

Test report No.: KES-RF-15T0081 Page (1) of (54)

# **TEST REPORT**

# FCC Part 15.247

Equipment under testCD RECEIVERModel nameCR-H101FCC IDXEGCR-H101ApplicantTEAC CorporationManufacturerTEAC CorporationDate of test(s)2015.09.21 ~ 2015.10.02Date of issue2015.10.07

Issued to TEAC Corporation

1-47 Ochiai. Tama-shi, Tokyo 206-8530 Japan

Issued by KES Co., Ltd.

C-3701, Simin-daero 365-40, Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea

473-29, Gayeo-ro, Yeoju-si, Gyeonggi-do, 12658, Korea

Tel: +82-31-425-6200 / Fax: +82-31-424-0450

Test and report completed by :	Report approval by :
The	Seafler
Hyeon-Su Jang	Jeff Do
Test engineer	Technical manager

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### **Revision history**

Revision	Date of issue Test report No.		Description
-	2015.10.07	KES-RF-15T0081	Initial



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### 1. General information

Applicant:	TEAC Corporation			
Applicant address:	1-47 Ochiai. Tama-shi, Tokyo 206-8530 Japan			
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, Gy	/eonggi-do, Korea		
FCC rule part(s):	15.247			
Model:	CR-H101			
FCC ID:	XEGCR-H101			
Test device serial No.:	Production	Pre-production	Engineering	

### **1.1. EUT description**

Equipment under test	CD RECEIVER			
Frequency range	$2402 \text{ MHz} \sim 2480 \text{ MHz}$			
Modulation technique	FHSS			
Number of channels	79			
Antenna specification	Antenna type: Chip Peak gain: -0.66 dBi			
Power source	AC 100 V $\sim 240$ 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:**

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, 02, 05, 31, 24, 20, 10, 43, 36, 30, 23, 40, 06, 21, 50, 44, 09,

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### System receiver input bandwidth

Each channel bandwidth is 1 Mtz.

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 CD RECEIVER FCC ID: XEGCR-H101 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 and AC line conducted testing.

### **1.3.** Frequency/channel operations

Ch.	Frequency (Mbz)	Rate(Mbps)
00	2402	1,2,3
- -		-
39	2441	1,2,3
78	2480	1,2,3

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	Channel (Mtz)	1 Mbps (GFSK)	2 Mbps (π/4-DQPSK)	3 Mbps (8DPSK)
	2402	<u>4.36</u>	2.49	<u>2.56</u>
Output power(dBm)	2441	<u>6.18</u>	4.65	<u>4.79</u>
	2480	<u>6.19</u>	4.68	<u>4.79</u>

### **1.4.** Information about derivative model

N/A



2. Summary of tests		
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
15.207	AC conducted emissions	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 and AC line conducted testing.

2. All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.

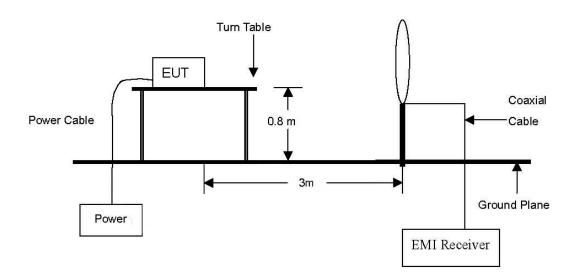


### 3. Test results

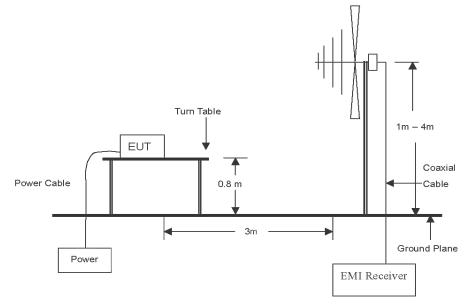
### 3.1. Radiated restricted band and emissions

### Test setup

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



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

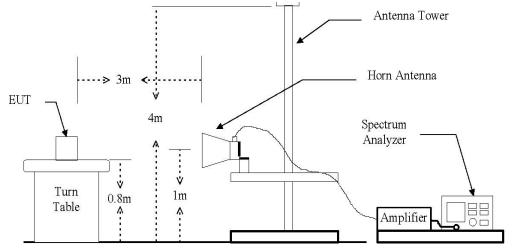


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The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 24 GHz emissions.





### **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 = 1 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. Field strength( $dB_{\mu}N/m$ ) = Level( $dB_{\mu}N$ ) + Correction factors(dB/m) + Cable loss(dB) + F<sub>d</sub>(dB)
- 6. Correction factors(dB/m) = Antenna factor(dB/m) + Cable loss(dB) + or Amp. gain(dB)
- 7. Margin(dB) = Limit(dB $\mu$ /m) Field strength(dB $\mu$ /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)
$0.009 \sim 0.490$	300	2 400 / F(klz)
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 Mlz (Worst case)
Channel:	00

Frequency (Mz)	Level (dBµV)	Ant. Pol.	Correction factors (dB/m)	F <sub>d</sub> (dB)	Field strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
No signal detected							

Test results (Below 1 000 Mz)				
Mode:	Bluetooth			
Transfer rate:	1 Mbps			
Distance of measurement:	3 meter			
Operating frequency:	2 402 M (Worst case)			
Channel:	00			

Radiated	emissions	Ant. Correction factors		Total		nit	
Frequency (Mz)	Reading (dBµN)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Actual (dBµN/m)	Limit (dBµV/m)	Margin (dB)
48.430	12.62	V	13.88	2.55	29.05	40.00	10.95
118.270	7.20	Н	9.84	3.43	20.47	43.50	23.03
128.940	5.62	V	8.85	3.41	17.88	43.50	25.62
184.230	16.75	Н	9.81	3.97	30.53	43.50	12.97
300.630	6.31	Н	13.39	5.04	24.74	46.00	21.26

### 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

Frequency (Mz)	Level (dBµV)	Detect	Ant. Pol.	Correction factors (dB/m)	Field strength (dBµW/m)	Limit (dBµV/m)	Margin (dB)
2362.04	44.75	Peak	Н	-1.09	43.66	74.00	30.34
2377.43	46.89	Peak	V	-1.01	45.88	74.00	28.12
4804.00	41.55	Peak	Н	8.07	49.62	74.00	24.38
4804.00	41.42	Peak	V	8.07	49.49	74.00	24.51

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

Frequency (Mz)	Level (dBµV)	Detect	Ant. Pol.	Correction factors (dB/m)	Field strength (dBµV/m)	Limit (dBµN/m)	Margin (dB)
4882.00	40.93	Peak	Н	8.63	49.56	74.00	24.44
4882.00	41.94	Peak	V	8.63	50.57	74.00	23.43

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

Frequency (Mz)	Level (dBµV)	Detect	Ant. Pol.	Correction factors (dB/m)	Field strength (dBµW/m)	Limit (dBµV/m)	Margin (dB)
2483.97	46.77	Peak	Н	-0.45	46.32	74.00	27.68
2496.13	44.71	Peak	V	-0.38	44.33	74.00	29.67
4960.00	41.19	Peak	Н	9.18	50.37	74.00	23.63
4960.00	42.20	Peak	V	9.18	51.38	74.00	22.62

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

Frequency (Mz)	Level (dBµV)	Detect	Ant. Pol.	Correction factors (dB/m)	Field strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2380.32	41.25	Peak	Н	-1.00	40.25	74.00	33.75
2379.91	47.20	Peak	V	-1.00	46.20	74.00	27.80
4804.00	40.99	Peak	Н	8.07	49.06	74.00	24.94
4804.00	41.05	Peak	V	8.07	49.12	74.00	24.88

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

Frequency (Mb)	Level (dBµV)	Detect	Ant. Pol.	Correction factors (dB/m)	Field strength (dBµV/m)	Limit (dBµN/m)	Margin (dB)
4882.00	40.72	Peak	Н	8.63	49.35	74.00	24.65
4882.00	40.89	Peak	V	8.63	49.52	74.00	24.48

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

Frequency (Mz)	Level (dBµV)	Detect	Ant. Pol.	Correction factors (dB/m)	Field strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2487.92	47.69	Peak	Н	-0.42	47.27	74.00	26.73
2492.76	45.65	Peak	V	-0.40	45.25	74.00	28.75
4960.00	41.03	Peak	Н	9.18	50.21	74.00	23.79
4960.00	41.70	Peak	V	9.18	50.88	74.00	23.12

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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

Ref Level 97.00 Att	dBµV 10 dB <b>SWT</b> 1			de Auto Si	weep			
1Pk Max							41	
90 dBuV-				M	1[1]			44.75 dBµ 2.362040 GH
								Λ
80 dBµV		+ +						
70 dBµV		-						
60 dBµV								
50 dBµV				M1				
43-18 Martin	Malurara	مه مروان المروان الم	فلسميه سالد مواسطة	e Justine	بماريد الإولام	alvertreman		Augural
30 dBµV								
20 dBµV								
10 dBµV								
0 dBµV							F1	
Start 2.31 GHz		-12 - 21 -	691 p	ots	57			op 2.405 GHz 01.10.2015 12:22:10



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

Ref Level 97. Att		VT 1 ms SVB	WIMHz WI3MHz M	lode Auto S	weep				
●1Pk Max	-		_						
90 dBµV			~	M	1[1]				.89 dBµV 7430 GHz
					n n				Δ
80 dBµV							-	-	-11
70 dBµV									
60 dBµV							-	-	
									1
50 dBµV-	1.0000					Y I		-	-
And the second with	Holm Borton	- May a ser had	Mulu manulade	بعيديد ليلاملون	hardend	lun	Mar	halle.	
30 dBµV							-	-	
20 dBµV									
20 0000									
10 dBµV		-		-	-		_		
							F1		
0 dBµV-	,		601	Lpts				ton 2	405 GHz
Start 2.51 GH			091		suring		_	01.	10.2015 2:22:59



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

Att	10 dB S	WT 1 ms 🖷	VBW 3 MHz	Mode Aut	o Sweep			
90 dBµV					M1[1]			ю.77 dBµV 39700 GH;
80 deuv-				_				
50 dBµV	1	M1			72.00			
40 dBµV		marchant	Anthone	- manhulla	Mondianewalas	anno-allinate	Harandehi	Introduction in the
30 dBµV								
20 dBµV							· · · · · · · · · · · · · · · · · · ·	
10 dBµV								
0 dBµV		F1						
Start 2.478 GH	z	n n		691 pts	517	2	Sto	p 2.5 GHz



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

Ref Level 97.00 Att		RBW 1 MHz ns VBW 3 MHz	Mode Auto S	Sweep		
90 dBuV			Ν	M1[1]	2.4	44.71 dBµV
BO dBLV						
70 dвµv						
50 dBµV	Luisme		don the second second	and white and	MI	aller has
30 dBµV						
20 dBµV		v				
10 dBµV						
0 dBµV	F1					
Start 2.478 GH	2		691 pts	asuring	S	top 2.5 GHz



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

Ref Level 97.		sone warwar	e RBW			101100-0-0			2 (Fill) - 2
Att 1Pk Max	10 dB	SWT 1	ms 🖷 VBW	3 MHz N	1ode Auto	Sweep			
90 dBµV-					1	M1[1]			41.25 dBµV 2.380320 GHz
80 dBµV					-	-			A
70 dBµV									+
60 dBµV									+++
50 dBµV							M1		
40 d6µV	م <del>ون بالسماني</del>	the states	twattowers	and training	all water and		the treestor	therefore	- l
30 dBµV			-		-				_
20 dBµV									
10 dBµV						-			
0 dBµV								F1	
Start 2.31 GH	2		22 - 23 2	69	1 pts	- 50			op 2.405 GHz
					Me	asuring		4,40	01.10.2015 12:25:34



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

Ref Level 97.0 Att		T 1 ms . VB	WIMHz WI3MHz N	lode Auto S	weep					
1Pk Max							- 61			
90 dBµV			8	M	1[1]			47.20 dBµV 2.379910 GHz		
80 dBµV							_			
70 dBµV							_	+		
60 dBµV							_			
50 dBµV	1. Mahrin	Julesman		s. Luc	a s.h	м <u>э</u>				
lds-belochilder.	THAT WAY WHAT	Miderandya	hele Aslengther	WILL HALFL AN	Millight	Killey Man Bar Bar	August	MALL		
30 dBµV							-			
20 dBµV							-			
10 dBµV							F1			
0 dBµV-				<u> </u>			1			
Start 2.31 GHz			69	1 pts	suring		10 m m	01.10.2015 12:24:33		



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

Ref Level 97.0 Att		/T 1 ms 🖷 VI	BW 3 MHz N	lode Auto S	weep			
90 dBuV			2	M	11[1]			47.69 dBµ\ 379180 GH;
80 d8µV								
70 dBµV	$\mathbf{h}$		_					
50 dBµV	were	monthermont	man Minut	hhh	Juliush Maller e	and and have been	Maridus	rihultanoch
30 dBµV			_					
20 dBµV								
10 dBµV								
0 dBµV	F	1						
Start 2.478 GH	z	1	69	1 pts	50 			op 2.5 GHz

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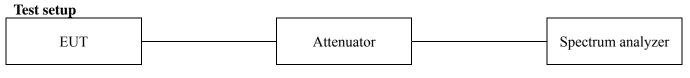


Bluetooth
3 Mbps
3 meter
2 480 MHz
78
Peak, Ver

	10 dB SWT 1 m	is 🖷 VBW 3 MHz	Mode Auto Sweep		
90 dBµV-			M1[1]	2.	45.65 dBµV 4927570 GHz
80 dBuv					
70 dBµV					
50 dBµV	Lune and		nguna ma	march about sheers	i conte
40 dBµV	- Waha	HARRING MARKEN AND AND AND AND AND AND AND AND AND AN	ALTA MINI ALA AND ANY GUARDINA	Hultoner allette Mirtela	Un folk for the has
30 dBµV-					
20 dBµV		<u> </u>			
10 dBµV					-
0 dBµV	F1				
Start 2.478 GHz		6	91 pts	S	top 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  $\geq$  300 kHz
- 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))



C-3701, Simin-daero 365-40l, 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-15T0081 Page (23) of (54)

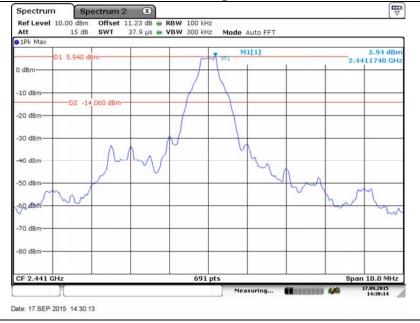


Att	15 dB 8	WT 265	ms 🖷 VBV	V 300 kHz	Mode /	Auto Sweep	1			
●1Pk Max	-D1 3.380 dBm-				M	1[1]			-53.43 dBm	
0 dBm	01 3,380 dBm									
-10 dBm-								i		
-20 dBm—	D2 -16.62	0 dBm								
-30 dBm—										
-40 dBm										
-50 dBm—		M1								
-60 dBm-	haberrand	nig under	ruhun	whether	monter	Marchan	un handler and	when the way was	manu	
-70 dBm—										
-80 dBm—										
Start 30.0	D MHz	1.5		691 p	ts	57			26.5 GHz	

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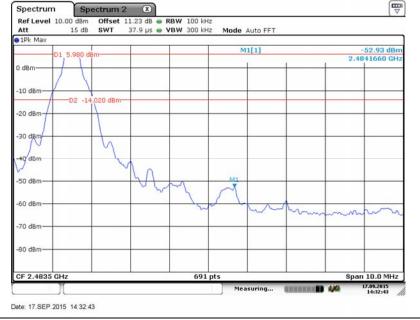


Att	15 dB 8	WT 26	is ills 🖝 🕯	BW 300 kH	- moue	Auto Sweep			
TEK MIGA	D1 5.140 dBm-				М	1[1]			48.42 dBm 7.3270 GHz
0 dBm									
-10 dBm—									
-20 dBm—	D2 -14.860	) dBm							
-30 dBm—									
-40 dBm		MI							
-50 dBm-		MI							
-60 dBm	an and a second	we have	Norman	where	untertailer	mum	for the receiver	whentype	orman
-70 dBm—									
-80 dBm—									
Start 30.0	D MHz			691	pts			Stop	26.5 GHz

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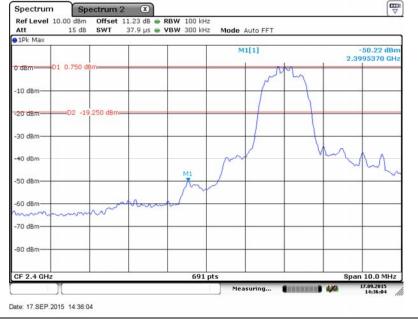
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Att	15 dB	SWT 2	265 ms 🖷	VBW 300 kH	z Mode	Auto Sweep	2		
1Pk Max	D1 5.270 dBn	n			м	1[1]			-44.43 dBm 7.4420 GH;
0 dBm						-			
-10 dBm—									
-20 dBm	D2 -14.7	'30 dBm							
-30 dBm—									
-40 dBm		MI							
-50 dBm-								-	
60 dBm	www.	work	unun	howanes	lenternan	Willam	water	numun	proventelle
-70 dBm									
-80 dBm—									
Start 30.0	) MHz		-	691	pts				26.5 GHz



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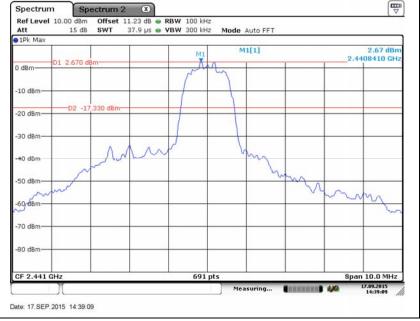


Ref Level Att	15 dB	SWT	RBW 100 kH VBW 300 kH		Auto Sweep			
1Pk Max								
				M	11[1]			-58.30 dBm 7.2130 GHz
0 dBm	D1 -0.260 d	Bm			-			1.2100 01/2
-10 dBm			 -				-	
20 dBm		.260 dBm-						
-30 dBm			_					
-40 dBm								
-50 dBm								
-60 dBm-	a president and the second	M1	 wellstemmerly	. An Another	getunen	unabound	monthem	moharres
p. Qup.		- Contraction						
-80 dBm								
	GHz		601	pts			Span	26.47 GHz
-70 dBm								

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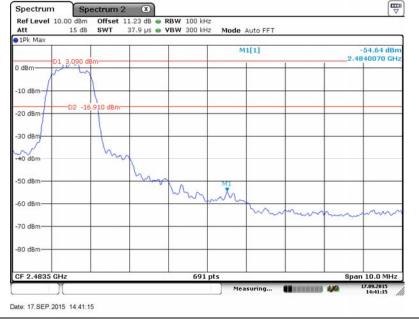


1Pk Max									
					м	1[1]			-55.61 dBm 7.3270 GHz
0 dBm-	D1 2.490 d	sm							
-10 dBm—	-								
-20 dBm—	D2 -17	.510 dBm-							
-30 dBm—									
-40 dBm									
-50 dBm	1	M1							
-60 dBm	mornin	- Martin	untron	elteran	howah	Munny	month	otherhout	nonmany
-70 dBm									
-80 dBm									
CF 13.265	i GHz			691	pts			Span	26.47 GHz

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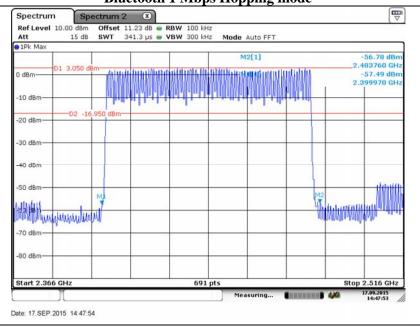


Att 1Pk Max	15 dB	SWT	203 115 🖷 🕻	/BW 300 kH	2 mode /	Auto Sweep	â.		
THE MAX					м		49.95 dBn 7.4420 GHa		
0 dBm	D1 0.230 de	3m-							
-10 dBm-									
-20 dBm	02 -19	.770 dBm-							-
-30 dBm									
40 dBm									
-50 dBm-		M1							
-60 dBm-	howthemathe	where	openaneta	www	website	markan	wanter	-cout was	manush
-70 dBm		(Contraction)	-						
-80 dBm									
CF 13.265	GHz			691	pts			Span 2	26.47 GHz

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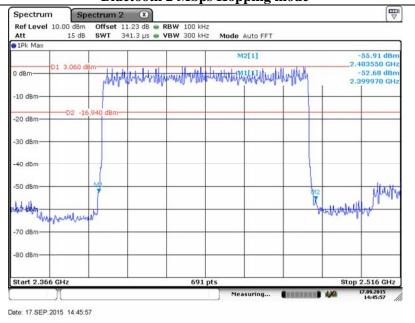


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### Bluetooth 1 Mbps Hopping mode

### **Bluetooth 2 Mbps Hopping mode**





### 3.3. 20 dB bandwidth



### Test procedure

DA 00-705

### Test setting

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

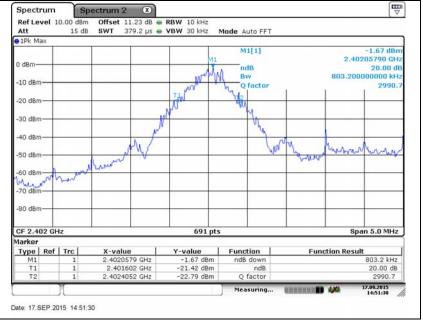
### Limit

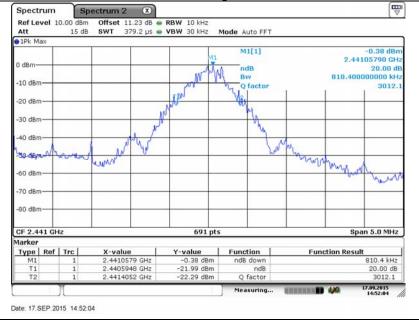
Not applicable

Frequency(Mz)	Channel no.	Data rate(Mbps)	Measured bandwidth(
2 402	00		803
2 441	39	1	810
2 480	78		767
2 402	00		1 274
2 441	39	3	1 274
2 480	78		1 274



#### Bluetooth 1 Mbps – Ch. 00

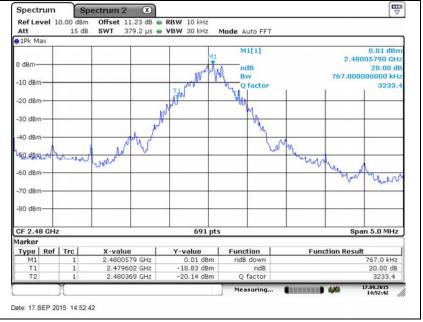


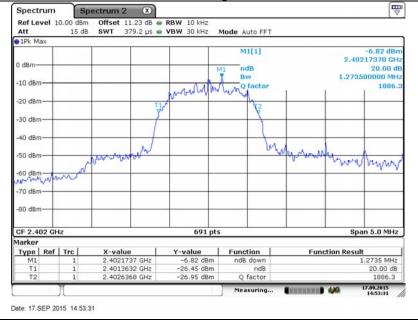


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#### Bluetooth 1 Mbps – Ch. 78

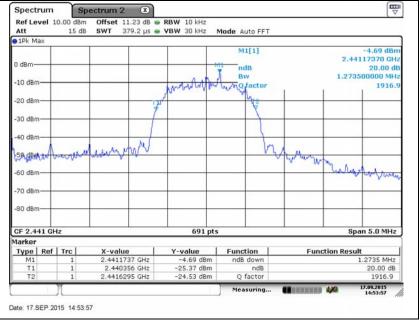


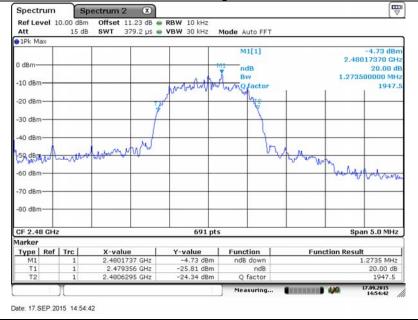


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### Bluetooth 3 Mbps – Ch. 39

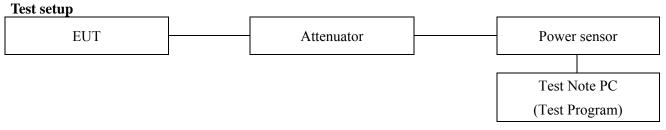




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### **3.4.** Output power



### **Test procedure**

DA 00-705

### **Test setting**

- $\overline{1. \text{Span} = \text{approximately 5 times the 20 dB bandwidth, centered on a hopping channel}$
- 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(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

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(Mb)	Channel no.	Data rate(Mbps)	Measured power(dBm)
2 402	00		4.36
2 441	39	1	6.18
2 480	78		6.19
2 402	00		2.56
2 441	39	3	4.79
2 480	78		4.79



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### Bluetooth 1 Mbps – Ch. 00





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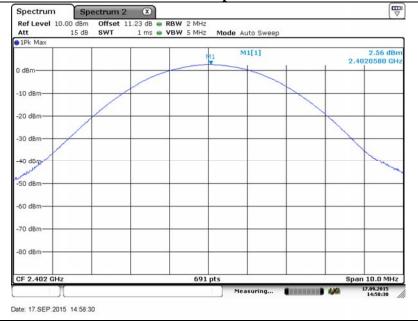


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#### Bluetooth 3 Mbps - Ch. 00



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## Bluetooth 3 Mbps - Ch. 39



#### Bluetooth 3 Mbps - Ch. 78



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## **3.5.** Carrier frequency separation



## **Test procedure**

DA 00-705

#### **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)  $\ge 1\%$  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 MHz. Band may have hopping channel carrier frequencies that are separated by 25 kHz 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(Mb)	ccy(Mz) Channel no. Data rate(Mbps)		Channel Separation (Mz)
2 441	39	1	0.998 6
2 441	39	3	0.998 6

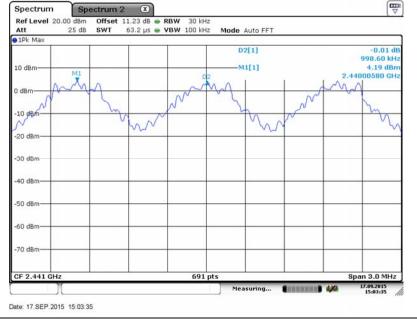


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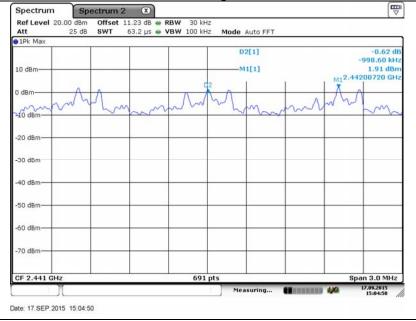
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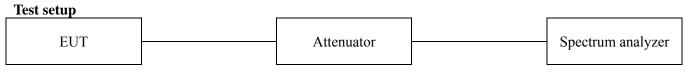
#### Bluetooth 3 Mbps - Ch. 39



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## **3.6.** Number of hopping frequency



#### **Test procedure**

DA 00-705

#### **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  $\frac{1}{2}$
- 4. RBW = 300 kHz ( $\geq 1\%$  of the span)
- 5. VBW = 1 Mz ( $\geq$  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

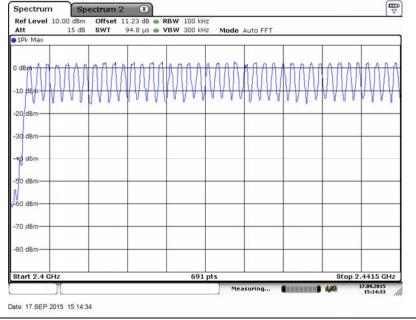
According to 15.247(a)(1)(iii), for frequency hopping system operating in the 2 400 ~ 2 483.5 Mz bands shall use at least 15 hopping frequencies.

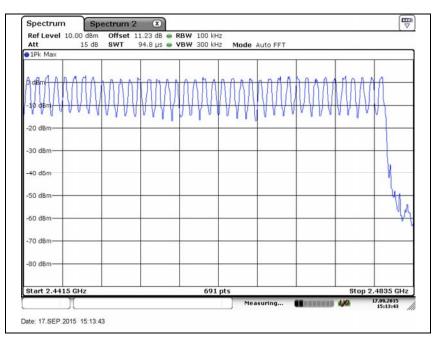
Data rate(Mbps)	Number of hopping frequency	Limit
1	79	≥ 15
2	79	≥ 15



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#### **Bluetooth 1 Mbps**

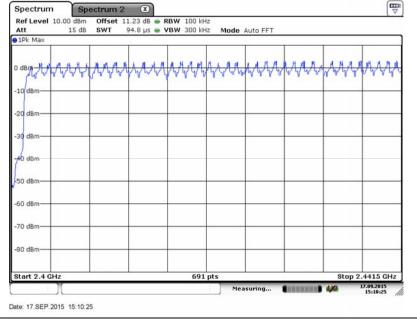






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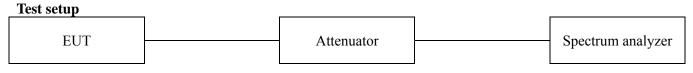
## **Bluetooth 3 Mbps**



1Pk Max			-	1					
of a start of the	MA	With	MW	Mart	mary	MA	ww	ANA	A
-10 dBm									
-20 dBm			-						
-30 dBm									
40 dBm									h
-50 dBm									4
-60 dBm									4
-70 dBm			-					-	
-80 dBm									
Start 2.4415	GHz			691	pts			Stop 2.	4835 GHz



## **3.7.** Time of occupancy



#### **Test procedure**

DA 00-705

#### **Test setting**

- 1. The EUT must have its hopping function enabled.
- 2. Span = zero span, centered on a hopping channel
- 4. RBW = 1 MHz
- 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 Mb 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	1.676	268.2	400
DH5	2 441	2.922	311.7	400
2-DH1	2 441	0.428	140.0	400
2-DH3	2 441	1.675	268.0	400
2-DH5	2 441	2.934	313.0	400

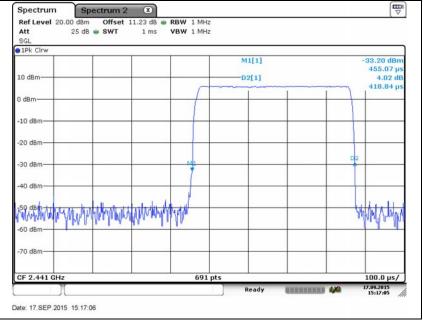
#### Note:

DH1: Dwell time (ms) ×  $[(1\ 600 \div 2) \div 79] \times 31.6(s) = 134.1$  (ms) DH3: Dwell time (ms) ×  $[(1\ 600 \div 4) \div 79] \times 31.6(s) = 268.2$  (ms) DH5: Dwell time (ms) ×  $[(1\ 600 \div 6) \div 79] \times 31.6(s) = 311.7$  (ms) 3-DH1: Dwell time (ms) ×  $[(1\ 600 \div 2) \div 79] \times 31.6(s) = 140.0$  (ms) 3-DH3: Dwell time (ms) ×  $[(1\ 600 \div 4) \div 79] \times 31.6(s) = 268.0$  (ms) 3-DH5: Dwell time (ms) ×  $[(1\ 600 \div 6) \div 79] \times 31.6(s) = 313.0$  (ms)

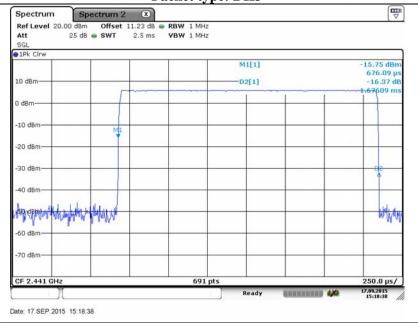


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#### Packet type: DH1



## Packet type: DH3

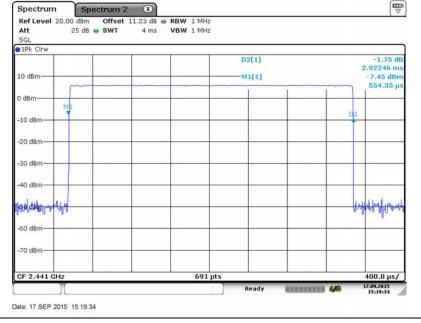




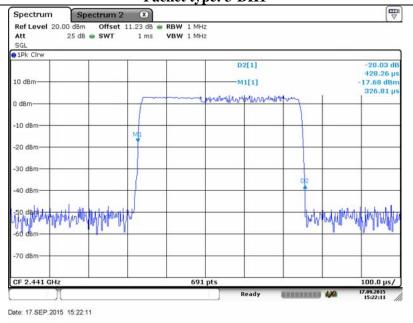
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#### Packet type: DH5



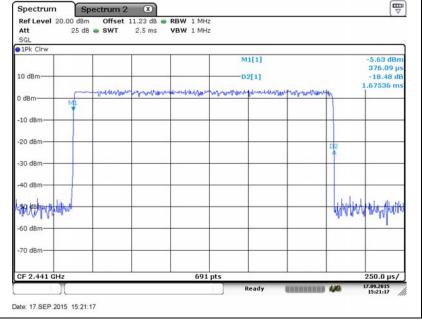
## Packet type: 3-DH1



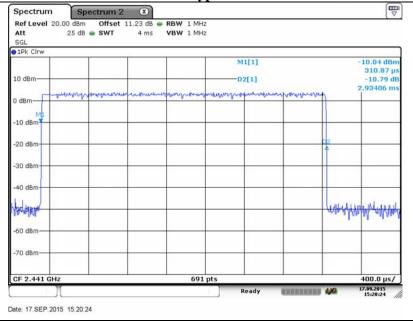


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#### Packet type: 3-DH3



#### Packet type: 3-DH5





#### **3.8.** AC conducted emissions

#### Limit

According to 15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50uH/50 ohm line impedance stabilization network (LISN). Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequencies ranges.

Encourse of Emission (Mb)	Conducted limit (dBµN/m)			
Frequency of Emission (Mz)	Quasi-peak	Average		
0.15 - 0.50	66 - 56*	56 - 46*		
0.50 - 5.00	56	46		
5.00 - 30.0	60	50		

Note:

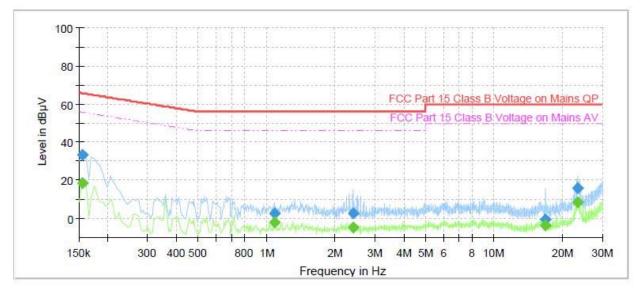
- 1. All modes of operation, data rates, and test channels were investigated and the worst-case emissions are reported in <u>GFSK mode using 1Mbps on Channel 00</u>. The emissions found were not affected by the choice of channel used during testing.
- 2. The limit for Class B device(s) from 150 kHz to 30 MHz are specified in Section 15.207 of the Title 47 CFR.
- 3. Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).
- 4. Deviations to the Specifications: None.



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#### **Test results**

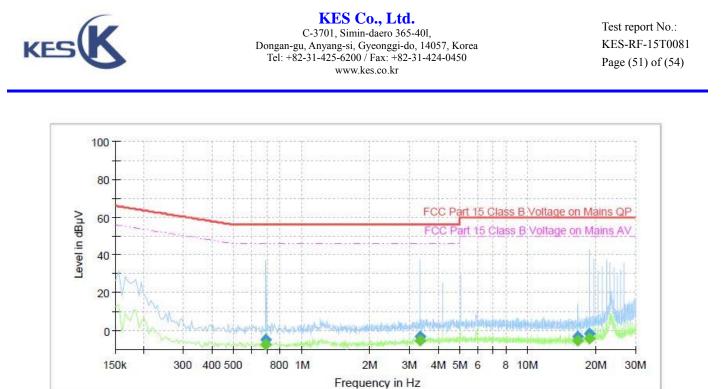


# Final\_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.155000		18.48	55.73	37.25	1000.0	9.000	L1	9.7
0.155000	33.25		65.73	32.48	1000.0	9.000	L1	9.7
1.080000		-2.02	46.00	48.02	1000.0	9.000	L1	9.7
1.080000	2.43		56.00	53.57	1000.0	9.000	L1	9.7
2.410000		-4.81	46.00	50.81	1000.0	9.000	L1	9.7
2.410000	2.74		56.00	53.26	1000.0	9.000	L1	9.7
16.760000		-3.58	50.00	53.58	1000.0	9.000	L1	10.1
16.760000	-0.72		60.00	60.72	1000.0	9.000	L1	10.1
23.365000		8.45	50.00	41.55	1000.0	9.000	L1	10.1
23.365000	15.90		60.00	44.10	1000.0	9.000	L1	10.1

#### Note; Hot Line

Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).



# Final\_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.695000		-7.22	46.00	53.22	1000.0	9.000	N	9.7
0.695000	-4.83		56.00	60.83	1000.0	9.000	N	9.7
3.325000		-5.37	46.00	51.37	1000.0	9.000	N	9.8
3.325000	-3.06		56.00	59.06	1000.0	9.000	N	9.8
16.665000		-5.08	50.00	55.08	1000.0	9.000	N	10.0
16.665000	-3.10		60.00	63.10	1000.0	9.000	N	10.0
18.800000		-4.01	50.00	54.01	1000.0	9.000	N	10.0
18.800000	-1.73		60.00	61.73	1000.0	9.000	N	10.0

#### Note; Neutral Line

Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).



Appendix A. Measurement equipment								
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			
Horn Antenna	Schwarzbeck	BBHA9170	BBHA9170550	2 years	2017.04.30			
High Pass Filter	Wainwright Instrument	WHJS3000-10TT	1	1 year	2016.07.24			
Preamplifier	SCHWARZBECK	BBV-9718	9718-246	1 year	2015.10.23			
Broadband Amplifier	SCHWARZBECK	BBV-9721	PS9721-003	1 year	2016.04.03			
EMI Test Receiver	R & S	ESR3	101781	1 year	2016.05.06			
EMI Test Receiver	R & S	ESR3	101783	1 year	2016.05.06			
LISN	R & S	ENV216	101137	1 year	2016.02.10			

## Appendix A. Measurement equipment

#### **Peripheral devices**

Device	Device Manufacturer		Serial No.
Notebook Computer	Samsung Electronics Co., Ltd.	NP-QX411L	HJV993BB905283V

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