dBc

#### **Test Results**

All conducted emission in any 100 kHz bandwidth outside of the spectrum band was at least 20 dB lower than the highest level of the in-band spectral density. Therefore the applying equipment meets the requirement.

See next pages for actual measured spectrum plots.



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## Band Edge

Test Mode : Hopping mode, GFSK

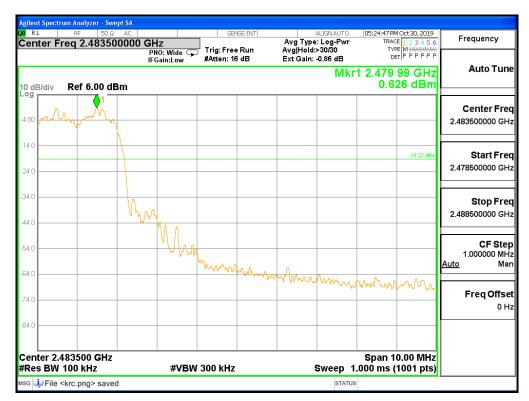






Analyzer - Swept SA	
RF         50 Ω         AC         SENSE:INT         ALIGN AUTO         05:22:50 PM Oct 3           α 2 400000000 GHz         Avg Type: Log-Pwr         TRACE         12	
TYPE MIN	PPPP
Mkr1 2.404 99           Ref 6.00 dBm         0.190 (	
	2.40000000 GHz
	19.81 dBm Start Freq 2.395000000 GHz
	<b>Stop Freq</b> 2.405000000 GHz
a mar mar mar mar a m	CF Step 1.000000 MHz <u>Auto</u> Man
	Freq Offset 0 Hz
0000 GHz Span 10.00 10 kHz #VBW 300 kHz Sweep 1.000 ms (100	
STATUS	

#### Test Mode : Hopping mode, 8-DPSK





								Analyzer - Swe	
Amplitude	04:52:56 PM Oct 30, 2019 TRACE 1 2 3 4 5 6	AUTO	ALIC vg Type: L	SE:INT	SEN		AC	RF 50 Ω	RL
RefLev	TYPE MWWWWW DET P P P P P P	0	vg Type: Li g Hold:>30 t Gain: -0.8		Trig: Free #Atten: 16	NO: Wide 😱 Gain:Low	P	.86 dBm	ef Leve
6.86 dB	2.402 15 GHz 1.396 dBm	Mkr1					m	ef 6.86 dB	dB/div
Attenuatior									<sup>bg</sup>
[16 dB									.14
Scale/Div	-18.60 dBm		/						3.1
10 c		+							3.1
Scale Tyr	4	how							3.1
Log L	Marwin A	1		- AM					3.1
				V <sup>NV</sup> V	N				3.1
Presel Cent	• •				Mal	$\langle \rangle$	$\sim$		
Presel Adju								Monnel	~^^^^
01									3.1
									3.1
Mo									
1 of	Span 10.00 MHz 000 ms (1001 pts)	ep 1.0	Sw		300 kHz	#VBW		0000 GHz 0 kHz	enter 2.4 Res BW
	,	STATUS							G

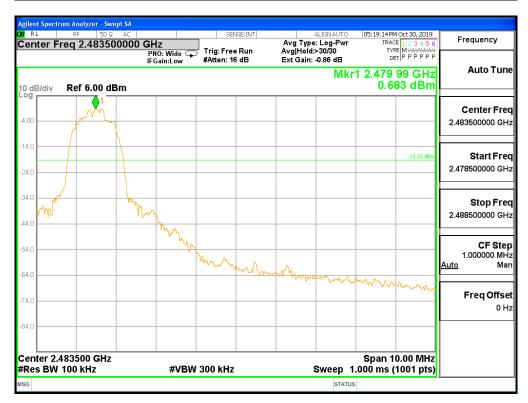
#### Test Mode : Non-Hopping mode, GFSK





	trum Analyzer - Swept SA					
U RL	RF 50 Ω AC		SENSE:INT	ALIGNAUTO	05:11:42 PM Oct 30, 2019	Frequency
Center F	Freq 2.4000000	I <mark>O GHz</mark> PNO: Wide 🖵 IFGain:Low	Trig: Free Run #Atten: 16 dB	Avg Type: Log-Pwr Avg Hold:>30/30 Ext Gain: -0.86 dB	TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P P P P P P	
I0 dB/div	Ref 6.00 dBm			Mk	r1 2.402 15 GHz 0.161 dBm	Auto Tune
4.00						Center Fred 2.400000000 GH:
24.0					-19.84 dBm	Start Free 2.395000000 GH
34.0			ar M		Winney A.	Stop Free 2.405000000 GH
54.0	- Marine	mhm	www.		A le fundar	CF Step 1.000000 MH <u>Auto</u> Ma
74.0						Freq Offse 0 H
84.0	.400000 GHz				Span 10.00 MHz	
	/ 100 kHz	#VBW	300 kHz	Sweep	1.000 ms (1001 pts)	
SG				STATU	JS	

#### Test Mode : Non-Hopping mode, 8-DPSK





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## **Spurious Emission**

## Test Mode : GFSK

[Lowest channel]

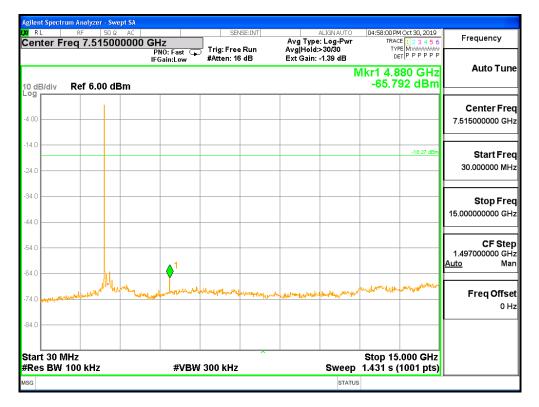
							nt \$4	TOT - SWO	Spectrum Ana	Anilost
	4:53:54 PM Oct 30, 2019	VAUTO C	ALTO	SE:INT	SEN		AC AC	201 - SW0 50 Ω	Spectrum Ana	Agneria XI R L
Frequency	TRACE 1 2 3 4 5 6 TYPE MWWWW DET P P P P P P	g-Pwr 30	Avg Type: L Avg Hold:>30	Run	] Trig: Free	PNO: Fast			Freq 30.	
Auto Tune	r1 4.805 GHz -63.866 dBm	Mk	Ext Gain: -1.	dB	#Atten: 16	FGain:Low		7.39 dB	/div Ref	10 dB Log r
Center Freq 7.515000000 GHz										-2.61 -
Start Freq 30.000000 MHz	-18.29 dBm									-12.6 -
<b>Stop Freq</b> 15.000000000 GHz										-32.6 -
<b>CF Step</b> 1.497000000 GHz <u>Auto</u> Mar						▲ <sup>1</sup>				-52.6 -
Freq Offse 0 Hz	all water and a second second	essel-hogod ada	ng markang kana ng mangang ng mang	-arlevelogy	an how the second	plater and produced and	official and a second	M	handelikalingersekendelikali	
										-82.6
	top 15.000 GHz 131 s (1001 pts)		ę		300 kHz	#VBW		Hz	30 MHz BW 100 k	
		STATUS								MSG

1103	Dee IC			#1000	500 KHZ			oweeh s		oo i pisj	
	15.000 BW 10			#\/B\A	300 kHz			Sween (	Stop 25.0 955.7 ms (1		
32.6											
72.6 -											Freq Offs 0
U.20	Man under	www.instructure.	Arm growing	when when the	Man Wester and	Man Marina	Constant Anton	hundernam	A trade of the second s	WWWWWWWWW	Erog Off
2.6											Auto N
2.6 -											CF St 1.000000000 0
2.6 -											
J											Stop Fi 25.00000000 0
2.6											
2.6 -										]	15.000000000
2.6										-18.29 dBm	Start F
.61 -											Center F 20.000000000 0
) dBi <sup>og</sup> [	div	Ref 7.39 di	5m								
			•				, i		Mkr1 24.68 GHz -60.558 dBm		Auto Tu
				PNO: Fast 🕞 Gain:Low	Trig: Free #Atten: 16		Avg Hold: Ext Gain:		DET	MWWWWW PPPPP	
	Freq	15.00000		lz			Avg Type	ALIGNAUTO	04:54:30 PM C TRACE	123456	Frequency
RL		RF 50 Ω	AC		CEN	ISE:INT			04-54-00 044	at 20, 2010	



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[Middle Channel]

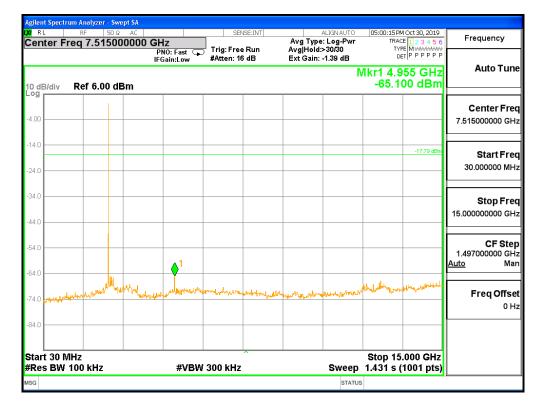


RL		RF 50 Ω			SEN	SE:INT	0	ALIGNAUTO e: Log-Pwr	04:58:36 PM		Frequency
en	ter Freq	20.0000	P	HZ NO: Fast 😱 Gain:Low	Trig: Free #Atten: 16		Avg Typ Avg Hold Ext Gain:	:>30/30	TYP	123456 MWWWWWW TPPPPPP	
0 dE	3/div Re	ef 6.00 dB	m					I	/lkr1 24. -60.89	99 GHz 92 dBm	Auto Tui
											Center Fr 20.000000000 G
4.0											20.0000000000
										-18.27 dBm	Start Fr 15.000000000 G
4.0											
4.0											Stop Fr 25.00000000 G
4.0											
4.0										1	CF St 1.000000000 G Auto M
4.0	le Maryon and	Autor and a state	mandun	warder particular	لسمور بعطمه المعالم	They and Marthy	and a state of the	and a second	and a start and a start of the	Marging weeting or	
4.0											Freq Offs 0
4.0											
tari	t 15.000 ·	GHz							Stop 25.	000 GHz	
Res	s BW 100	) kHz		#VBW	300 kHz			Sweep 9	)55.7 ms (′	1001 pts)	



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[Highest Channel]



	.000 GHz V 100 kHz		#VBW	300 kHz			Sweep 9	Stop 25. 55.7 ms (*	000 GHz 1001 pts)	
4.0										
4.0										0
4.0	ad march	where a supplicity of the second s	rran hayan gerin a agan la	and the second second	"byfe"					Freq Offs
4.0				de la contrata de	- ANN AND	white when	A HALLAND	and application in the same	Long to the state	<u>Auto</u> M
i.0 —									1	CF St 1.000000000 G
\$.0										
										Stop Fr 25.00000000 G
4.0										15.00000000 G
4.0									-17.79 dBm	Start Fr
.00										20.00000000 0
										Center Fr
) dB/div	Ref 6.00	dBm					r	/lkr1 23. -61.17	99 GHZ 76 dBm	,400 10
			PNO: Fast 🖵 IFGain:Low	Trig: Free #Atten: 16		Avg Hold Ext Gain:	-1.39 dB	DE		Auto Tu
RL enter	RF 5	0Ω AC	GHz	1	SE:INT		ALIGNAUTO e: Log-Pwr	TRACE	Oct 30, 2019	Frequency



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### Test Mode : 8-DPSK

RL	rum Analyzer - Swept SA RF 50 Ω AC		SENSE:INT	ALIGNAUTO	05:12:36 PM Oct 30, 2019	_
enter F	req 7.51500000	10 GHz PNO: Fast 😱 IFGain:Low	Trig: Free Run #Atten: 16 dB	Avg Type: Log-Pwr Avg Hold:>30/30 Ext Gain: -1.39 dB	TRACE 1 2 3 4 5 6 TYPE M M P P P P P P DET P P P P P P	Frequency
dB/div	Ref 6.00 dBm			Ν	/lkr1 4.805 GHz -64.152 dBm	Auto Tur
						Center Fre
00						7.515000000 GH
.0					-23.00 dBm	Start Fre 30.000000 Mi
4.0						00.00000 Min
						Stop Fre 15.000000000 Gi
.0						
.0		1				CF Ste 1.497000000 GF <u>Auto</u> Mi
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art 30 P	√Hz 100 kHz	#\/B\//	300 kHz	Sweep	Stop 15.000 GHz 1.431 s (1001 pts)	
		#VDVV	JOO KHZ	STATUS		

[Lowest channel]

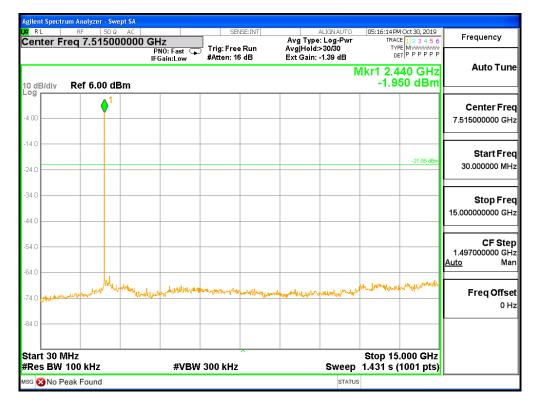
# [Middle Channel]

	05:13:12 PM Oct 30, 2019	ALIGN AUTO		SENSE:INT		AC	m Analyzer - Swept RF 50 Ω /	gilent Spect
Frequency	TRACE 1 2 3 4 5 6 TYPE MWWWW DET P P P P P	e: Log-Pwr	AvgHo	Free Run	st 🕞 Trig: Fre		eq 20.00000	
Auto Tui	1kr1 23.94 GHz -60.415 dBm		Ext Ga		ow whiten.		Ref 6.00 dBm	0 dB/div
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<b>Start Fre</b> 15.000000000 Gi	-23.00 dBm							24.0
<b>Stop Fr</b> 25.00000000 G								14.0
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	Stop 25.000 GHz 55.7 ms (1001 pts)	Sween 0			VBW 300 kH	#\/P\/		tart 15.0
	, ,	Sweep 9		.82			krc.png> saved	



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[Middle Channel]

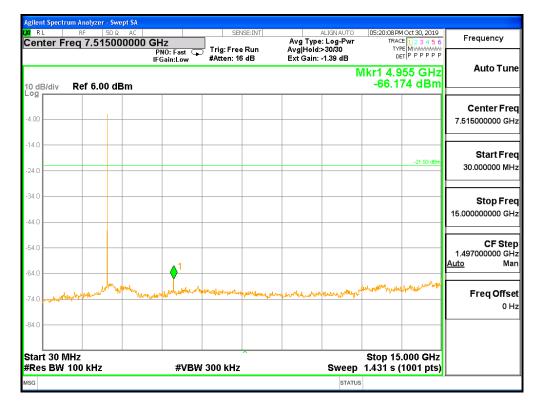


	RF 50 Ω AC		SENSE:INT	ALIGNAUTO	05:16:49 PM Oct 30, 2019	Frequency
enter Fred	20.00000000	IU GHZ PNO: Fast IFGain:Low	Trig: Free Run #Atten: 16 dB	Avg Type: Log-Pwr Avg Hold:>30/30 Ext Gain: -1.39 dB	TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P P P P P P	
0 dB/div R	ef 6.00 dBm			Ν	/lkr1 23.96 GHz -60.336 dBm	Auto Tui
Jg						Center Fre
.00						20.00000000 G
4.0					-21.95 dBm	Start Fr 15.00000000 G
4.0						
4.0						<b>Stop Fr</b> 25.00000000 G
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tart 15.000 Res BW 10		#VBW	300 kHz	Sweep 9	Stop 25.000 GHz 55.7 ms (1001 pts)	



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[Highest Channel]



q 20.0000000	DOU GHZ PNO: Fast 🗔				
	IFGain:Low	Trig: Free Run #Atten: 16 dB	Avg Type: Log-Pwr Avg Hold:>30/30 Ext Gain: -1.39 dB	TRACE 1 2 3 4 5 6 TYPE M M M M M M M M M M M M M M M M M M M	Frequency
tef 6.00 dBm			r	Vkr1 23.99 GHz -60.445 dBm	Auto Tur
					Center Fre
					20.00000000 G
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					15.00000000 G
					Stop Fr
					25.000000000 G
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the any plate when	for the fail of the second states of the second sta	and a free service of the last			Freq Offs
					0
GHZ		200 kHz	Swoon (	Stop 25.000 GHz	
					GHz Stop 25.000 GHz



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# 4.7 Radiated Emission

#### **Test Location**

 $\boxtimes$  10 m SAC (test distance :  $\square$  10 m,  $\boxtimes$  3 m)  $\boxtimes$  3 m SAC (test distance : 3 m)

### **Test Procedures**

ANSI C63.10-2013 - Section 6.5, 6.6

- 1) In the frequency range of 9 kHz to 30 MHz, magnetic field is measured with Loop Antenna. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
- 2) In the frequency rage above 30 MHz, Bi-Log Test Antenna(30 MHz to 1 GHz) and Horn Test Antenna(above 1 GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is carried from 1m to 4m above the ground to determine the maximum value of the field strength. The emissions levels at both horizontal and vertical polarizations should be tested.

## **Instrument Settings**

Frequency Range = 9 kHz  $\sim$  25 GHz (2.4 GHz 10<sup>th</sup> harmonic)

a) RBW = 1 MHz for f  $\geq$  1 GHz, 100 kHz for f < 1 GHz, 9 kHz for f < 30 MHz

- b) VBW  $\geq$  RBW
- c) Sweep time = auto couple



## Limit :

Unwanted emissions that do not fall within the restricted frequency bands of Table 1 shall comply either with the limits specified in the applicable RSS or with those specified in this RSS-Gen.

FCC Part 15 § 15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

			• •		
MHz	MHz	MHz	MHz	MHz	GHz
0.09-0.11	8.37626-8.38675	73-74.6	399.9-410	2690-2900	10.6-12.7
<sup>1</sup> 0.495-0.505	8.41425-8.41475	74.8-75.2	608-614	3260-3267	13.25-13.4
2.1735-2.1905	12.29-12.293	108-121.94	960-1240	3332-3339	14.47-14.5
4.125-4.128	12.51975-12.52025	123-138	1300-1427	3345.8-3358	15.35-16.2
4.17725-4.17775	12.57675-12.57725	149.9-150.05	1435-1626.5	3600-4400	17.7-21.4
4.20725-4.20775	13.36-13.41	156.52475- 156.52525	1645.5-1646.5	4500-5150	22.01-23.12
6.215-6.218	16.42-16.423	156.7-156.9	1660-1710	5350-5460	23.6-24
6.26775-6.26825	16.69475-16.69525	162.0125-167.17	1718.8-1722.2	7250-7750	31.2-31.8
6.31175-6.31225	16.80425-16.80475	167.72-173.2	2200-2300	8025-8500	36.43-36.5
8.291-8.294	25.5-25.67	240-285	2310-2390	9000-9200	<sup>2</sup> Above 38.6
8.362-8.366	37.5-38.25	322-335.4	2483.5-2500	9300-9500	

**Table 1. Restricted Frequency Bands** 

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> Above 38.6

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



FCC Part 15 § 15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table :

Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table 2 Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Frequency(MHz)	Field Strength uV/m@3m	Field Strength dBuV/m@3m	Measurement Distance (meters)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705-30	30	-	30
30-88	100**	40	3
88-216	150**	43.5	3
216-960	200**	46	3
Above 960	500	54	3

## Table 2. General Field Strength Limits for Licence-Exempt Transmitters

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

Note :

- 1) For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
- For above 1 GHz, limit field strength of harmonics : 54 dBuV/m@3m (AV) and 74 dBuV/m@3m (PK)
- For measurement above 1GHz, the resolution bandwidth is set to 1 MHz and video bandwidth is set to 1 MHz for peak measurement and 10 Hz for average measurement.(Duty Cycle is > 98%,)
- 4) Duty Cycle is < 98%, VBW setting will need to > 1/T.
- 5) DCCF = Duty Cycle Correction Factor

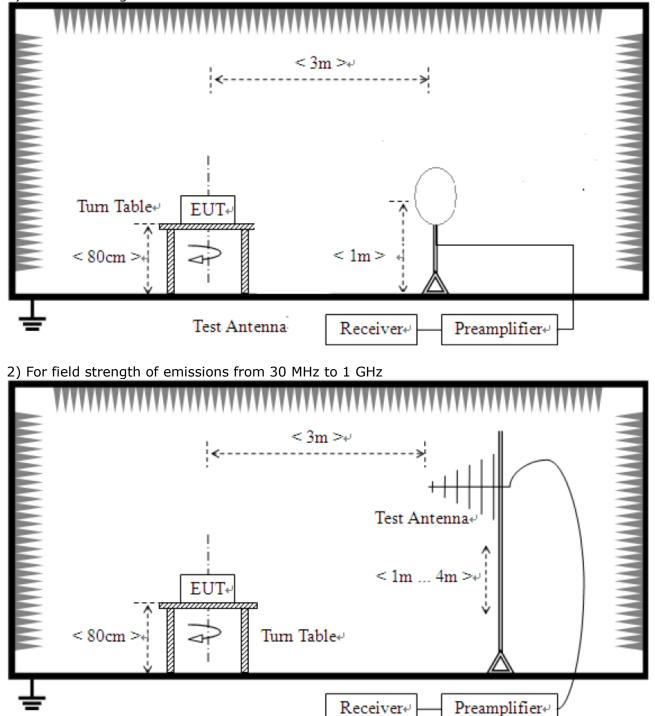
 $DCCF = 20*Log(T_{on}/100 \text{ ms})$   $T_{on} = 2.91\text{ms} (GFSK)$   $T_{on} = 2.92\text{ms} (8-DPSK)$  DCCF = -30.72 dB (GFSK) DCCF = -30.69 dB (8-DPSK)Result Average = Result Peak + DCCF



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# **Test Setup:**

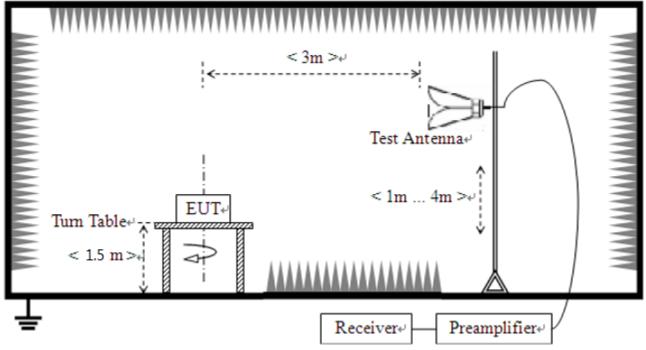
1) For field strength of emissions from 9 kHz to 30 MHz





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# 3) For field strength of emissions above 1 GHz





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## **Test results**

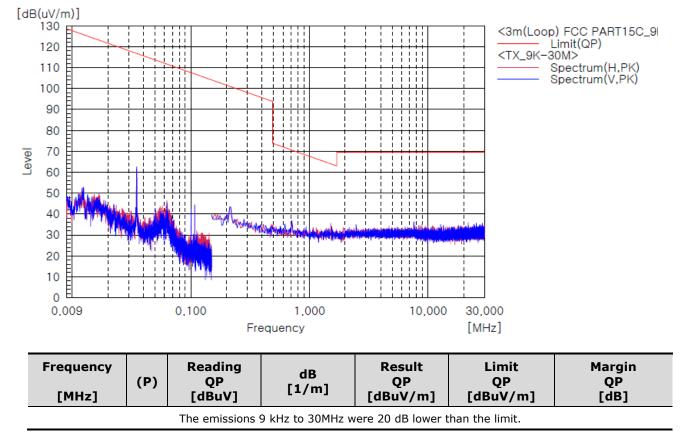
### 1) 9 kHz to 30 MHz

Test mode : Transmitter(Worst Case)

The requirements are:  $\square$  Complies

#### **Test Data**

Test Model	: WH-CH710N
Test Mode	: TX_9K-30M
Tester	: KIM JI HYE



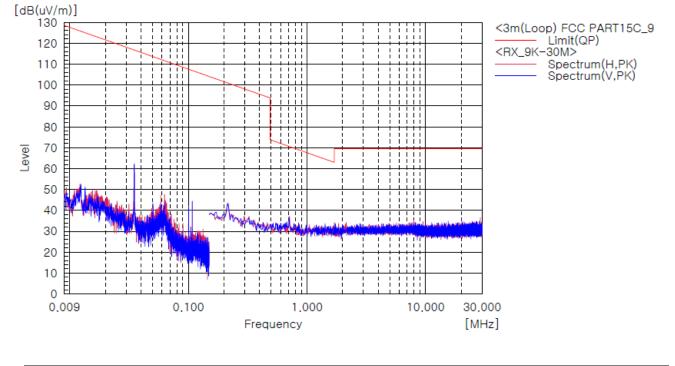
- 1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in stand-up position(Z axis) and the worst case was recorded.
- 2. Distance extrapolation factor = 40 log (specific distance / test distance) (dB)



### Test mode : Receiver(Worst Case)

# The requirements are: $\square$ Complies

Test Model	: WH-CH710N
Test Mode	: RX_9K-30M
Tester	: KIM JI HYE



Frequency [MHz]	(P)	Reading QP [dBuV]	dB [1/m]	Result QP [dBuV/m]	Limit QP [dBuV/m]	Margin QP [dB]				
	The emissions 9 kHz to 30MHz were 20 dB lower than the limit.									

- 1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in stand-up position(Z axis) and the worst case was recorded.
  - 2. Distance extrapolation factor = 40 log (specific distance / test distance) (dB)



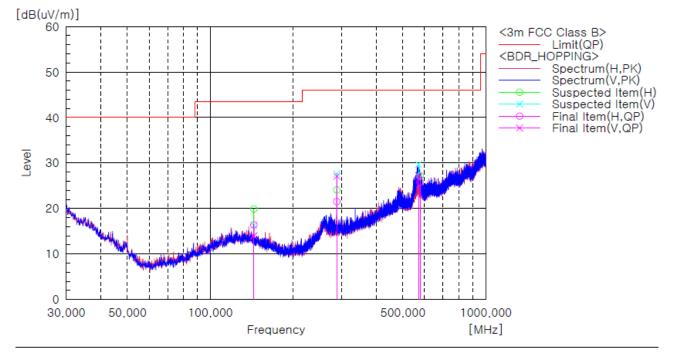
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# 2) 30 MHz to 1 GHz

Test mode : GFSK, Hopping mode

The requirements are:  $\square$  Complies

#### **Test Data**



Final Result

No.	Frequency	(P)	Reading QP	c.f	Result QP	Limit QP	Margin QP	Height	Angle
	[MHz]		[dB(uV)]	[dB(1/m)]	[dB(uV/m)]	[dB(uV/m)]	[dB]	[cm]	[deg]
1	143.975	н	28.1	-11.7	16.4	43.5	27.1	100.0	350.0
2	143.975	V	25.7	-11.7	14.0	43.5	29.5	101.0	236.0
3	288.020	Н	30.2	-8.7	21.5	46.0	24.5	100.0	70.0
4	288.020	V	35.8	-8.7	27.1	46.0	18.9	191.0	201.0
5	570.048	V	27.2	0.0	27.2	46.0	18.8	101.0	226.0
6	577.565	Н	26.0	-0.2	25.8	46.0	20.2	399.0	9.0

- 1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in in stand-up position(Z axis) and the worst case was recorded.
- 2. Result = Reading + c.f(Correction factor)
- 3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator Amp Gain

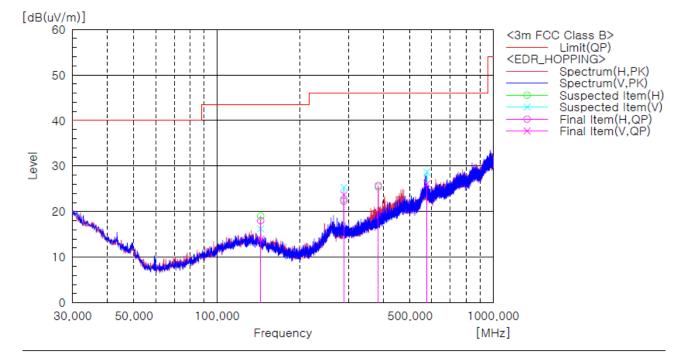


#### Test mode : 8-DPSK, Hopping mode

The requirements are:  $\square$  Complies

#### **Test Data**

Test Model	: WH-CH710N
Test Mode	: EDR_HOPPING
Tester	: KIM JI HYE



Final Result

No.	Frequency	(P)	Reading QP	c.f	Result QP	Limit QP	Margin QP	Height	Angle
	[MHz]		[dB(uV)]	[dB(1/m)]	[dB(uV/m)]	[dB(uV/m)]	[dB]	[cm]	[deg]
1	143.975	Н	29.7	-11.7	18.0	43.5	25.5	209.0	183.0
2	143.975	V	25.6	-11.7	13.9	43.5	29.6	101.0	262.0
3	287.899	Н	31.0	-8.7	22.3	46.0	23.7	100.0	19.0
4	288.020	V	32.4	-8.7	23.7	46.0	22.3	191.0	24.0
5	384.050	Н	31.5	-5.8	25.7	46.0	20.3	100.0	17.0
6	576.110	V	26.2	-0.1	26.1	46.0	19.9	101.0	189.0

- 1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in in stand-up position(Z axis) and the worst case was recorded.
- 2. Result = Reading + c.f(Correction factor)
- 3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator Amp Gain

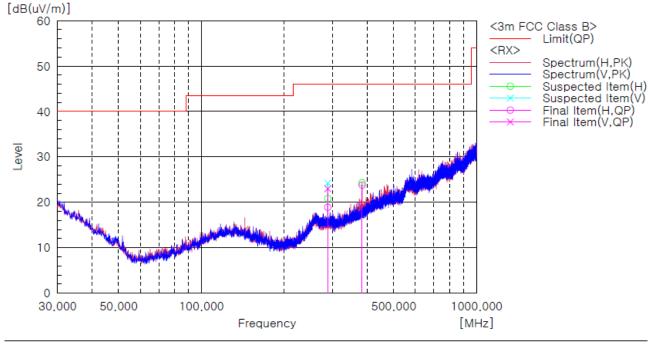


#### **Test mode : Receiver**

The requirements are:  $\square$  Complies

#### **Test Data**

Test Model	: WH-CH710N
Test Mode	: RX
Tester	: KIM JI HYE



Final Result

No.	Frequency	(P)	Reading QP	c.f	Result QP	Limit QP	Margin QP	Height	Angle
	[MHz]		[dB(uV)]	[dB(1/m)]	[dB(uV/m)]	[dB(uV/m)]	[dB]	[cm]	[deg]
1	288.020	Н	27.6	-8.7	18.9	46.0	27.1	208.0	323.0
2	288.020	V	31.7	-8.7	23.0	46.0	23.0	191.0	354.0
3	384.050	Н	29.6	-5.8	23.8	46.0	22.2	100.0	181.0

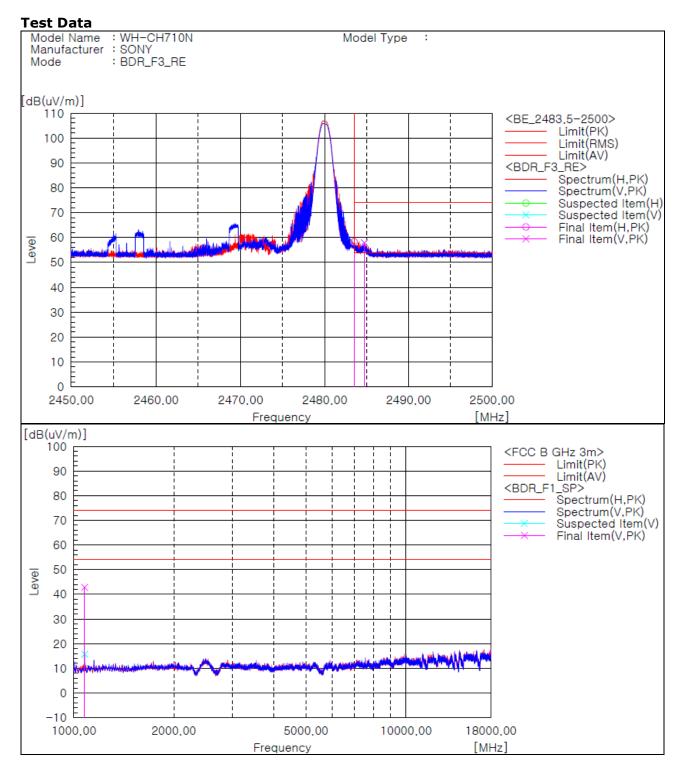
- 1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in in stand-up position(Z axis) and the worst case was recorded.
- 2. Result = Reading + c.f(Correction factor)
- 3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator Amp Gain



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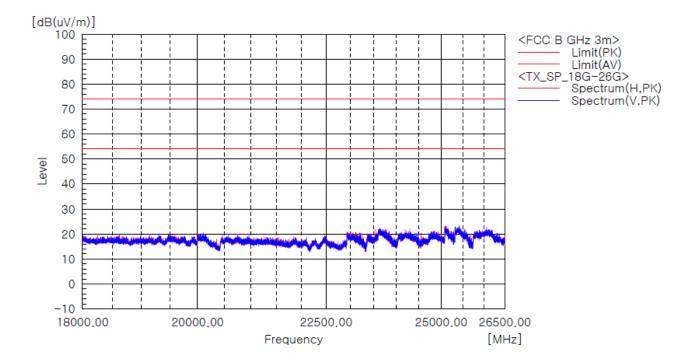
# 3) above 1 GHz

The requirements are:  $\square$  Complies





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#### Test mode : GFSK

#### Lowest frequency(2 402 MHz)

Frequency	(P)	Limit AV	Limit PK	Result AV	Result PK	Margin AV	Margin PK		
[MHz]		[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]		

The emissions above 1 GHz were 20 dB lower than the limit.

#### Middle frequency(2 441 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]		
The emissions above 1 GHz were 20 dB lower than the limit.									

#### Highest frequency(2 480 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
2 483.51	Н	54.00	74.00	27.58	58.3	26.42	15.7
2 484.73	V	54.00	74.00	27.18	57.9	26.82	16.1

#### Remarks

1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in stand-up position(Z axis) and the worst case was recorded.

2. Result = Reading + c.f(correction factor) + Duty cycle c.f

3. Correction factor = Antenna factor + Cable loss - Amp Gain

4. Result Average = Result Peak + DCCF



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#### Test mode : 8-DPSK

#### Lowest frequency(2 402 MHz)

Frequency	(P)	Limit AV	Limit PK	Result AV	Result PK	Margin AV	Margin PK		
[MHz]		[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]		
The emissions shows 1 Cills were 20 dD laws they the limit									

The emissions above 1 GHz were 20 dB lower than the limit.

#### Middle frequency(2 441 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]		
The emissions above 1 GHz were 20 dB lower than the limit.									

#### Highest frequency(2 480 MHz)

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
2 499.09	н	54.00	74.00	24.81	55.5	29.19	18.5
2 484.00	V	54.00	74.00	25.41	56.1	28.59	17.9

#### Remarks

1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in stand-up position(Z axis) and the worst case was recorded.

2. Result = Reading + c.f(correction factor) + Duty cycle c.f

3. Correction factor = Antenna factor + Cable loss - Amp Gain

4. Result Average = Result Peak + DCCF



#### **Test mode : Receiver**

Frequency [MHz]	(P)	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Result AV [dBuV/m]	Result PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]		
The emissions above 1 GHz were 20 dB lower than the limit.									

#### Remarks

1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in stand-up position(Z axis) and the worst case was recorded.

- 2. Result = Reading + c.f(correction factor) + Duty cycle c.f
- 3. Correction factor = Antenna factor + Cable loss Amp Gain
- 4. Result Average = Result Peak + DCCF



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# **4.8 AC Power Line Conducted Emissions**

A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz-30 MHz, shall not exceed the limits.

### **Instrument Settings**

IF Band Width: 9 kHz

#### **Test Procedures**

RSS-Gen - Section 8.8

The EUT was placed on a non-metallic table 0.8m above the metallic, grounded floor and 0.4m from the reference ground plane wall. The distance to other metallic surfaces was at least 0.8m.

Amplitude measurements were performed with a quasi-peak detector and an average detector.

#### Limit

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

\* The level decreases linearly with the logarithm of the frequency.

\*\* A linear average detector is required.



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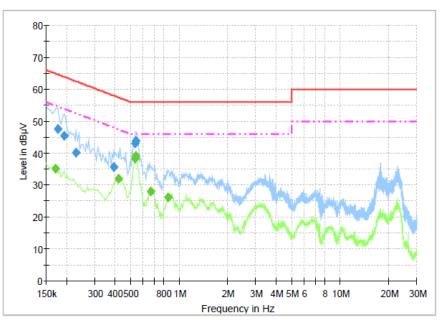
# **Test Results**

The requirements are:  $\square$  Complies

# Test Data

# [LINE]

3CE\_Class B\_L1



# **Final Result 1**

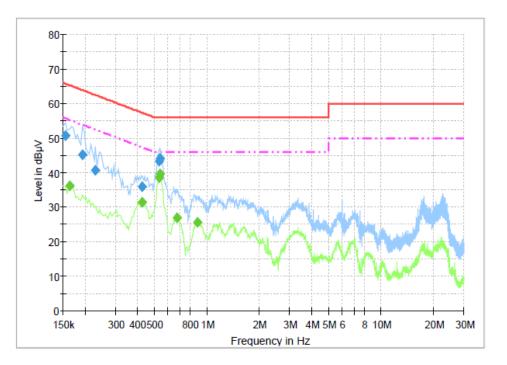
Frequency	QuasiPeak	Meas.	Bandwidth	Filter	Line	Corr.	Margin	Limit
(MHz)	(dBµV)	Time	(kHz)			(dB)	(dB)	(dBµV)
		(ms)						
0.177000	47.5	1000.0	9.000	On	L1	10.1	17.1	64.6
0.195000	45.4	1000.0	9.000	On	L1	10.0	18.5	63.8
0.231000	40.3	1000.0	9.000	On	L1	9.8	22.2	62.4
0.393000	35.7	1000.0	9.000	On	L1	10.0	22.3	58.0
0.532500	43.0	1000.0	9.000	On	L1	10.0	13.0	56.0
0.541500	43.7	1000.0	9.000	On	L1	10.0	12.3	56.0

# **Final Result 2**

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.172500	35.1	1000.0	9.000	On	L1	10.1	19.8	54.8
0.424500	31.9	1000.0	9.000	On	L1	10.0	15.5	47.4
0.532500	38.3	1000.0	9.000	On	L1	10.0	7.7	46.0
0.541500	39.2	1000.0	9.000	On	L1	10.0	6.8	46.0
0.672000	27.9	1000.0	9.000	On	L1	10.0	18.1	46.0
0.856500	26.2	1000.0	9.000	On	L1	9.9	19.8	46.0



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# [NEUTRAL]

# Final Result 1

Frequency	QuasiPeak	Meas.	Bandwidth	Filter	Line	Corr.	Margin	Limit
(MHz)	(dBµV)	Time	(kHz)			(dB)	(dB)	(dBµV)
		(ms)						
0.154500	50.8	1000.0	9.000	On	N	9.9	15.0	65.8
0.195000	45.1	1000.0	9.000	On	N	10.0	18.7	63.8
0.231000	40.7	1000.0	9.000	On	N	9.8	21.7	62.4
0.429000	36.0	1000.0	9.000	On	N	10.0	21.3	57.3
0.532500	43.4	1000.0	9.000	On	Ν	10.0	12.6	56.0
0.541500	44.1	1000.0	9.000	On	N	10.0	11.9	56.0

# **Final Result 2**

Frequency (MHz)	CAverage (dBµV)	Meas. Time	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
(11112)	(ubµv)	(ms)	(112)			(ab)	(ub)	(abµv)
0.163500	36.2	1000.0	9.000	On	N	10.0	19.1	55.3
0.429000	31.4	1000.0	9.000	On	N	10.0	15.9	47.3
0.532500	38.7	1000.0	9.000	On	N	10.0	7.3	46.0
0.541500	39.7	1000.0	9.000	On	N	10.0	6.3	46.0
0.681000	26.8	1000.0	9.000	On	N	10.0	19.2	46.0
0.888000	25.6	1000.0	9.000	On	N	9.9	20.4	46.0



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# **4.9 Frequency Hopping System Requirements**

# Standard Applicable

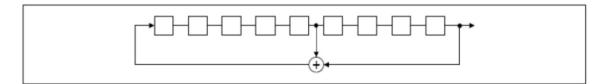
According to FCC Part 15.247(a)(1), The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

(h) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

#### EUT Pseudorandom Frequency Hopping Sequence

The pseudo random sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage, and the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones. Number of shift register stages: 9 Length of pseudo-random sequence:  $2^9-1 = 511$  bits Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

0246	62 64 78 1	73 75 77
		<u>i</u>

Each frequency used equally on the average by each transmitter. The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.



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#### **Frequency Hopping System**

This transmitter device is frequency hopping device, and complies with FCC part 15.247 rule. This device uses Bluetooth radio which operates in 2400-2483.5 MHz band. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 bands (1 MHz each; centred from 2402 to 2480 MHz) in the range 2,400-2,483.5 MHz. The transmitter switches hop frequencies 1,600 times per second to assure a high degree of data security. All Bluetooth devices participating in a given piconet are synchronized to the frequency-hopping channel for the piconet. The frequency hopping sequence is determined by the master's device address and the phase of the hopping sequence (the frequency to hop at a specific time) is determined by the master's internal clock. Therefore, all slaves in a piconet must know the master's device address and must synchronize their clocks with the master's clock.

Adaptive Frequency Hopping (AFH) was introduced in the Bluetooth specification to provide an effective way for a Bluetooth radio to counteract normal interference. AFH identifies "bad" channels, where either other wireless devices are interfering with the Bluetooth signal or the Bluetooth signal is interfering with another device. The AFH-enabled Bluetooth device will then communicate with other devices within its piconet to share details of any identified bad channels. The devices will then switch to alternative available "good" channels, away from the areas of interference, thus having no impact on the bandwidth used.

\*Example for a Bluetooth device using channel numbers would be : Ch 44, 35, 78, 03, 15, 21, 76, 40, 56, 13, 02, 19, 67, 39, 78, 20, 21, 64, 75 etc.



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# **APPENDIX A – Test Equipment Used For Tests**

	Name of Equipment	Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date
1	MXA Signal Analyzer	Keysight	N9020A	MY48011598	2019-10-16	2020-10-16
2	Signal Generator	Rohde & Schwarz	SMB100A	175528	2019-10-16	2020-10-16
3	EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2019-10-22	2020-10-22
4	Bilog Antenna	Schaffner	CBL6111C	2551	2018-05-10	2020-05-10
5	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-126	2018-05-27	2020-05-27
6	6dB Attenuator	R&S	DNF	272.4110.50-2	2019-10-25	2020-10-25
7	AMPLIFIER	SONOMA	310	291721	2019-01-28	2020-01-28
8	EMI Test Receiver	Rohde & Schwarz	ESU40	100336	2019-01-29	2020-01-29
9	Preamplifier	Agilent	8449B	3008A01504	2018-12-17	2019-12-17
10	Double Ridged Guide Antenna	ETS-Lindgren	3117	00154525	2019-09-25	2021-09-25
11	Horn Antenna	ETS-Lindgren	3116	00062916	2019-04-22	2021-04-22
12	Band Reject Filter	Micro Tronics	BRM50702	G233	2019-01-28	2020-01-28
13	LISN	Rohde & Schwarz	ENV216	101235	2019-01-29	2020-01-29

	Cable	Manufacturer	Model No.	Serial No.	Check Date
1	RF Cable	Canare Corporation	L-5D2W	N/A	2018-12-19
2	RF Cable	Junkosha Inc.	MWX221	1512S149	2019-10-30
3	RF Cable	HUBER+SUHNER	SUCOFLEX 102	MY073/2	2018-12-19
4	RF Cable	HUBER+SUHNER	SUCOFLEX 102	MY4728/2	2018-12-19
5	RF Cable	HUBER+SUHNER	SUCOFLEX 104	MY27558/4	2018-12-19
6	RF Cable	HUBER+SUHNER	SUCOFLEX 104	N/A	2018-12-19
7	RF Cable	HUBER+SUHNER	SUCOFLEX 104	MY27573/4	2018-12-19
8	RF Cable	HUBER+SUHNER	SUCOFLEX 106	N/A	2018-12-19