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TEST REPORT

FCC Part 15.247

Equipment under testIn-vehicle Infotainment SystemModel nameXSG3NAFCC IDYE4XSG3NAApplicantGlosys Inc.ManufacturerGlosys Inc.Date of test(s)2015.08.04 ~ 2015.08.19Date of issue2015.09.22

Issued to Glosys Inc.

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GwonseonGu, SuwonSi, GyeonggiDo, korea

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Test engineer	Technical manager

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KES-P-5101-14 Rev. 1



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Revision history

Revision	Date of issue	Test report No.	Description	
-	- 2015.08.31 KES-RF-15T0057		Initial	
R1	2015.09.22	KES-RF-15T0057-R1	A change of product name	



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1.

Applicant: Glosys Inc. #510, Venture Valley B/D, 40, OmokcheonRo 152beonGil GwonseonGu, Applicant address: SuwonSi, GyeonggiDo, korea Test site: KES Co., Ltd. Test site address: C-3701, Simin-daero 365-40, Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea 473-29, Gayeo-ro, Yeoju-si, Gyeonggi-do, 12658, Korea FCC/IC rule part(s): 15.247 Model: XSG3NA FCC ID: YE4XSG3NA Test device serial No .: Production Pre-production Engineering

General information

1.1. **EUT description**

Equipment under test	In-vehicle Infotainment System			
Frequency range	2402 MHz ~ 2480 MHz			
Modulation technique	FHSS			
Number of channels	79			
Antenna specification	Antenna type: PCB Peak gain: -4.54 dBi			
Power source	DC 12.0 V			

15.247(a)(1) that the rx input bandwidths shift frequencies in synchronization with the transmitted

15.247(g): In accordance with the Bluetooth Industry Standard, the system is designed to comply with all of the regulations in Section 15.247 when the transmitter is presented with a continuous data (or information) system.

15.247(h): In accordance with the Bluetooth Industry Standard, the system does not coordinate it channels selection/ hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

Pseudorandom frequency hopping sequence

The channel is represented by a pseudo-random hopping sequence hopping through the 79 RF channels. The hopping sequence is unique for the piconet and is determined by the Bluetooth device address of the master; the phase in the hopping sequence is determined by the Bluetooth clock of the master. The channel is divided into time slots where each slot corresponds to an RF hop frequency. Consecutive hops correspond to different RF hop frequencies. The nominal hop rate is 1 600 hops/s.

Equal hopping frequency use

The channels of this system will be used equally over the long-term distribution of the hopsets.

Example of a 79 hopping sequence in data mode:

02, 05, 31, 24, 20, 10, 43, 36, 30, 23, 40, 06, 21, 50, 44, 09, 71, 78, 01, 13, 73, 07, 70, 72, 35, 62, 42, 11, 41, 08, 16, 29, 60, 15, 34, 61, 58, 04, 67, 12, 22, 53, 57, 18, 27, 76, 39, 32, 17, 77, 52, 33, 56, 46, 37, 47, 64, 49, 45, 38, 69, 14, 51, 26, 79, 19, 28, 65, 75, 54, 48, 03, 25, 66, 05, 16, 68, 74, 59, 63, 55,

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System receiver input bandwidth

Each channel bandwidth is 1 Mt.

The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

1.2. Test configuration

The Bluetooth Car Audio FCC ID: YE4XSG3NA was tested per the guidance of ANSI C63.10-2009 and DA 00-705. ANSI C63.10-2009 was used to reference the appropriate EUT setup for radiated spurious emissions testing.

1.3. Frequency/channel operations

Ch.	Frequency (MLz)	Rate(Mbps)
00	2402	1,3
		-
39	2441	1,3
78	2480	1,3

Preliminary tests were performed in different data rate and the highest power data rates(1 Mbps, 3 Mbps) were chosen for full test

Data rate	Data rateChannel (Mz)1 Mbps(GFSK)		2 Mbps(π/4-DQPSK)	3 Mbps(8DPSK)
Output power(dBm)	2402	<u>-1.80</u>	-3.07	<u>-2.85</u>
	2441	<u>-1.84</u>	-2.96	<u>-2.76</u>
	2480	<u>-2.48</u>	-3.72	<u>-3.36</u>

1.4. Information about derivative model

N/A



2. Summary of tests	5	
Section in FCC Part 15	Test description	Test results
15.205, 15.209	Radiated restricted band and emission	Pass
15.207(d)	Conducted band edge and out of band emissions	Pass
15.247(a)(1)(iii)	20 dB bandwidth	Pass
15.247(b)(1)	Output power	Pass
15.247(a)(1)	Channel separation	Pass
15.247(a)(1)(iii)	Number of channels	Pass
15.247(a)(1)(iii)	Time of occupancy	Pass

Note:

- 1. The EUT was tested per the guidance of DA 00-705. ANSI C63.10-2009 was used to reference the appropriate EUT setup for radiated spurious emissions testing.
- 2. All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.

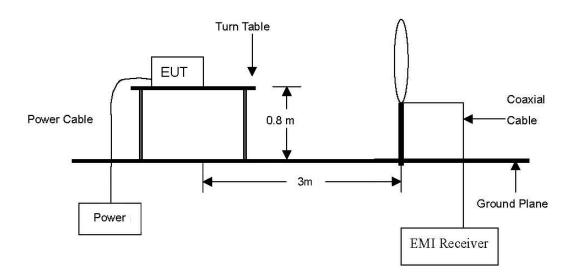


3. Test results

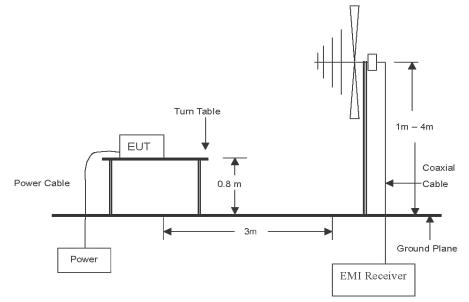
3.1. Radiated restricted band and emissions

Test setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 Mz to 1 GHz emissions.

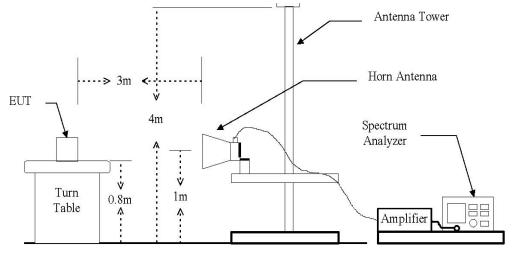


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The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 24 GHz emissions.





Test procedure

- 1. The EUT is placed on a turntable, which is 0.8 m above ground plane.
- 2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
- 3. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
- 4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 6. Repeat above procedures until the measurements for all frequencies are complete.
- 7. Average measurements > 1 GHz using RBW = 1 MHz and VBW = 10 Hz. Peak measurements > 1 GHz using RBW = 1 MHz and VBW = 3 MHz. Both average and peak measurements were made using a peak detector.

Note:

- 1. The spectrum is measured from 9 kHz to the 10th harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1 GHz. Above 1 GHz, average and peak measurements were taken using linearly polarized horn antennas. The worst-case emissions are reported however emissions whose levels were not within 20 dB of the respective limits were not reported.
- 2. When Average result is different from peak result over 20 dB (over-averaging), according to 15.35 (c), as a "duty cycle correction factor", pulse averaging with 20 log(duty cycle) has to be used.
- 3. Emissions below 18 GHz were measured at a 3 meter test distance while emissions above 18 GHz were measured at a 1 meter test distance with the application of a distance correction factor.
- 4. Average test would be performed if the peak result were greater than the average limit.
- 5. "*" means restricted band edge.
- 5. Field strength($dB\mu N/m$) = Level($dB\mu N$) + Correction factors(dB/m) + Cable loss(dB) + F_d(dB)
- 6. Correction factors(dB/m) = Antenna factor(dB/m) + Cable loss(dB) + or Amp. gain(dB)
- 7. Margin(dB) = Limit(dB μ V/m) Field strength(dB μ V/m)
- 8. $F_d = 40 \log(D_m / D_s)$

Where:

- F_d = Distance factor in dB
- D_m = Measurement distance in meters
- D_s = Specification distance in meters



Limit

According to 15.209(a), for an intentional radiator devices, the general required of field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values :

Frequency (Mz)	Distance (Meters)	Radiated (µV/m)
0.009 ~ 0.490	300	2 400 / F(kHz)
0.490 ~ 1.705	30	24 000 / F(kHz)
1.705 ~ 30.0	30	30
30 ~ 88	3	100**
88 ~ 216	3	150**
216 ~ 960	3	200**
Above 960	3	500

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



Test results (Below 30 Mz)

Mode:	Bluetooth		
Transfer rate:	1 Mbps		
Distance of measurement:	3 meter		
Operating frequency:	2 402 MHz (Worst case)		
Channel:	00		

Frequency (Mbz)	Level (dBµV)	Ant. Pol.	Correction factors (dB/m)	F _d (dB)	Field strength (dBµV/m)	Limit (dBµN/m)	Margin (dB)
No signal detected							

Test results (Below 1 000Mz)Mode:BluetoothTransfer rate:1 Mbps

	1
Distance of measurement:	3 meter
Operating frequency:	2 402 Mtz (Worst case)
Channel:	00

Radiated emissions		Ant. Correction factors		Total	Limit		
Frequency (Mz)	Reading (dBµN)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Actual (dBµN/m)	Limit (dBµV/m)	Margin (dB)
95.960	20.58	Н	12.99	0.75	34.32	43.50	9.18
120.210	20.89	Н	16.55	0.87	38.31	43.50	5.19
167.740	24.09	Н	13.51	1.06	38.66	43.50	4.84
191.020	22.62	V	11.04	1.27	34.93	43.50	8.57
217.210	31.07	Н	10.92	1.33	43.32	46.00	2.68
281.230	20.62	V	12.91	1.53	35.06	46.00	10.94
313.240	23.26	Н	13.77	1.63	38.66	46.00	7.34
446.130	21.68	Н	16.56	1.99	40.23	46.00	5.77
539.250	21.07	V	18.59	2.28	41.94	46.00	4.06
562.530	20.02	V	19.12	2.36	41.50	46.00	4.50

Note.

- 1. All spurious emission at channels are almost the same below 1 GHz, so that <u>low channel</u> was chosen at representative in final test.
- 2. Actual = Reading + Ant. factor + Cable loss
- 3. Detector mode: Quasi peak
- 4. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.



Test results (Above 1 000 Mz)

Mode:	Bluetooth
Transfer rate:	1 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 402 MHz
Channel:	00

Radiated emissions		Ant.	Correction factors	Total	Liı	mit	
Frequency (MLz)	Reading (dBµN)	Detector mode	Pol.	AFCL (dB)	Actual (dBµN/m)	Limit (dBµN/m)	Margin (dB)
2361.21	49.42	Peak	Н	-1.10	48.32	74.00	25.68
2389.67	51.51	Peak	V	-0.95	50.56	74.00	23.44
4799.00	41.48	Peak	Н	8.03	49.51	74.00	24.49
4799.00	45.12	Peak	V	8.03	53.15	74.00	20.85

Mode:	Bluetooth
Transfer rate:	1 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 441 MHz
Channel:	39

Radiated emissions		Ant.	Correction factors	Total	Liı	mit	
Frequency (MHz)	Reading (dBµN)	Detector mode	Pol.	AFCL (dB)	Actual (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4884.00	43.28	Peak	Н	8.64	51.92	74.00	22.08
4884.00	47.92	Peak	V	8.64	56.56	74.00	17.44
4884.70	27.73	Avg	V	8.65	36.38	54.00	17.62

Mode:	Bluetooth
Transfer rate:	1 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 480 MHz
Channel:	78

Radiated emissions		Ant.	Correction factors	Total	Liı	mit	
Frequency (Mz)	Reading (dBµN)	Detector mode	Pol.	AFCL (dB)	Actual (dBµN/m)	Limit (dBµV/m)	Margin (dB)
2494.92	49.82	Peak	Н	-0.39	49.43	74.00	24.57
2489.35	51.56	Peak	V	-0.42	51.14	74.00	22.86
4954.00	43.95	Peak	Н	9.14	53.09	74.00	20.91
4954.00	47.99	Peak	V	9.14	57.13	74.00	16.87
4962.70	28.36	Avg	V	9.20	37.56	54.00	16.44



Mode:	Bluetooth
Transfer rate:	3 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 402 MHz
Channel:	00

Radiated emissions		Ant.	Correction factors	Total	Li	mit	
Frequency (MHz)	Reading (dBµN)	Detector mode	Pol.	AFCL (dB)	Actual (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2345.68	49.22	Peak	Н	-1.18	48.04	74.00	25.96
2389.53	51.75	Peak	V	-0.95	50.80	74.00	23.20
4982.00	38.02	Peak	Н	9.34	47.36	74.00	26.64
4982.00	42.30	Peak	V	9.34	51.64	74.00	22.36

Mode:	Bluetooth
Transfer rate:	3 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 441 MHz
Channel:	39

Radiated emissions		Radiated emissions		Ant.	Correction factors	Total	Li	mit
Frequency (Mz)	Reading (dBµN)	Detector mode	Pol.	AFCL (dB)	Actual (dBµV/m)	Limit (dBµN/m)	Margin (dB)	
4884.00	39.33	Peak	Н	8.64	47.97	74.00	26.03	
4884.00	41.83	Peak	V	8.64	50.47	74.00	23.53	

Mode:	Bluetooth
Transfer rate:	3 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 480 MHz
Channel:	78

Radiated emissions		Ant.	Correction factors	Total	Liı	mit	
Frequency (MHz)	Reading (dBµN)	Detector mode	Pol.	AFCL (dB)	Actual (dBµV/m)	Limit (dBµN/m)	Margin (dB)
2490.15	50.10	Peak	Н	-0.41	49.69	74.00	24.31
2498.30	52.11	Peak	V	-0.37	51.74	74.00	22.26
4982.00	39.10	Peak	Н	9.34	48.44	74.00	25.56
4982.00	41.55	Peak	V	9.34	50.89	74.00	23.11

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Worst case mode:	Bluetooth
Transfer rate:	1 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 402 MHz
Channel:	00
Detected mode:	Peak, Hor

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100 dBµV	_			M	11[1]	1	49.4 2.3612	2 dBµV 10 GHz
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30 dBµV								
20 dBµV								
10 dBuV-						F	1	



Worst case mode:	Bluetooth
Transfer rate:	1 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 402 MHz
Channel:	00
Detected mode:	Peak, Ver

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30 dBµV	_					
20 dBµV						
10 dBuV					F	1



Worst case mode:	Bluetooth
Transfer rate:	1 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 480 MHz
Channel:	78
Detected mode:	Peak, Hor

91Pk Max										
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30 dBµV										
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Worst case mode:	Bluetooth
Transfer rate:	1 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 480 MHz
Channel:	78
Detected mode:	Peak, Ver

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40 dBµV							
30 dBµV							
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10 dBuV	F	1					



Worst case mode:	Bluetooth
Transfer rate:	3 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 402 MHz
Channel:	00
Detected mode:	Peak, Hor

1Pk Max									
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40 dBµV	_								
30 dBµV									
20 dBµV									
10 dBuV						F			



Worst case mode:	Bluetooth
Transfer rate:	3 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 402 MHz
Channel:	00
Detected mode:	Peak, Ver

100 dBµV		M1[1]						5 dBµV 30 GHz
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30 dBµV								
20 dBµV								
10 dBuV						F	1	



Worst case mode:	Bluetooth
Transfer rate:	3 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 480 MHz
Channel:	78
Detected mode:	Peak, Hor

1Pk Max							
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10 dBµV	F	1					
Start 2.478 GH	z		691	lpts			Stop 2.5 GHz



Worst case mode:	Bluetooth
Transfer rate:	3 Mbps
Distance of measurement:	3 meter
Operating frequency:	2 480 MHz
Channel:	78
Detected mode:	Peak, Ver

Att 1Pk Max			ms 👄 VB			uto Sweep			
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40 dBµV									
30 dBµV									
20 dBµV									
10 dBµV	F	1							
Start 2.478 GHz				691 p	ots			St	op 2.5 GHz



3.2. Conducted band edge and out of band emissions



Test procedure

DA 00-705

Test setting

- 1. Span = wide enough to capture the peak level of the in-band emission and all spurious emissions(e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic.
- 2. RBW = 100 kHz
- 3. VBW \geq RBW
- 4. Detector = Peak
- 5. Number of sweep points $\geq 2 \times \text{Span/RBW}$
- 7. Trace mode = max hold
- 8. Sweep time = auto couple
- 9. The trace was allowed to stabilize

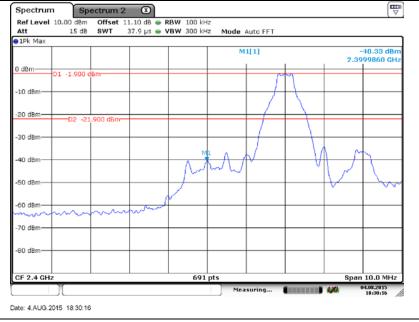
Limit

According to 15.247(d), 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 section 15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section 15.205(a), must also comply the radiated emission limits specified in section 15.209(a) (see section 15.205(c))



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Bluetooth 1 Mbps - Ch. 00



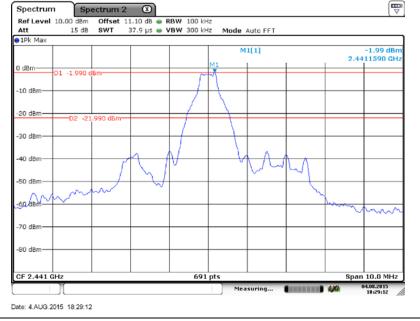
1Pk Max			VBW 300 kH	- House	Auto Sweep			
TER HIGH								
				M	1[1]			53.83 dBm
) dBm								4.7990 GH2
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0.00000	1041-	www.	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~					
70 dBm								
80 dBm								
Start 30.0 MHz			691	ots			Stop	26.5 GHz

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Bluetooth 1 Mbps - Ch. 39



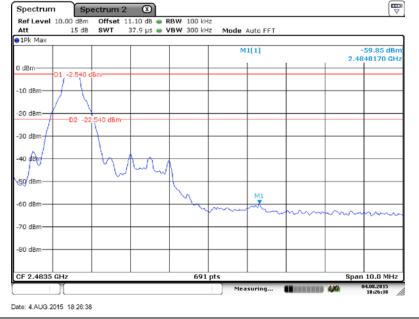
	ms 🖶 VBW 300 kHz Mode	Auto Sweep	
1Pk Max	м	11[1]	-53.38 dBm 4.8760 GHz
0 dBm D1 -2.350 dBm			
-10 dBm			
-20 dBm			
-30 dBm			
-40 dBm			
-50 dBm			
-60 dBm	many white shall and a start	and when the production of the	and and and have the state of t
-70 dBm			
-80 dBm			
CF 13.265 GHz	691 pts		Span 26.47 GHz

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Bluetooth 1 Mbps – Ch. 78



Att	15 dB	SWT	265 ms 🕯	VBW	300 kH	z Mode	Auto Sweep			
1Pk Max										
						м	1[1]			54.53 dBm
0 dBm							1	1		4.9520 GHz
o ubin	D1 -3.350 d	Bm								
-10 dBm-										
10 00111										
20 dBm-										
20 0011	D2 -23	.350 dBm-								
-30 dBm-										
-40 dBm-										
-50 dBm-	M1									
	. Y									
-60 dBm-	monut	- Martin		_						
wetter would	de altraction	լ՝՝ և	newwww	mound	www	willia	WHILE AND	untworklas	mounder	al he and he are
70 dBm-				_						
-80 dBm				_						
Start 30.0	MUS				691	nte			Stor	26.5 GHz
start au.u					041		suring			0 20.3 GHZ

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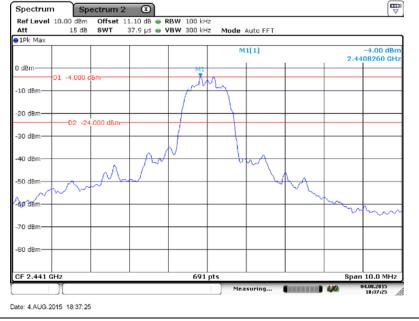
Att 15 dB	8WT 265	ms 👄 VBW 3	00 kHz Mode	Auto Sweep		
1Pk Max			0	M1[1]		-54.19 dBm 3.1900 GHz
0 dBm D1 _4.220 d	Bm					
-10 dBm						
-20 dBm-	.220 dBm					
-30 dBm	.220 06m					
-40 dBm						
-50 dBm						
60 dBm	- Markey	which are a low of	مريدهم والمراجع	Manaha	homework	uldumentshine wasa
-70 dBm	Capitolit	V				
-80 dBm						
Start 30.0 MHz			691 pts			top 26.5 GHz

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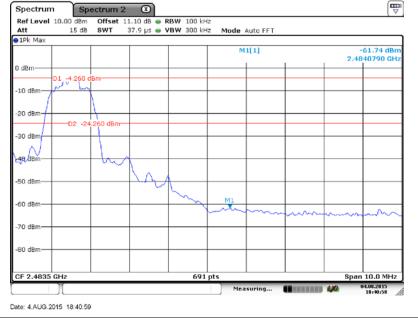
Att	15 dB	SWT	265 ms 👄 🕯	/BW 300 kH	z Mode	Auto Sweep			
●1Pk Max									
					м	1[1]			54.26 dBm 3.2670 GHz
0 dBm	D1 -6.170 d								
-10 dBm—	DI -6.170 d	sm							
-20 dBm-									
-30 dBm	D2 -26	170 dBm-							
-40 dBm-									
-50 dBm—	MI								
-60 dBm	alunter	methy	andonanto			6000	the set of	the set of the set	
up march	and the second s	ميسا	wholework	www.	winner	1 martin	man	and the second	elsenter of the
-70 dBm									
-80 dBm									
Start 30.0	MHz			691	pts			Stor	26.5 GHz
	1					suring			04.08.2015

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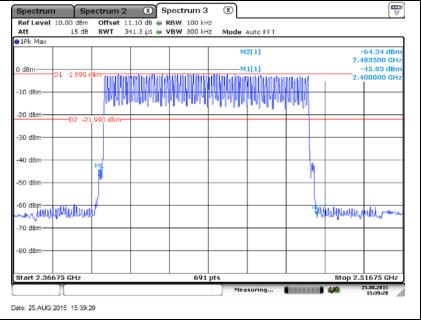


Att	15 dB	SWT	265 ms 👄	VBW 300 k	Hz Mode	Auto Sweep			
1Pk Max									
					M	1[1]			54.06 dBm 3.3050 GHz
0 dBm									
-10 dBm-	01 -4.690 d	Bm							
-20 dBm-									
		.690 dBm-			+				
-30 dBm									
-40 dBm			+		+				
-50 dBm	M1								
-60 dBm	mum	month			wenner	Annual and a			
an war		البيا	when	Non when	server and		a care and		- marine
-70 dBm			1		-				
-80 dBm									
Start 30.0 /	411-			60	1 pts			Stor	26.5 GHz
start 30.01	nHz			09	1 prs				4.08.2015

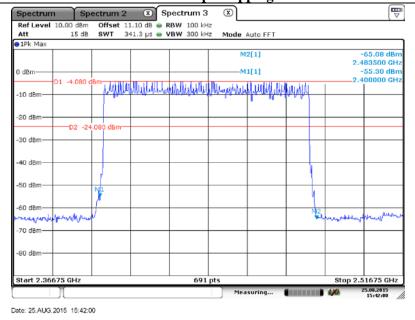


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Bluetooth 1 Mbps Hopping mode



Bluetooth 3 Mbps Hopping mode



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3.3. 20 dB bandwidth

Test setup EUT Attenuator Spectrum analyzer

Test procedure

DA 00-075

Test setting

- 1. Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
- 2. RBW \ge 1% of the 20 dB bandwidth
- 3. VBW \geq RBW
- 4. Sweep = auto
- 5. Detector function = peak
- 6. Sweep = auto couple
- 7. Trace mode = max hold

Limit

Not applicable

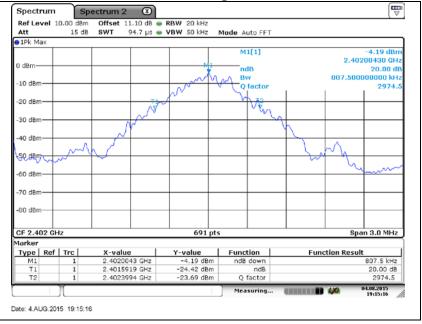
Frequency(Mb)	Channel no.	Data rate(Mbps)	Measured bandwidth(
2 402	00		0.808
2 441	39	1	0.808
2 480	78		0.808
2 402	00		1.207
2 441	39	3	1.211
2 480	78		1.211



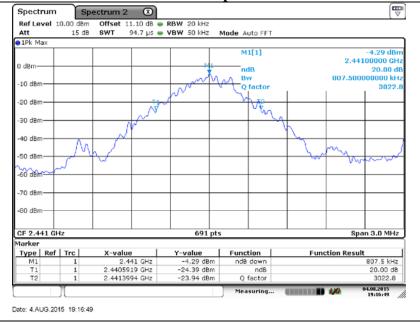
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Bluetooth 1 Mbps – Ch. 39



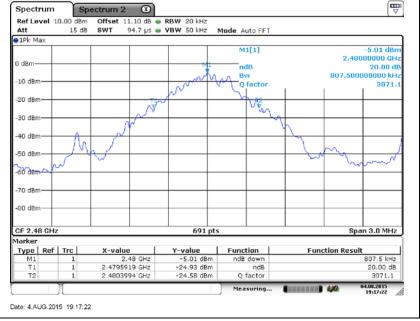
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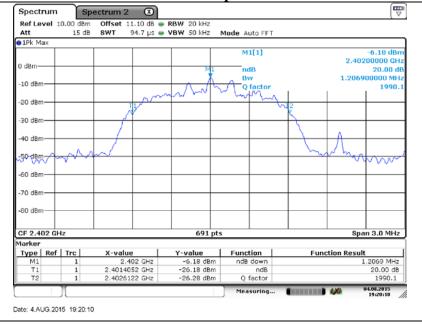
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Bluetooth 3 Mbps – Ch. 00



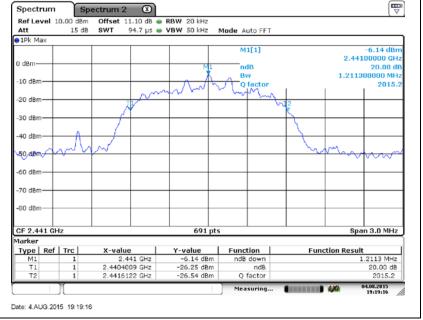
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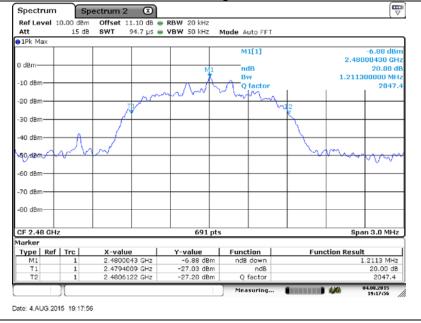
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3.4. Output power



Test procedure

DA 00-075

Test setting

- 1. Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
- 2. RBW > the 20 dB bandwidth of the emission being measured
- 3. VBW \geq RBW
- 4. Sweep = Auto
- 5. Detector function = Peak
- 6. Trace = Max hold

Limit

According to \$15.247(b)(1), For frequency hopping systems operating in the 2 400 ~ 2 483.5 Mz employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5 725 ~ 5 805 Mz band: 1 Watt.



Frequency(Mz)	Channel no.	Data rate(Mbps)	Measured power(dBm)
2 402	00		-1.80
2 441	39	1	-1.84
2 480	78		-2.48
2 402	00		-2.85
2 441	39	3	-2.76
2 480	78		-3.36



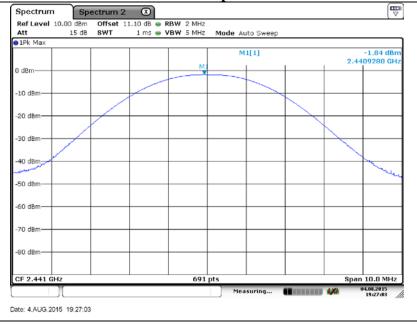
KES Co., Ltd.

C-3701, Simin-daero 365-40, Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea Tel: +82-31-425-6200 / Fax: +82-31-424-0450 www.kes.co.kr Test report No.: KES-RF-15T0057 Page (36) of (50)

Bluetooth 1 Mbps – Ch. 00



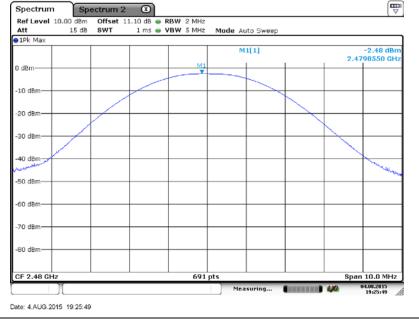
Bluetooth 1 Mbps - Ch. 39





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Bluetooth 3 Mbps - Ch. 39



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3.5. Carrier frequency separation



Test procedure

DA 00-075

Test Setting

- 1. The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
- 2. Span = wide enough to capture the peaks of two adjacent channels
- 3. Resolution (or IF) Bandwidth (RBW) $\geq 1\%$ of the span
- 4. Video (or Average) Bandwidth (VBW) \geq RBW
- 5. Sweep = auto
- 6. Detector function = peak
- 7. Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section. Submit this plot.

Limit

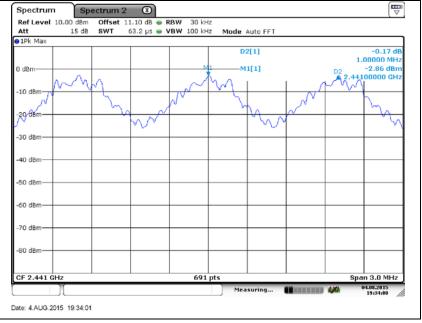
According to 15.247(a)(1), frequency hopping system operating in 2 400 ~ 2 483.5 Mz. Band may have hopping channel carrier frequencies that are separated by 25 kz or two-third of 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Frequency(Mz)	Channel no.	Data rate(Mbps)	Channel Separation (Mz)
2 441	39	1	1.000
2 441	39	3	1.012

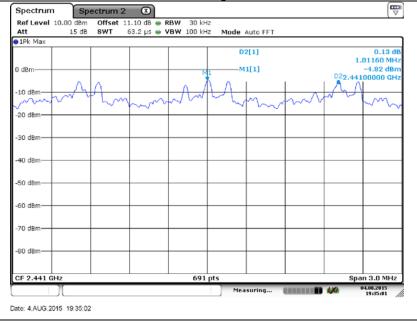


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Bluetooth 1 Mbps – Ch. 39



Bluetooth 3 Mbps – Ch. 39





3.6. Number of hopping frequency



Test procedure

DA 00-075

Test setting

- 1. The EUT must have its hopping function enabled.
- 2. Frequency range: 2 400 MHz ~ 2 441.5 MHz, 2 441.5 MHz ~ 2 483.5 MHz
- 3. Span = the frequency band of operation
- 4. RBW = 100 kHz (\geq 1% of the span)
- 5. VBW = 300 kHz (\geq RBW)
- 6. Sweep = auto
- 7. Detector function = peak
- 8. Trace = max hold

All the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

Limit

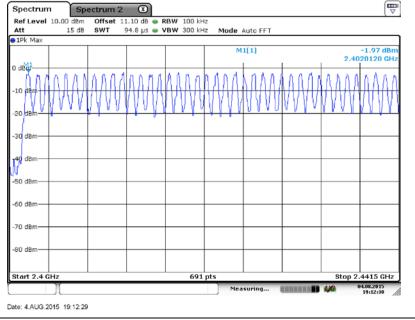
According to 15.247(a)(1)(iii), for frequency hopping system operating in the 2 400 ~ 2 483.5 Mb bands shall use at least 15 hopping frequencies.

Data rate(Mbps)	Number of hopping frequency	Limit
1	79	≥ 15
3	79	≥ 15



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Bluetooth 1 Mbps



Att	15 dB	SWT	94.8 µs 👄	/ BW 300 kH	z Mode Auto FFT		
●1Pk Max					M1[1]		-3.72 dBm
							2.4799440 GHz
0 dBm		0.0.0	AAAAA				a. b. b. 1
	IIANA	MANA	I A A A A	IAAAA	64.866.877	ыллаал	ARDA —
YVY	WW	VVVV	VVVV	WW	NWWW	MAAAN.	WWN
-20 dBm-							
-30 dBm							
-40 dBm							
							1 YVV
-50 dBm							
-60 dBm							
							1
-70 dBm							
-80 dBm							
Start 2.44	15 GHz			691	Measuring	1	Stop 2.4835 GHz



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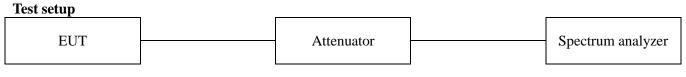
Bluetooth 3 Mbps

	10.00 dBm		1.10 dB 👄 🛛						
Att	15 dB	SWT	94.8 µs 👄 🛛	'BW 300 kH	z Mode	Auto FFT			
1Pk Max									
					M	1[1]			-3.80 dBm 20120 GHz
0 dBm						L			
-10,58%	MM	MAAA	MAA	MAA	U.U.	www	MM	ANU	MA
-20 dBm									
-30 dBm									
-40 dBm									
50 dBm									
-60 dBm									
-70 dBm									
-80 dBm									
Start 2.4 G	Hz			691	pts			Stop 2.	.4415 GHz
][]				Mea	suring		4,0	04.08.2015 19:09:47
ato: 4 ALIG 2	015 19:09:47								

Att	15 dB	SWT	94.8 µs 👄 🍾	/BW 300 kH	z Mode	Auto FFT			
●1Pk Max									
					м	1[1]		2.40	-5.22 dBm 01270 GHz
0 dBm						L	L	2.40	1
	ст на I	1.1.6.	10.19.	341.0	1. I N			1671	MI
10 MBm	WWW	WW	YYYY	AMAA	$\Delta \Delta \Delta \lambda$	AAAAA	\mathcal{W}	WYV	M
-20 dBm-									
-30 dBm									
-40 dBm									
									٩
-50 dBm									W
									1
-60 dBm									40
-70 dBm									
00 IN									
-80 dBm									
Start 2.44	L5 GHz			691	pts			Stop 2	4835 GHz



3.7. Time of occupancy



Test procedure

DA 00-075

Test setting

- 1. The EUT must have its hopping function enabled.
- 2. Span = zero span, centered on a hopping channel
- 4. RBW = 1 M/z
- 5. VBW = 1 MHz (\geq RBW)
- 6. Sweep = as necessary to capture the entire dwell time per hopping channel
- 7. Detector function = peak
- 8. Trace = max hold

Limit

According to 15.247(a)(1)(iii), for frequency hopping system operating in the 2 400 ~ 2 483.5 Mz band, the average time of occupancy on any frequency shall not be greater than 0.4 second within a 31.6 second period.

A period time = $0.4(s) \times 79 = 31.6(s)$



Time of occupancy on the TX channel in 31.6 sec

= time domain slot length \times (hop rate \div number of hop per channel) \times 31.6

Packet type	Frequency (Mz)	Dwell time (ms)	Time of occupancy on the Tx channel in 31.6 sec (ms)	Limit for time of occupancy on the Tx channel in 31.6 sec (ms)
DH1	2 441	0.419	134.1	400
DH3	2 441	1.674	267.8	400
DH5	2 441	2.928	312.3	400
3-DH1	2 441	0.432	138.2	400
3-DH3	2 441	1.678	268.5	400
3-DH5	2 441	2.933	312.9	400

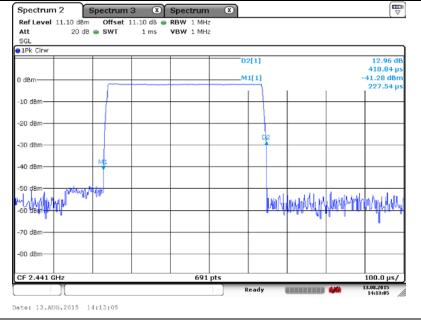
Note:

DH1: Dwell time (ms) × $[(1\ 600 \div 2) \div 79] \times 31.6(s) = 134.1$ (ms) DH3: Dwell time (ms) × $[(1\ 600 \div 4) \div 79] \times 31.6(s) = 267.8$ (ms) DH5: Dwell time (ms) × $[(1\ 600 \div 6) \div 79] \times 31.6(s) = 312.3$ (ms) 3-DH1: Dwell time (ms) × $[(1\ 600 \div 2) \div 79] \times 31.6(s) = 138.2$ (ms) 3-DH3: Dwell time (ms) × $[(1\ 600 \div 4) \div 79] \times 31.6(s) = 268.5$ (ms) 3-DH5: Dwell time (ms) × $[(1\ 600 \div 6) \div 79] \times 31.6(s) = 312.9$ (ms)

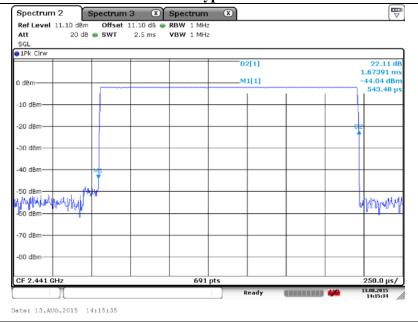


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Packet type: DH1



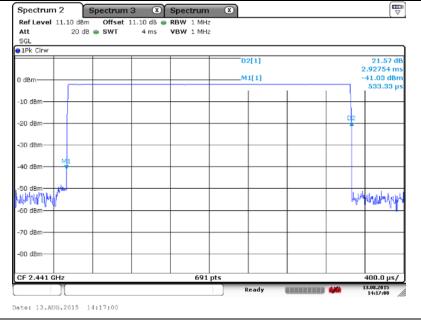
Packet type: DH3



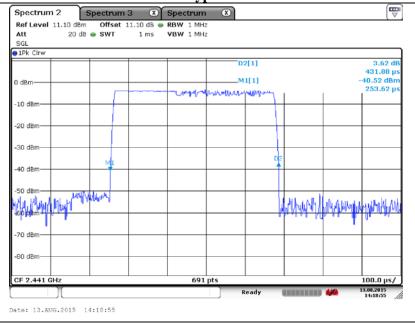


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Packet type: DH5



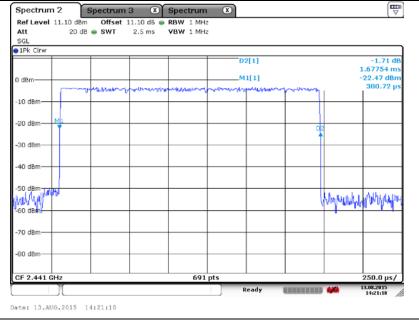
Packet type: 3-DH1



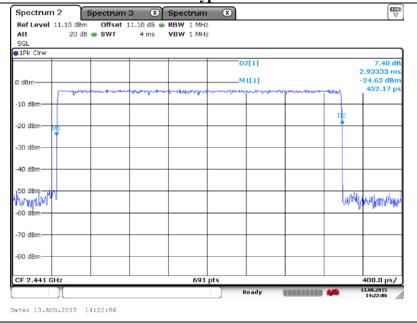


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Packet type: 3-DH3



Packet type: 3-DH5





Equipment	Manufacturer	Model	Serial No.	Calibration interval	Calibration due.
Spectrum Analyzer	R&S	FSV40	101002	1 year	2016.07.25
8360B Series Swept Signal Generator	HP	83630B	3844A00786	1 year	2016.01.23
Attenuator	HP	8493C	51401	1 year	2016.07.24
Loop Antenna	R&S	HFH2-Z2.335.4711.52	826532	2 years	2017.03.03
Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-461	2 years	2017.04.03
Horn Antenna	A.H. System	SAS-571	414	2 years	2017.02.09
High Pass Filter	Wainwright Instrument	WHJS3000-10TT	1	1 year	2016.07.24
Preamplifier	SCHWARZBECK	BBV-9718	9718-246	1 year	2015.10.23
EMI Test Receiver	R & S	ESR3	101781	1 year	2016.05.06
DC power supply	SMtechno	SDP 30-5D	305DKJ119	1 year	2016.04.01

Appendix A. Measurement equipment

Peripheral devices

Device	Manufacturer	Model No.	Serial No.
Notebook Computer	Samsung Electronics Co., Ltd.	NT-R530	ZWC493BZC00014H
Mouse	Moneual	MSU0846	0910020101086E
Adapter	LITE-ON Technology Co., Ltd.	PA-1600-66	AD-6019R



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Appendix B. Test setup photo

Radiated Emission (30MHz~1GHz)



Radiated Emission (Above 1GHz)

