

# **TEST REPORT**

KCTL Inc. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-31-285-0894 FAX: 82-505-299-8311 www.kctl.co.kr		Report No.: KR18-SRF0111 Page (1) of (62)	KCTL			
1. Client						
• Name	• Name : IRIVER LIMITED					
<ul> <li>Addres</li> </ul>	<ul> <li>Address</li> <li>Iriverhouse, 5, Bangbae-ro 18-gil, Seocho-gu, Seoul, Korea</li> </ul>					
∘ Date of	Receipt : 2018-07-13					
2. Use of Re	eport : -					
3. Name of	Product and Model : SP	1000M / PPF32				
6. Date of To 7. Test Stan	5. FCC ID: QDMPPF326. Date of Test: 2018-08-16 to 2018-08-307. Test Standards: FCC Part 15 Subpart C 15.2478. Test Results: Refer to the test result in the test report					
Affirmation	Tested by Name : Jinhwa Cho	Technical Manag	the			
2018-09-04 KCTL Inc.						
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#### **REPORT REVISION HISTORY**

Date	Revision	Page No
2018-09-04	Originally issued	-

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# 1. Client information

Applicant:	IRIVER LIMITED
Address:	Iriverhouse, 5, Bangbae-ro 18-gil, Seocho-gu, Seoul, Korea
Telephone number:	+82 2 3019 7514
Contact person:	Ye-Won Jeong / yewon.jeong@iriver.com

Manufacturer:	IRIVER LIMITED
Address:	Iriverhouse, 5, Bangbae-ro 18-gil, Seocho-gu, Seoul, Korea



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# 2. Laboratory information

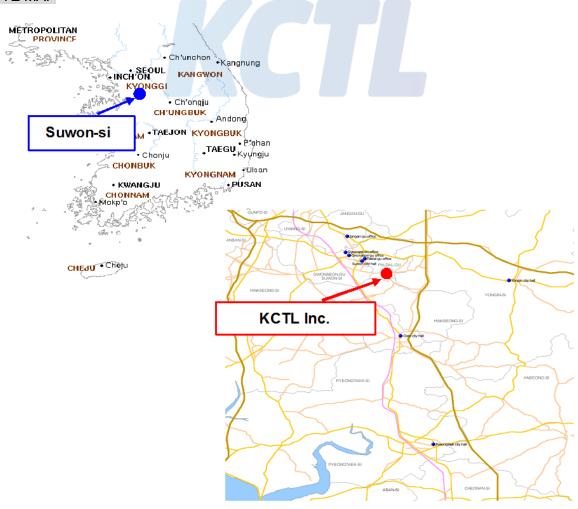
#### <u>Address</u>

#### KCTL Inc.

65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea Telephone Number: +82 31 285 0894 Facsimile Number: +82 505 299 8311

FCC Site Designation No: KR0040, FCC Site Registration No: 687132 VCCI Registration No. : R-3327, G-198, C-3706, T-1849 Industry Canada Registration No. : 8035A KOLAS NO.: KT231

#### SITE MAP



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# 3. Description of E.U.T.

### 3.1 Basic description

Applicant	IRIVER LIMITED
Address of Applicant	Iriverhouse, 5, Bangbae-ro 18-gil, Seocho-gu, Seoul, Korea
Manufacturer	IRIVER LIMITED
Address of Manufacturer	Iriverhouse, 5, Bangbae-ro 18-gil, Seocho-gu, Seoul, Korea
Type of equipment	SP1000M
Basic Model	PPF32
Serial number	N/A

### 3.2 General description

Frequency Range	2 412 M ∼ 2 462 M (802.11b/g/n_HT20), 2 402 M ∼ 2 480 M (Bluetooth)	
Type of Modulation	DSSS (802.11b), OFDM (802.11g/n_HT20), GFSK, π/4DQPSK, 8DPSK (Bluetooth)	
The number of channels	11 ch (802.11b/g/n_HT20), 79 ch (Bluetooth)	
Type of Antenna	FPCB Antenna	
Antenna Gain	-0.393 dBi	
Transmit Power	<b>8.94</b> dBm	
Power supply	DC 3.70 V	
Product SW/HW version	1.0 / 1.0	
Radio SW/HW version	1.0 / 1.0	
Test SW Version	RF Test Tool V3.10.61	
RF power setting in TEST SW	Referred the measuring instrument from manufacturer	

Note : The above EUT information was declared by the manufacturer.

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### 3.3 Test frequency

	Frequency
Lowest frequency	2 402 MHz
Middle frequency	<b>2 441</b> Młz
Highest frequency	2 480 MHz

### 3.4 Test Voltage

Mode	Voltage
Nominal Voltage	DC 3.70 V

#### - 15.247 Requirements for Bluetooth transmitter

- This Bluetooth module has been tested by a Bluetooth Qualification Lab, and we confirm the following:
  - 1) This system is hopping pseudo-randomly.
  - 2) Each frequency is used equally on the average by each transmitter.
  - 3) The receiver input bandwidths that match the hopping channel bandwidths of their corresponding transmitters
  - 4) The receiver shifts frequencies in synchronization with the transmitted signals.
- 15.247(g): The system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this Section 15.247 should the transmitter be presented with a continuous data (or information) stream.
- 15.247(h): 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.

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# 4. Summary of test results

### 4.1 Standards & results

FCC Rule	Parameter	Report Section	Test Result	
15.203, 15.247(b)(4)	Antenna Requirement	5.1	С	
15.247(b)(1), (4)	Maximum Peak Output Power	5.2	С	
15.247(a)(1)	Carrier Frequency Separation	5.3	С	
15.247(a)(1)	20dB Channel Bandwidth	5.4	С	
-	Occupied Bandwidth	5.4	С	
15.247(a)(iii) 15.247(b)(1)	Number of Hopping Channel	5.5	С	
15.247(a) (iii)	Time of Occupancy(Dwell Time)	5.6	С	
15.247(d),15.205(a),15.209(a)	Spurious Emission, BandEdge, Restricted Band	5.7	С	
15.207(a)	Conducted Emissions	5.8	С	
Note C - Complian NC - Not Complian NT - Not Tested NA - Not Applicable				

Note : C = Complies, NC = Not Complies, NT = Not Tested, NA = Not Applicable

- The general test methods used to test on this device are ANSI C63.10-2013

### 4.2 Measurement Uncertainty

Measurement Item	Expanded Uncertainty U = kUc (k = 2)		
Conducted RF power	<b>1.44</b> dB		
Conducted Spurious Emissions	<b>1.52</b> dB		
	30 Młz ~ 300 Młz:	<b>+4.94</b> dB, <b>-5.06</b> dB	
	50 MIZ ~ 500 MIZ.	<b>+4.93</b> dB, <b>-5.05</b> dB	
Radiated Spurious Emissions	300 M批 ~ 1 000 M批:	<b>+4.97</b> dB, <b>-5.08</b> dB	
		<b>+4.84</b> dB, <b>-4.96</b> dB	
	1 GHz ~ 25 GHz:	<b>+6.03</b> dB, <b>-6.05</b> dB	
Conducted Emissions	9 kHz ~ 150 kHz:	<b>3.75</b> dB	
	150 kHz ~ 30 MHz:	<b>3.36</b> dB	

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# 5. Test results

### 5.1 Antenna Requirement

### 5.1.1 Regulation

According to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to \$15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 5.1.2 Result

### -Complied

The transmitter has permanently attached FPCB Antenna (internal antenna) on board.



### 5.2 Maximum Peak Output Power

### 5.2.1 Regulation

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. Alternatively, frequency hopping systems operating in the 2 400-2 483.5 MHz band 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, 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 Mb band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5 725-5 850 Mb band: 1 watt. For all other frequency hopping systems in the 2 400-2 483.5 Mb band: 0.125 watts.

According to §15.247(b)(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 5.2.2 Measurement Procedure

The method of measurement used to test this FHSS device is ANSI C63.10-2013.

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:

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- a) Use the following spectrum analyzer settings:
  - 1) Span: Approximately five times the 20  ${
    m dB}$  bandwidth, centered on a hopping channel.
  - 2) RBW > 20 dB bandwidth of the emission being measured.
  - 3) VBW ≥ RBW.
  - 4) Sweep: Auto.
  - 5) Detector function: Peak.
  - 6) Trace: Max hold.
- b) Allow trace to stabilize.
- c) Use the marker-to-peak function to set the marker to the peak of the emission.
- d) The indicated level is the peak output power, after any corrections for external attenuators and cables.
- e) A plot of the test results and setup description shall be included in the test report.

#### NOTE:

A peak responding power meter may be used, where the power meter and sensor system video bandwidth is greater than the occupied bandwidth of the unlicensed wireless device, rather than a spectrum analyzer.

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### 5.2.3 Test Result

### - Complied

#### - GFSK

Channel	Frequency [ᢂᡌ]	Result [dBm]	Limit [dBm]	Margin [dB]	Average Power [dBm]
Lowest	2 402	8.34	20.97	12.63	6.62
Middle	2 441	8.04	20.97	12.93	6.18
Highest	2 480	8.94	20.97	12.03	7.00

#### - π/4DQPSK

Channel	Frequency [Mb]			Margin [dB]	Average Power [dBm]
Lowest	2 402	6.54	20.97	14.43	2.50
Middle	2 441	6.14	20.97	14.83	2.21
Highest	2 480	7.14	20.97	13.83	3.42
- 8DPSK					

#### - 8DPSK

Channel	Frequency [Mb]	Result [dBm]	Limit [dBm]	Margin [dB]	Average Power [dBm]
Lowest	2 402	6.74	20.97	14.23	2.51
Middle	2 441	6.34	20.97	14.63	2.20
Highest	2 480	7.24	20.97	13.73	3.40

#### NOTE:

1. We took the insertion loss of the cable loss into consideration within the measuring instrument.



### 5.3 Carrier Frequency Separation

### 5.3.1 Regulation

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. Alternatively, frequency hopping systems operating in the 2 400-2 483.5 MHz band 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, provided the systems operate with an output power no greater than 125 mW.

### 5.3.2 Measurement Procedure

The method of measurement used to test this FHSS device is ANSI C63.10-2013.

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

- a) Span: Wide enough to capture the peaks of two adjacent channels.
- b) RBW: 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) Video (or average) bandwidth (VBW) ≥ RBW.
- d) Sweep: Auto.
- e) Detector function: Peak.
- f) Trace: Max hold.
- g) Allow the trace to stabilize.

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

Compliance of an EUT with the appropriate regulatory limit shall be determined. A plot of the data shall be included in the test report.

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### 5.3.3 Test Result

### - Complied

- GFSK

Channel	Channel Frequency [Mtz]		Limit
Lowest	2 402	1.010	0.705
Middle	2 441	1.010	0.707
Highest	2 480	1.010	0.705

#### - 8DPSK

Channel	Frequency [₩z]	Carrier frequency separation [Mb]	Limit
Lowest	2 402	1.010	0.891
Middle	2 441	1.010	0.893
Highest	2 480	1.010	0.893

NOTE:

1. We took the insertion loss of the cable loss into consideration within the measuring instrument.

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### 5.3.4 Test Plot

Figure 1. Plot of the Carrier Frequency Separation

#### - GFSK

Lowest Channel (2 402 Mb)



#### Middle Channel (2 441 Mtz)

			Spectrum 4 🛛 🗙	
Ref Level         20.00 dB           Att         40 d           TDF	m Offset 0.50 dB ● Rt dB SWT 6.4 µs ● VI		Auto FFT	
●1Pk Max			02[1]	-0.08 dB
10 dBm		M1 N	41[1]	1.01000 MHz 4.84 dBm 9244105990 GHz
0 dBm	+			
-10 dBm			· ·	
-20 dBm				
-40 dBm				
-50 dBm				
-60 dBm				
-70 dBm				
CF 2.441 GHz		1001 pts		Span 3.0 MHz

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Highest Channel (2 480 Mz)



#### - 8DPSK

Lowest Channel (2 402 Mz)

Spectrun		ectrum 2		pectrum 3	× Sp	ectrum 4	×		( <del>4</del>
				<b>BW</b> 300 kHz					
Att TDF	40 dB	SWT	6.4 µs 🖷 V	BW 1 MHz	Mode Aut	o FFT			
101 1Pk Max									
					D2[	1]			0.09 d
10 dBm								1.	01000 MH 2.01 dB
TO OBIII				MI	M1[	1]		2.402	2.01 dB 00300 GF
0 dBm							+	D2	
0 ubiii									
-10 dBm									
10 000									
-20 dBm		<u> </u>							
-30 dBm									
	~								
-40 dBm									
-50 dBm									
-60 dBm									
-70 dBm									
CF 2.402 (			1	1001	ata			0.0.0	n 3.0 MHz

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Middle Channel (2 441 Mb)

Spectrum		ectrum		Spectrun		Spectrum -	4 🗙		
Ref Level 20 Att	40 dB	SWT	6.4 µs 👄 1			Auto FFT			
TDF	40 UD	3771	0.4 µs 🖶 1		initial initial	AULU FFI			
1Pk Max									
						02[1]		-	-0.42 dE
								1.	01000 MH;
10 dBm					-	M1[1]			1.48 dBn
					MI	1		2.441 I D2	00600 GH
0 dBm					-			-	
-10 dBm					_				
-20 dBm									
-30 dBm									
-40 dBm									
-50 dBm									
-60 dBm									
00 00									
-70 dBm									
-/o ubin									

# Highest Channel (2 480 Mz)

Spectrum	Spe	ectrum 2	×	Spectr	um 3	XS	pectrum	4 X		E □
Ref Level 20 Att TDF	0.00 dBm 40 dB		.50 dB 👄 6.4 μs 👄			Mode A	uto FFT			
1Pk Max										
							2[1]		1.	0.06 d 01000 MH
10 dBm	M1					D2	1[1]	I	2.479	2.76 dBi 03800 GH
0 dBm			$\sim$			•				
-10 dBm				+						
-20 dBm				_						
-30 dBm				_						
-40 dBm				_						
-50 dBm				_						
-60 dBm				_						
-70 dBm				_						
CF 2.48 GHz					1001					n 3.0 MHz



# 5.4 20 dB Channel Bandwidth

### 5.4.1 Regulation

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. Alternatively, frequency hopping systems operating in the 2 400-2 483.5 MHz band 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, provided the systems operate with an output power no greater than 125 mW.

### 5.4.2 Measurement Procedure

The method of measurement used to test this FHSS device is ANSI C63.10-2013.

The occupied bandwidth is measured as the width of the spectral envelope of the modulated signal, at an amplitude level reduced from a reference value by a specified ratio (or in decibels, a specified number of dB down from the reference value). Typical ratios, expressed in dB, are -6 dB, -20 dB, and -26 dB, corresponding to 6 dB BW, 20 dB BW, and 26 dB BW, respectively. In this subclause, the ratio is designated by "-xx dB." The reference value is either the level of the unmodulated carrier or the highest level of the spectral envelope of the modulated signal, as stated by the applicable requirement. Some requirements might specify a specific maximum or minimum value for the "-xx dB" bandwidth; other requirements might specify that the "-xx dB" bandwidth be entirely contained within the authorized or designated frequency band.

- a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the EMI receiver or spectrum analyzer shall be between two times and Five times the OBW.
- b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1 % to 5 % of the OBW and video bandwidth (VBW) shall be approximately three times RBW, unless otherwise specified by the applicable requirement.
- c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2.
- d) Steps a) through c) might require iteration to adjust within the specified tolerances.
- e) The dynamic range of the instrument at the selected RBW shall be more than 10 dB below the target "-xx dB down" requirement; that is, if the requirement calls for measuring the −20 dB OBW, the instrument noise floor at the selected RBW shall be at least 30 dB below the reference value.
- f) Set detection mode to peak and trace mode to max hold.

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- g) Determine the reference value: Set the EUT to transmit an unmodulated carrier or modulated signal, as applicable. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
- h) Determine the "-xx dB down amplitude" using [(reference value) xx]. Alternatively, this calculation may be made by using the marker-delta function of the instrument.
- i) If the reference value is determined by an unmodulated carrier, then turn the EUT modulation ON, and either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise, the trace from step g) shall be used for step j).
- j) Place two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the "-xx dB down amplitude" determined in step h). If a marker is below this "-xx dB down amplitude" value, then it shall be as close as possible to this value. The occupied bandwidth is the frequency difference between the two markers. Alternatively, set a marker at the lowest frequency of the envelope of the spectral display, such that the marker is at or slightly below the "-xx dB down amplitude" determined in step h). Reset the marker-delta function and move the marker to the other side of the emission until the delta marker amplitude is at the same level as the reference marker amplitude. The marker-delta frequency reading at this point is the specified emission bandwidth.
- k) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

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### 5.4.3 Test Result

### - Complied

Mode	Channel	Frequency [Mtz]	20 dB Channel Bandwidth [Mb]	Occupied Bandwidth (99 % BW) [₩½]
	Lowest	2 402	1.058	0.950
GFSK	Middle	2 441	1.061	0.953
	Highest	2 480	1.058	0.953
	Lowest	2 402	1.337	1.211
8DPSK	Middle	2 441	1.340	1.214
	Highest	2 480	1.340	1.217

NOTE:

1. We took the insertion loss of the cable loss into consideration within the measuring instrument.





### 5.4.4 Test Plot

Figure 2. Plot of the 20 dB Channel Bandwidth & Occupied Bandwidth (Conducted)

#### - GFSK\_20 dB Channel Bandwidth

Lowest Channel (2 402 Mtz)



#### Middle Channel (2 441 Mz)

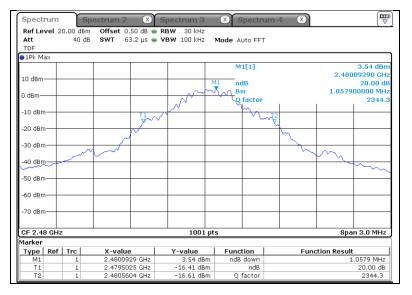
Spectrur	n	Spectrum 2 🛛 🗴	Spectrum 3	Spectru	ım 4 🛛 🗙	
Ref Level Att TDF	20.00 dB 40 d			Mode Auto FFT		
●1Pk Max						
				M1[1]		2.17 dBr
10 dBm						2.44108690 GH
			N	11 ndB		20.00 d 1.060900000 MH
0 dBm			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			1.060900000 MH 2300.
				2 lactor	1	2300.
-10 dBm—		T1	N	- m	. 12	
-20 dBm—			v		Ĩ	
-20 0011					m	
-30 dBm—		-				
	1 r	$\sim$			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	m.
-40 dBm—						
-50 dBm-						1 mm
-50 UBIII-						
-60 dBm—						
-70 dBm—						
CF 2.441	ĠHz		1001 pt	s		Span 3.0 MHz
1arker						
	ef Trc	X-value	Y-value	Function	Fun	ction Result
M1	1	2.4410869 GHz	2.17 dBm	ndB down		1.0609 MHz
T1 T2	1	2.4404935 GHz 2.4415544 GHz	-17.87 dBm -17.98 dBm	ndB		20.00 dB 2300.9
12	1	2.4415544 GHZ	-17.98 dBm	Q factor		2300.9

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#### Highest Channel (2 480 Mz)



#### - 8DPSK\_20 dB Channel Bandwidth

Lowest Channel (2 402 Mz)

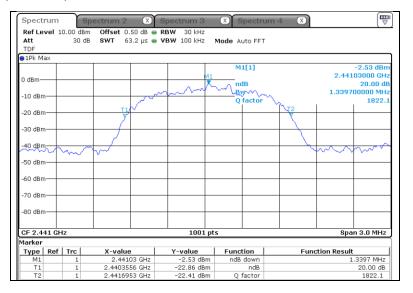


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#### Middle Channel (2 441 Mz)



#### Highest Channel (2 480 Mz)

Spectr	um	Spo	ectrum 2 🛛 🔀	Spectrum 3	× Spectru	m 4 🛛 🗶	E ⊽
Ref Lev Att TDF	<b>/el</b> 10.	.00 dBm 30 dB	Offset 0.50 dB ( SWT 63.2 µs (		Mode Auto FFT		
∋1Pk Ma	эх						
0 dBm—				M1	M1[1]		-1.04 dBm 2.48003600 GHz 20.00 dE
-10 dBm	-		т1		Bw/~``/~ Q factor	WT2	1.339700000 MH; 1851.2
-20 dBm	+		7			- F	
-30 dBm	+						
-40'dBm	~~	$\sim$	~~~			~	$\sim\sim\sim\sim\sim\sim\sim$
-50 dBm	+						
-60 dBm	+						
-70 dBm	+						
-80 dBm	+						
CF 2.48	B GHz			1001 p	ts		Span 3.0 MHz
Marker Type	Ref	Trc	X-value	Y-value	Function	Funr	tion Result
M1		1	2.480036 GHz	-1.04 dBm	ndB down	- un	1.3397 MHz
T1		1	2.4793616 GHz	-20.87 dBm	ndB		20.00 dB
T2		1	2.4807013 GHz	-20.85 dBm	Q factor		1851.2

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#### - GFSK\_Occupied Bandwidth

Lowest Channel (2 402 Mtz)



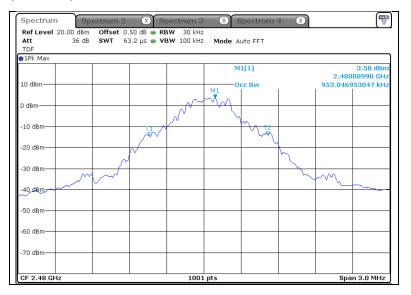
#### Middle Channel (2 441 Mtz)



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Highest Channel (2 480 Mz)



#### - 8DPSK\_Occupied Bandwidth

Lowest Channel (2 402 Mtz)

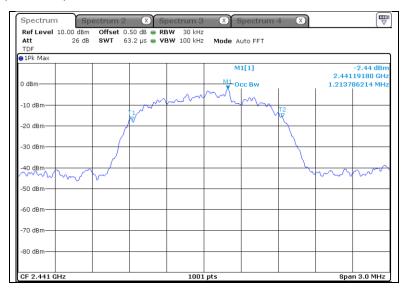


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J J

#### Middle Channel (2 441 Mz)



#### Highest Channel (2 480 Mz)

Spectrum	Spectru		-	rum 3 🛛 🚺	Spectrum	14 X		
Ref Level 10.00 Att TDF	dBm Off 26 dB SW	set 0.50 dB T 63.2 µs	<ul> <li>RBW</li> <li>VBW</li> </ul>		de Auto FFT			
1Pk Max								
0 dBm		_			M1[1]		2.480	-0.70 dBm 19780 GHz 83217 MHz
-10 dBm		1	~~~	_//~~ ·	how			
-20 dBm		-						
-30 dBm								
	-	, 					$\sim$	$\sim$
-50 dBm								
-60 dBm								
-70 dBm								
-80 dBm								
CF 2.48 GHz				1001 pts		1	Sna	n 3.0 MHz



## 5.5 Number of Hopping Channels

### 5.5.1 Regulation

According to §15.247(a)(1)(iii), Frequency hopping systems in the 2 400-2 483.5 Mb band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used. According to §15.247(b)(1), For frequency hopping systems operating in the 2 400-2 483.5 Mb band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5 725-5 850 Mb band: 1 watt. For all other frequency hopping systems in the 2 400-2 483.5 Mb band: 0.125 watts.

### 5.5.2 Measurement Procedure

The method of measurement used to test this FHSS device is ANSI C63.10-2013.

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

- a) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
- b) RBW: To identify clearly the individual channels, set the RBW to less than 30 % of the channel spacing or the 20 dB bandwidth, whichever is smaller.
- c) VBW ≥ RBW.
- d) Sweep: Auto.
- e) Detector function: Peak.
- f) Trace: Max hold.
- g) Allow the trace to stabilize.

It might prove necessary to break the span up into subranges to show clearly all of the hopping frequencies. Compliance of an EUT with the appropriate regulatory limit shall be determined for the number of hopping channels. A plot of the data shall be included in the test report.

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### 5.5.3 Test Result

### - Complied

Mode	Frequency [Mb]	Number of hopping channel	Limit
GFSK	2 402 – 2 480	79	≥15
8DPSK	2 402 – 2 480	79	≥15

#### NOTE:

- 1. We took the insertion loss of the cable loss into consideration within the measuring instrument.
- 2. Measurement is made with EUT operating in hopping mode between 79 channels providing a worse case scenario as compared to AFH mode hopping between 20 channels.



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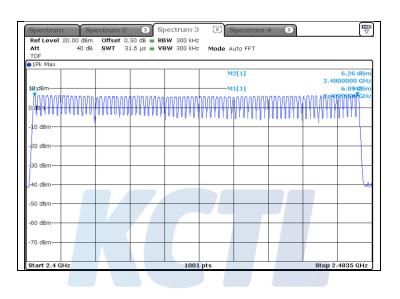


### 5.5.4 Test Plot

Figure 3. Plot of the Number of Hopping Channels (Conducted)

### Non-AFH Mode

#### - GFSK



#### - 8DPSK

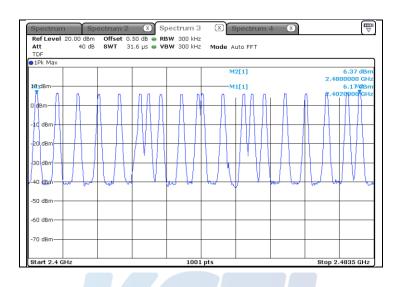
Spectrum		ectrum 2		pectrum 3		pectrum	4 X		$\nabla$
Ref Level 2 Att				BW 300 kHz BW 300 kHz		uto FET			
TDF	40 00	3771	51.0 µ5 🚽 🖡	DW 500 KH2	Mode A				
⊖1Pk Max									
					M	2[1]			2.36 dBm
10 dBm								2.48	00000 GHz
M1					M	1[1]		2 40	2.51 dBm 20000/36Hz
	mm	000000	honor	mm	mmm	loopoor			
0 dBm				1					
-10 dBm									
-20 dBm									
									6
30 dBm			-						
-40 dBm			-						
-50 dBm			+						
-60 dBm									
-70 dBm			-						
Start 2.4 G	-			1001	nte	1		Oton 0	4835 GHz

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#### AFH Mode

- GFSK



- 8DPSK

Spectrum Sp Ref Level 20.00 dBm Att 40 dB TDF	Offset 0.50 dB 👄 F	Beetrum 3 X S BW 300 kHz VBW 300 kHz Mode Au	pectrum 4 🛛 🗶	
19k Max 0 dBm 41 dBm 20 dBm 40 dBm 40 dBm 50 dBm 50 dBm 70 dBm				2.45 dBm 2.460000 GH2 2.78 dBm 2.402000082H



# 5.6 Time of Occupancy(Dwell Time)

### 5.6.1 Regulation

According to §15.247(a)(1)(iii), frequency hopping systems in the 2 400-2 483.5 Mb band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### 5.6.2 Measurement Procedure

The method of measurement used to test this FHSS device is ANSI C63.10-2013.

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

- a) Span: Zero span, centered on a hopping channel.
- b) RBW shall be ≤ 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.

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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) × (period specified in the requirements / analyzer sweep time)

The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.

The measured transmit time and time between hops shall be consistent with the values described in the operational description for the EUT.

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### 5.6.3 Test Result

#### - Complied

#### - Non-AFH

Modulation	Frequency [Mt/2]	Reading [ms]	Hopping rate [hop/s]	Number of Channels	Result [s]	Limit [s]
DH1	2 441	0.380	800.000	79	0.122	0.400
DH3	2 441	1.638	400.000	79	0.262	0.400
DH5	2 441	2.891	266.667	79	0.308	0.400
2-DH1	2 441	0.389	800.000	79	0.124	0.400
2-DH3	2 441	1.642	400.000	79	0.263	0.400
2-DH5	2 441	2.894	266.667	79	0.309	0.400
3-DH1	2 441	0.388	800.000	79	0.124	0.400
3-DH3	2 441	1.642	400.000	79	0.263	0.400
3-DH5	2 441	2.888	266.667	79	0.308	0.400
AFH						·······································

- AFH

Modulation	Frequency [1912]			Number of Channels	Result [s]	Limit [s]
DH1	2 441	0.380	400.000	20	0.061	0.400
DH3	2 441	1.638	200.000	20	0.131	0.400
DH5	2 441	2.891	133.333	20	0.154	0.400
2-DH1	2 441	0.389	400.000	20	0.062	0.400
2-DH3	2 441	1.642	200.000	20	0.131	0.400
2-DH5	2 441	2.891	133.333	20	0.154	0.400
3-DH1	2 441	0.388	400.000	20	0.062	0.400
3-DH3	2 441	1.642	200.000	20	0.131	0.400
3-DH5	2 441	2.888	133.333	20	0.154	0.400

#### NOTE 1. Non AFH

Result = Reading x (Hopping rate / Number of channels) x Test Period Hopping rate = 1600/time slot

Test period = 0.4 [seconds / channel] × 79 [channel] = 31.6 [seconds]

NOTE 2. AFH

Result = Reading x (Hopping rate / Number of channels) x Test Period Hopping rate = 800/time slot

Test period = 0.4 [seconds / channel] × 20 [channel] = 8 [seconds]

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### 5.6.4 Test Plot

Figure 4. Plot of the Time of Occupancy (Conducted)

#### - GFSK\_Non AFH mode

DH1 (2 441 Mb)

Ref Level 20				RBW 1 MHz					
Att TRG: VID TDF	40 dB (	swi	500 µs 🦷	<b>VBW</b> 1 MHz					
1Pk Max									
						D2[1]			-0.44 d
10 dBm									380.000 µ
TR	3 4.000 d	Bm				M1[1]	 		5.52 dB
0 dBm								0.50	
10.10									
-10 dBm									
-20 dBm						_	 		
power									
-30 d8m									
								1	
M74M8								ľ	ANNAAN (MAN
-50 d8m							 		~ q.
-60 dBm									
-70 dBm									
-/0 ubiii									
CF 2.441 GHz				1001	nte				50.0 µs/
larker				1001	pts	-			00.0 µ3/
Type   Ref	Trc	X-value	1	Y-value	Fun	ction	Functi	on Result	
M1	1		0.0 s	5.52 dB	m				

#### DH3 (2 441 Mz)

Spectrum				Spectrum 3	X	Spectr	um 4	X		
				RBW 1 MHz						
Att		SWT	2 ms 👄	VBW 1 MHz						
TRG: VID TD	F									
●1Pk Max										
					D	2[1]				-0.46 dl
10 dBm										1.63800 m
<b>V</b>	RG 4.000 d	IR management			M	1[1]				D5.57 dBr
0 dBm	KG 4.000 C					1				500 n
-10 dBm										
-20 dBm						-				
[~]										14
-30 dBm										
silpermoned										Uninterstation
-40 dBm										
-50 dBm										
-50 dBm										
-60 dBm										
-00 00111										
-70 dBm										
CF 2.441 GH	łz			1001	pts					200.0 µs/
Marker					•					
Type   Ref	Trc	X-value	1	Y-value	Func	tion		Fund	tion Resu	lt
M1	1		0.0 ns	5.57 dB						
D2 M1	1	1.6	38 ms	-0.46 d	B					

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#### DH5 (2 441 Mz)

TRG: VI		40 UB	👄 SWT 🛛 3.3 ms 🧉	VBW 1 MHz			
	ID TDF						
∋1Pk M	ах						
					D2[1]		-0.16 di
10 d <b>bh</b>							2.89110 m
			dBm		M1[1]		5D26 dBr
0 dBm-		0 0.000	ubiii				<mark>3.30 µ</mark>
-10 dBn	-						
-20 dBn							
ď							
-30 dBn	1—						
mand							Winsuber
-40 dBn	n—						
-50 dBn	1—						
-60 dBn	1		+ +				
-70 dBn	<u>ו</u> רי		+ +				
CF 2.4	41 GH	z		1001 pt:	5		330.0 µs/
larker							
Type	Ref	Trc	X-value	Y-value	Function	Function	n Result
M1		1	-3.3 µs	5.76 dBm			
D2	M1	1	2.8911 ms	-0.16 dB			

#### - π/4DQPSK\_Non AFH mode

2-DH1 (2 441 Mz)

Ref Level 20.00 d Att 40		VBW 1 MHz			
TRG: VID TDF	ub 🖶 awri 500 µs	WHY I MHZ			
1Pk Max					
			D2[1]		1.76 0
10.10.					388.500
10 dBm			M1[1]		-0.09 dB
0 dBm		- AMARAMINA	ามีเสมองปลายป	MUMMALINAL	H.M. R. 10000000
-10 dBm TRG -7.0	000 dBm				
10 00.00					
-20 dBm					
man					
-30 d <mark>8</mark> m					
phonen					Montoneo
-40 dBm					
-50 dBm					
-60 dBm					
-ou ubili					
-70 dBm					
-/0 00111					
CF 2.441 GHz		1001 p	ts		50.0 µs,
Marker Type   Ref   Trc				-	
	X-value	Y-value	Function	Func	tion Result

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#### 2-DH3 (2 441 Mz)

Spectr	_		pectrum 2 🛛 🕅	oposaanio	Spec	trum 4 🔍	×	
	<b>/el</b> 2	0.00 dBm		RBW 1 MHz				
Att			3 🖷 SWT 2 ms	😑 VBW 1 MHz				
TRG: VI								
●1Pk Ma	x							
					D2[1]			0.49 dE
10 dBm-								1.64200 m
10 00111	M1				M1[1]			1.59 dBn
0 dBm—	- <b>T</b>	Utr/	<b>Ъ¶_40/40~~~1446/</b> ~~140/~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	physicallering the second of the second s	4144-471	and the should be	MUHANAN 11-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1	.៧,ពិលោកក្នុង
o abiii								
-10 dBm	-HTF	RG -9.00	0 dBm					
10 0011								
-20 dBm								
20 000	~							
-30 dBm								
Mar leve								hoursenal
-40 dBm	$\rightarrow$							
-50 dBm	$\rightarrow$							
-60 dBm	$\rightarrow$							
-70 dBm	$\rightarrow$							
05.0.1								
CF 2.44	1 GH	z		1001 p	pts			200.0 µs/
Marker		- 1		1	1	1		
	Ref		X-value	Y-value	Function		Function Res	sult
M1 D2	M1	1	0.0 s 1.642 ms					
D2	1/11	1	1.642 ms	U.49 dB				

#### 2-DH5 (2 441 Mz)

Spect	rum	S	bectrum 2	2 🛛	Spectrum 3	XS	pectru	m 4	×		T T
Ref Le	vel 2	0.00 dBm	Offset	0.50 dB	RBW 1 MHz						
Att		40 dB	SWT	3.3 ms 🧃	VBW 1 MHz						
TRG: VI	D TDF										
∋1Pk Ma	эх										
						D2	[1]				0.99 d
10 dBm·											2.89440 m
TO OBIII-							[1]				0.67 dB
0 dBm	in the second	Manhaller	- propriate	man <mark>ulu</mark> tion	source and the	- whether the start of the second	and Marke	مريون محمد المرحب	man mark	happer and the factor of the second s	wywing:30 f
U UBIII-											
-1U dBr	TF	RG -9.000	) dBm								
-10 050	' T.'										
-20 dBn											
20 00	.										
-30 dBm											
handhand											wheel
-40 dBm				_	_						
-50 dBm				_							+
-60 dBm											+
-70 dBm											+
CF 2.4	11 GH	z	-		1001 p	its				-	330.0 µs/
/larker											
Type	Ref	Trc	X-val	ue	Y-value	Funct	ion		Fund	ction Resu	lt
M1		1		-3.3 µs	0.67 dBm						
D2	M1	1	2.	8944 ms	0.99 dB						

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#### - 8DPSK\_Non AFH mode

3-DH1 (2 441 Mz)

1Pk Max					м	1[1]			0.82 dBr
10 dBm					D	2[1]			500 n 1.15 d
0 dBm	11				annal-phory	har with the state	warden we	Manarali	2 <b>388.000</b> µ
-10 dBm-							· • • •		
	TRG -15.00	) dBm							
-20 dBm									
-30 dBm-									
Num									hurrens
-40 dBm									
-50 dBm									
-60 dBm									+
-70 dBm									
CF 2.441 G	Hz			1001 p	ots				50.0 μs/
1arker	1- 1		1		1 -		_		
Type Ref M1	Trc 1	X-value 50	0.0 ns	Y-value 0.82 dBm	Func	tion	Fund	tion Resul	t
D2 M			8.0 µs	1.15 dB					

### 3-DH3 (2 441 Mz)

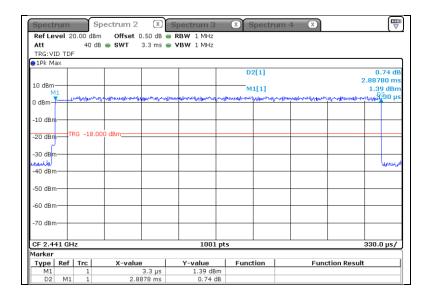
Spectrum	Spectrum 2 🛛 🕅	Spectrum 3	× Spectru	um 4 🛛 🗵	[ <del>]</del>
Ref Level 20.00	dBm Offset 0.50 dB	RBW 1 MHz			
Att 40	) dB 😑 SWT 2 ms	VBW 1 MHz			
TRG: VID TDF					
●1Pk Max					
			D2[1]		0.90 d
10 10					1.64150 n
10 dBm			M1[1]		1.42 dB
0 d0	()มักรไป <mark>ปฏิการในไปให้เหม</mark> ามารถเป็นหูเข	where the state of	har warmen for services	والملابط ووالمحاص المساجع ومسا	այստասիլի այդերին 00000
0 dBm					
10 10					
-10 dBm					
-20 dBm TRG -1	8.000 dBm				
-20 dBm					
-30 dBm					
-40 dBm					Manufall
-40 UBIII					
-50 dBm					
-SU UBIII					
-60 dBm					
-00 dbm					
-70 dBm					
-/0 0011					
CF 2.441 GHz		1001 pt	s		200.0 µs,
Marker					
Type Ref Trc	X-value	Y-value	Function	Fun	ction Result
M1 1	0.0 s	1.42 dBm			
D2 M1 1	1.6415 ms	0.90 dB			

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3-DH5 (2 441 Mz)



#### - GFSK\_AFH mode

DH1 (2 441 Mz)

Spectrum	Spectrum 2		ectrum 3	× sp	ectrum 4			Ţ
Ref Level 20.00		50 dB 👄 RE						
Att 4 TRG: VID TDF	0 dB 👄 SWT - 5	600 µs 👄 ۷	3W 1 MHz					
1Pk Max								
TEK Max				D2	11			-0.43 d
				02				380.000 μ
10 dBm M1				M1	[1]		D2	5.53 dB
TRG 4	.000 dBm						0 <b>.</b> pc	0000000
0 dBm								
-10 dBm								
-10 00111								
-20 dBm								
r								
-30 d8m							4	
moland								Munun
-40 dBm								
-50 dBm								
-60 dBm								
-00 ubiii								
-70 dBm								
CF 2.441 GHz			1001 pt					50.0 µs/
Marker			1001 pt	-				0010 µ3/
Type   Ref   Tro	X-value	1	Y-value	Functi	on	Fund	tion Result	
	1	0.0 s	5.53 dBm			1 411		
D2 M1	1 38	).O µs	-0.43 dB					

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### DH3 (2 441 Mz)

Spectrum Ref Level 20.00	Spectrum 2 🛛 🛪	Spectrum 3	× Spectr	um 4 🙁	
		S VBW 1 MHz			
TRG: VID TDF	0 00 <b>- 3</b> 441 - 2 113				
1Pk Max					
IFK Maa			D2[1]		-0.46 di
			02[1]		1.63800 m
10 dBm 10			M1[1]		D5.58 dBn
	.000 dBm				+ 500 n
0 dBm					
-10 dBm					
00 10-1					
-20 dBm					
00 10					1
-30 dBm					
-40 dBm					hondoserver
-to ubiii					
-50 dBm					
00 00					
-60 dBm					
-70 dBm					
CF 2.441 GHz		1001 pt	ts		200.0 µs/
Marker		1001 p			20010 [057
Type   Ref   Trc	X-value	Y-value	Function	Function	n Result
M1 1					
D2 M1 1	1.638 ms	-0.46 dB			

DH5 (2 441 Mtz)

Spectrum	Sp	ectrum 2	X	Spectrum 3	X Sp	ectrum ·	4 🛛 🗙		
Ref Level 2	0.00 dBm	Offset 0.5	50 dB 🥃	RBW 1 MHz					
Att	40 dB	SWT 3.	3 ms 🧉	VBW 1 MHz					
TRG: VID TD	-								
🕽 1Pk Max 👘									
					D2	1]			-0.15 dl
10 104		1 1						2.	89110 m
10 dBm					M1	[1]			5025 dBn
0 dBm	RG 5.000	dBW							3.30 µ
U UBII									
-10 d6m									
-10 uBill									
-20 dBm									
-20 0000									
-30 cBm									
under and a second seco									witnessel
-40 dBm									0.000
io abiii		1 1							
-50 dBm									
00 00.00		1 1							
-60 dBm									
		1 1							
-70 dBm									
CF 2.441 GH	IZ			1001 p	ts			3	130.0 µs/
Marker		×	1		1				
Type Ref		X-value	2	Y-value 5.75 dBm	Functi	on	Fund	tion Result	
M1 D2 M1	1	2.891	3 µs	-0.15 dBm					

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#### - π/4DQPSK\_AFH mode

2-DH1 (2 441 Mz)

1Pk Max	-								
					D2	[1]			1.75 d 388.500 µ
10 dBm—					M	[1]			-0.11 dBr
) dBm—	M1			-I. Mark Arail In	alitante-bat.	dimuthu	Unportunite	mult	00000000
U UBIII									
-10 dBm—	TRG -7.00	0 dBm							
-20 dBm—									
-30 dBm-	~1								1
-30 upin-									-
-40 dBm—									trans. trans. and the fil
-50 dBm—									
-60 dBm—									
oo abiii									
-70 dBm—	-	_					_	-	-
CF 2.441	GHz			1001 p	ts				50.0 µs/
1arker									
Type R		X-valu		Y-value	Funct	ion	Fun	ction Resu	lt
M1	1 M1 1	_	0.0 s 38.5 µs	-0.11 dBm 1.75 dB					

### 2-DH3 (2 441 Mb)

Spectrum	Spectrum 2	Spectrum 3	Spectru	ım 4 🛛 🔊	(E
Ref Level 20.00	dBm Offset 0.50 d	B RBW 1 MHz			(
Att	40 dB 😑 SWT 2 m	is 😑 VBW 1 MHz			
TRG: VID TDF					
●1Pk Max					
			D2[1]		0.47 d
					1.64200 m
10 dBm			M1[1]		1.58 dB
-		Manager and the second second second	ultohim or a second		~ <sub>10</sub> ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
0 dBm					
TRC	9.000 dBm				
-10 dBm TRG	9.000 dBm				
-20 dBm					
<b>ا</b> م					
-30 dBm					
the destroyed and the second					Linche berton
-40 dBm					
-50 dBm					
60 d0 -					
-60 dBm					
70 10					
-70 dBm					
CF 2.441 GHz		1001 p	ts		200.0 µs/
Marker					
Type   Ref   Tr	c X-value	Y-value	Function	Fund	tion Result
M1	1 0.0	s 1.58 dBm			
D2 M1	1 1.642 m	s 0.47 dB			

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#### 2-DH5 (2 441 Mz)

Ref Le	vel 2	0.00 dBn	n Offset 0.50 dB	RBW 1 MHz				
Att		40 dE	3 👄 SWT 3.3 m s 🗧	VBW 1 MHz				
TRG: V	ID TDF							
∋1Pk M	ах							
					D2[1]			0.47 d
10 Jp							2.8	9110 m
10 dBm M					M1[1]			.45 dBr
0 dBm		manena	and a set of the set o		when you want to make the		ֈֈՠֈՠՠՠֈ <sub>֎</sub> ՠֈ <mark>֎ֈՠ֎</mark> ֈ	<b>0000</b>
111 du	T	RG -9.00	0 dBm:					
-10 UB	· · ·							
-20 dB								
20 00	' I.							
-30 dBr	-							
hand	.							under school
-40 dBr	η							on And Andrew
-50 dBr	1—							
-60 dBr	∩— -							
-70 dBr	<b>-</b> +−			_				
CF 2.4	41 GF	17		1001 pt:	5	1	33	0.0 µs/
darker	11 01			1001 pt.	,			0.0 µ37
Type	Ref	Trc	X-value	Y-value	Function	Euno	ction Result	
M1	1.01	1	0.0 s	1.45 dBm	ranotion	- T une	scion Resource	
D2	M1	1	2.8911 ms	0.47 dB				

### - 8DPSK\_AFH mode

3-DH1 (2 441 Mz)

Att	40 dB	SWT 500	us 😑 VBW 1 MH:	z			
TRG: VID TD							
●1Pk Max							
				M1[1	1		0.83 dB
10 dBm							500
TO UBIII	1			D2[1	1		1.10
0 dBm	i			hand water and the second s	ഷികാണംസംവില	11.1.11.11.1.11/10	2388.000
0 ubiii					. արդվերվերվ	Red and the second	
-10 dBm							1
	RG -15.00	d d B m					
-20 dBm	KG -13.00	Jubin					
many							ų –
-30 d3m							1
way							mennerth
-40 dBm							Annual and the other
-50 dBm							
-60 dBm							
-70 dBm							_
CF 2.441 GH	17		100	11 pts			50.0 µs
Marker			100	- pc3			0010 µ3
Type   Ref	Trc	X-value	Y-value	Function		unction Resu	1+
M1	1	500.0			· · ·	unction Rest	it.
D2 M1	1	388.0					

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#### 3-DH3 (2 441 Mz)

Spectr		.00 dBm	ectrum 2 Offset	50 dB	Spectrum 3		- op		ım 4	×		
Att	161 20		SWT		VBW 1 MHz							
TRG: VII		10 00	• • • • •	2 1115 4								
1Pk Ma												
						1	D2[	11				0.88 d
												1.64150 m
10 dBm-	MI					<u> </u>	M1[	1]				1.39 dBn
o 40	×		المحاولين المحادث	-manutativ-	where the states and the states of the state	amon	where the	errougel	mental	براطايه وللماس	Monte March 19 and	000006
0 dBm—												
-10 dBm												
10 0011												
-20 dBm		G -18.000	) dBm			<u> </u>						
	2											
-30 dBm	$\square$											
Junha	)											Lungar
-40 dBm	+											
-50 dBm	+											
-60 dBm	-					<u> </u>						
70.10												
-70 dBm												
CF 2.44	1 GH:	z			100:	1 pts						200.0 µs/
Marker												
	Ref	Trc	X-value		Y-value		Functio	on		Fun	ction Resu	ılt
M1		1		0.0 s	1.39 dB							
D2	M1	1	1.64	15 ms	0.88	dB						

#### 3-DH5 (2 441 Mz)

Spectr	um	Spe	ectrum 2	$\mathbf{X}$	Spectrum 3	X S	pectru	ım 4	×		[₩
Ref Lev	<b>7el</b> 20	.00 dBm	Offset (	).50 dB 🥃	RBW 1 MHz						
Att		40 dB	SWT	3.3 ms 🧉	VBW 1 MHz						
TRG: VI	d tdf										
∋1Pk Ma	эx										
						D	2[1]				0.74 di
10 dBm-										2	2.88780 m
TO UBIII-	1						1[1]				1.39 dBn
0 dBm	E. M.	whetersta	nonwishawly	den mary marked	environter for the second	manualition	howwww	wymmede	oneighter	with million and the part	чна <mark>, 30 н</mark>
o ubili											
-10 dBm											
-TO UDII											
-20 dBm		G -18.000	dBm								
20 001											
-30 dBm											
ulur de											ut-mu-h
-40 dBm	_										Officiality
-50 dBm	_										
-60 dBm	$\rightarrow$										
-70 dBm	$\rightarrow$						-				
CF 2.44		,			1001	nte					330.0 µs/
darker	ni urla	-			1001	PC3					000.0 µS/
Type	Rof	Trc	X-value		Y-value	Func	tion		Eun	ction Result	
M1	No1	1	A Value	3.3 µs	1.39 dBr				- un	cton Kesuit	
D2	M1	1	2.0	378 ms	0.74 di						



### 5.7 Spurious Emission, Band edge and Restricted bands

### 5.7.1 Regulation

According to §15.247(d), in any 100 kt/z 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 kt/z 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 emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

According to §15.209(a), Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall notexceed the field strength levels specified in the following table:

Frequency (Mb)	Field strength ( $\mu$ /m)	Measurement distance (m)
0.009 - 0.490	2 400/F(kHz)	300
0.490 -1.705	24 000/F(kHz)	30
1.705 – 30	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

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

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According to § 15.205(a) and (b), only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
MHz           0.009 - 0.110           0.495 - 0.505           2.1735 - 2.1905           4.125 - 4.128           4.17725 - 4.17775           4.20725 - 4.20775           6.215 - 6.218           6.26775 - 6.26825           6.31175 - 6.31225           8.291 - 8.294           8.362 - 8.366           8.37625 - 8.38675	Mb	Mtz	GHz
	16.42 - 16.423	399.9 - 410	4.5 - 5.15
	16.69475 - 16.69525	608 - 614	5.35 - 5.46
	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
	25.5 - 25.67	1300 - 1427	8.025 - 8.5
	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
	74.8 - 75.2	1660 - 1710	10.6 - 12.7
	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
	123 - 138	2200 - 2300	14.47 - 14.5
	149.9 - 150.05	2310 - 2390	15.35 - 16.2
	156.52475 -	2483.5 - 2500	17.7 - 21.4
	156.52525	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	Above 38.6
13.36 - 13.41	322 - 335.4	0000 - 4400	A5070 30.0

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1 000 Mb, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1 000 Mb, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

### 5.7.2 Measurement Procedure

The method of measurement used to test this FHSS device is ANSI C63.10-2013.

### 1) Band-edge Compliance of RF Conducted Emissions

These procedures are applicable for determining compliance at authorized-band band-edges where the requirements are expressed as a value relative to the in-band signal level. Procedures for determining compliance with field strength limits at or close to the band-edges are given in 6.10.6 (see also Table A.2).

Band-edge tests are typically performed as a conducted test but may be performed as Radiated measurements on a test site meeting the specifications in 5.2, at the measurement distances specified in 5.3. The instrumentation shall meet the requirements in 4.1.1 using the bandwidths and detectors Specified in 4.1.4.2.

When performing radiated measurements, the measurement antenna(s) shall meet the specifications in 4.3. The EUT shall be connected to an antenna and operated at the highest power settings following procedures in 6.3.

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For other than frequency-hopping devices, this test sequence shall be performed once. For devices that support frequency hopping, this test sequence shall be performed twice: once with the hopping function turned OFF and then repeated with the hopping function turned ON. The purpose of the test with the hopping function turned on is to confirm that the RF power remains OFF while the device is changing frequencies, and that the oscillator stabilizes at the new frequency before RF power is turned back ON.Overshoot of any oscillator, including phase-lock-loop stabilized oscillators, can cause the device to be temporarily tuned to frequencies outside the authorized band, and it is important that no transmissions occur during such temporary periods. Particular attention to the hopping sequence requirements specified below is needed in the case of adaptive frequency-hopping devices:

- a) Connect the EMI receiver or spectrum analyzer to the EUT using an appropriate RF cable connected to the EUT output. Configure the spectrum analyzer settings as described in step e) (be sure to enter all losses between the unlicensed wireless device output and the spectrum analyzer).
- b) Set the EUT to the lowest frequency channel (for the hopping on test, the hopping sequence shall include the lowest frequency channel).
- c) Set the EUT to operate at maximum output power and 100 % duty cycle, or equivalent "normal mode of operation" as specified in 6.10.3.
- d) If using the radiated method, then use the applicable procedure(s) of 6.4, 6.5, or 6.6, and orient the EUT and measurement antenna positions to produce the highest emission level.
- e) Perform the test as follows:
  - 1) Span: Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products that fall outside of the authorized band of operation.
  - 2) Reference level: As required to keep the signal from exceeding the maximum instrument input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2.
  - 3) Attenuation: Auto (at least 10 dB preferred).
  - 4) Sweep time: Coupled.
  - 5) Resolution bandwidth: 100 kHz.
  - 6) Video bandwidth: 300 kHz.
  - 7) Detector: Peak.
  - 8) Trace: Max hold.



- f) Allow the trace to stabilize. For the test with the hopping function turned ON, this can take several minutes to achieve a reasonable probability of intercepting any emissions due to oscillator overshoot.
- g) Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the markerdelta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.
- h) Repeat step c) through step e) for every applicable modulation.
- i) Set the EUT to the highest frequency channel (for the hopping on test, the hopping sequence shall include the highest frequency channel) and repeat step c) through step d).
- j) The band-edge measurement shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).



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### 2) Spurious RF Conducted Emissions:

Conducted spurious emissions shall be measured for the transmit frequency, per 5.5 and 5.6, and at the Maximum transmit powers.

Connect the primary antenna port through an attenuator to the spectrum analyzer input; in the results, account for all losses between the unlicensed wireless device output and the spectrum analyzer. The instrument shall span 30 Mb to 10 times the operating frequency in Gb, with a resolution bandwidth of 100 kb, video bandwidth of 300 kb, and a coupled sweep time with a peak detector. The band 30 Mb to the highest frequency may be split into smaller spans, as long as the entire spectrum is covered.

### 3) Spurious Radiated Emissions:

- 1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an semi-anechoic chamber at a distance of 3 meters.
- 2. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360°.
- 3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, and from 30 to 1 000 MHz using the Bi-Log antenna, and from 1 000 MHz to 26 500 MHz using the horn antenna.
- 4. To obtain the final measurement data, the EUT was arranged on a turntable situated on a 4 × 4 meter in an semi-anechoic chamber. The EUT was tested at a distance 3 meters.
- 5. Each frequency found during preliminary measurements was re-examined and investigated. The testreceiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
- 6. The 0.8m height is for below 1 G testing, and 1.5m is for above 1G testing.

#### 

The procedure for unwanted emissions measurements below 1 000 Mb is as follows:

- a) Follow the requirements in 12.7.4.
- b) Compliance shall be determined using CISPR quasi-peak detection; however, peak detection is permitted as an alternative to quasi-peak detection.

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#### - Procedure for peak unwanted emissions measurements above 1 000 Mb

The procedure for peak unwanted emissions measurements above 1 000 Mb is as follows:

- a) Follow the requirements in 12.7.4.
- b) Peak emission levels are measured by setting the instrument as follows:
  - 1) RBW = 1 Mz.
  - 2) VBW ≥ [3 ₩₂ RBW].
  - 3) Detector = peak.
  - 4) Sweep time = auto.
  - 5) Trace mode = max hold.
  - 6) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, then the time required for the trace to stabilize will increase by a factor of approximately 1 / D, where *D* is the duty cycle. For example, at 50 % duty cycle, the measurement time will increase by a factor of two, relative to measurement time for continuous transmission.

#### - Procedures for average unwanted emissions measurements above 1 000 Mb

Method VB-A is averaging using reduced video bandwidth. The procedure for this method is as follows:

- a) RBW = 1 ₩±.
- b) Video bandwidth:
  - 1) If the EUT is configured to transmit with D  $\geq$  98 %, then set VBW  $\leq$  RBW / 100
    - (i.e., 10 kHz), but not less than 10 Hz.

2) If the EUT D is < 98%, then set VBW  $\ge$  1 / T, where T is defined in item a1) of 12.2. c) Video bandwidth mode or display mode:

- 1) The instrument shall be set with video filtering applied in the power domain. Typically, this requires setting the detector mode to RMS (power averaging) and setting the average-VBW type to power (rms).
- 2) As an alternative, the instrument may be set to linear detector mode. Video filtering shall be applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear display mode to accomplish this. Others have a setting for average-VBW type, which can be set to "voltage" regardless of the display mode.
- d) Detector = peak.
- e) Sweep time = auto.
- f) Trace mode = max hold.
- g) Allow max hold to run for at least 50 traces if the transmitted signal is continuous or has at least 98% duty cycle. For lower duty cycles, increase the minimum number of traces by a factor of 1/x, where D is the duty cycle. For example, use at least 200 traces if the duty cycle is 25%. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 50 traces should be averaged.)

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### 5.7.3 Test Result

### - Complied

- 1. Conducted Spurious Emissions was shown in figure 3. Note: We took the insertion loss of the cable into consideration within the measuring instrument.
- 2. Measured value of the Field strength of spurious Emissions (Radiated)
- 3. It tested x,y and z 3 axis each, mentioned only worst case data at this report.

### - Below 1 🕀 data (Worst-case: GFSK)

#### Highest Channel (2 480 Mb)

Frequency [Mtz]	Receiver Bandwidth [kltz]	Pol. [V/H]	Reading [dB(µN)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(µN/m)]	Limit [dB(µV/m)]	Margin [dB]		
Quasi-Peak DATA. Emissions below 30 Mz												
				Not d	etected							
Quasi-Peak DATA. Emissions below 1 @												
46.61	120	V	23.10	1.86	-32.06	18.40	-11.80	11.30	40.00	28.70		
82.02	120	Н	22.60	2.37	-32.15	14.28	-15.50	7.10	40.00	32.90		
152.95	120	V	21.80	3.77	-32.03	18.86	-9.40	12.40	43.50	31.10		
299.05	120	Н	21.70	5.20	-32.07	19.27	-7.60	14.10	46.00	31.90		
414.36	120	V	20.40	6.31	-32.11	22.00	-3.80	16.60	46.00	29.40		
662.20	120	V	22.30	8.13	-32.28	26.45	2.30	24.60	46.00	21.40		

NOTE 1. Factor = Cable loss - Amplifier gain + Antenna factor

NOTE 2. Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site.

Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB414788.

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### - Above 1 🕀 data

#### GFSK\_Lowest channel (2 402 Mb)

		- 1									
Frequency	Receiver Bandwidth	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	DCCF	Factor	Result	Limit	Margin
[MHz]	[kHz]	[V/H]	[dB(µV)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB(µV/m)]	[dB(µV/m)]	[dB]
Peak DATA	. Emission	s above	1 GHz								
1 535.89 <sup>1)</sup>	1 000	Н	70.10	2.98	-60.77	25.94	-	-31.85	38.25	74.00	35.75
2 983.36	1 000	V	66.94	4.13	-59.38	29.67	-	-25.58	41.35	74.00	32.65
2 322.14 <sup>1)</sup>	1 000	V	69.26	3.66	-59.08	28.41	-	-27.01	42.25	74.00	31.75
4 803.821,2)	1 000	V	68.23	5.34	-61.69	32.80	-	-23.55	44.68	74.00	29.32
14 666.81	1 000	V	58.87	9.70	-60.78	40.53	-	-10.55	48.32	74.00	25.68
20 208.061)	1 000	Н	48.07	11.50	-48.82	44.30	-	6.98	55.05	74.00	18.95
23 032.471)	1 000	V	46.51	12.40	-49.04	45.10	-	8.46	54.97	74.00	19.03
Average DA	TA. Emiss	ions abo	ove 1 🕮								
1 535.89 <sup>1)</sup>	1 000	Н	54.04	2.98	-60.77	25.94	-	-31.85	22.19	54.00	31.81
2 322.14 <sup>1)</sup>	1 000	V	57.27	3.66	-59.08	28.41	-	-27.01	30.26	54.00	23.74
4 803.821,2)	1 000	V	55.97	5.34	-61.69	32.80		-23.55	32.42	54.00	21.58
20 208.061)	1 000	Н	34.06	11.50	-48.82	44.30	-	6.98	41.04	54.00	12.96
23 032.471)	1 000	V	32.71	12.40	-49.04	45.10	-	8.46	41.17	54.00	12.83
<sup>1)</sup> Restricted	band										

<sup>2)</sup> Harmonic

#### GFSK\_Middle channel (2 441 Mz)

			••••								
Frequency	Receiver Bandwidth	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	DCCF	Factor	Result	Limit	Margin
[MHz]	[kHz]	[V/H]	[dB(µV)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB(µV/m)]	[dB(µV/m)]	[dB]
Peak DATA	. Emission	s above	1 GHz								
1 536.07 <sup>1)</sup>	1 000	V	68.86	2.98	-60.78	25.94	-	-31.86	37.00	74.00	37.00
2 519.61	1 000	V	71.46	3.80	-59.10	28.79	-	-26.51	44.96	74.00	29.04
4 881.991,2)	1 000	V	71.97	5.39	-61.22	32.84	-	-22.99	48.98	74.00	25.02
9 712.34	1 000	Н	62.37	7.82	-62.44	37.84	-	-16.78	45.59	74.00	28.41
20 368.941)	1 000	V	47.17	11.50	-48.83	44.40	-	7.07	54.24	74.00	19.76
25 867.81	1 000	V	41.65	13.60	-46.70	45.60	-	12.50	54.16	74.00	19.84
Average DATA. Emissions above 1 🕮											
1 536.07 <sup>1)</sup>	1 000	V	57.27	2.98	-60.78	25.94	-	-31.86	25.41	54.00	28.59
4 881.991,2)	1 000	V	58.06	5.39	-61.22	32.84	-	-22.99	35.07	54.00	18.93
20 368.941)	1 000	V	34.08	11.50	-48.83	44.40	-	7.07	41.15	54.00	12.85
	1.1										

<sup>1)</sup> Restricted band.

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#### GFSK\_Highest channel (2 480 Mz)

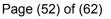
·	ignoot on										
Frequency	Receiver Bandwidth	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	DCCF	Factor	Result	Limit	Margin
[MHz]	[kHz]	[V/H]	[dB(µV)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB(µV/m)]	[dB(µV/m)]	[dB]
Peak DATA	. Emission	s above	1 GHz								
2 401.72	1 000	V	69.99	3.71	-59.24	28.56	-	-26.97	43.02	74.00	30.98
2 560.78	1 000	V	71.01	3.83	-59.13	28.87	-	-26.43	44.58	74.00	29.42
2 489.59 <sup>1)</sup>	1 000	V	80.39	3.77	-59.10	28.73	-	-26.60	53.79	74.00	20.21
4 959.921,2)	1 000	Н	71.22	5.44	-60.80	32.88	-	-22.48	48.74	74.00	25.26
10 389.77	1 000	V	61.65	8.11	-62.55	38.02	-	-16.42	45.23	74.00	28.77
19 025.78 <sup>1)</sup>	1 000	V	47.52	11.10	-48.30	43.40	-	6.20	53.72	74.00	20.28
22 876.39 <sup>1)</sup>	1 000	V	46.57	12.40	-49.17	45.10	-	8.33	54.90	74.00	19.10
Average DA	TA. Emiss	ions abo	ove 1 🕮								
2 489.59 <sup>1)</sup>	1 000	V	58.28	3.77	-59.10	28.73	-	-26.60	31.68	54.00	22.32
4 959.921,2)	1 000	Н	58.00	5.44	-60.80	32.88	-	-22.48	35.52	54.00	18.48
19 025.78 <sup>1)</sup>	1 000	V	33.81	11.10	-48.30	43.40	-	6.20	40.01	54.00	13.99
22 876.39 <sup>1)</sup>	1 000	V	32.70	12.40	-49.17	45.10		8.33	41.03	54.00	12.97
1) Postrictor	dhand										

<sup>1)</sup> Restricted band.

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#### 8DPSK\_Lowest channel (2 402 Mb)

				,									
Frequency	Receiver Bandwidth	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	DCCF	Factor	Result	Limit	Margin		
[MHz]	[kHz]	[V/H]	[dB(µV)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB(µV/m)]	[dB(µV/m)]	[dB]		
Peak DATA	Peak DATA. Emissions above 1 🕮												
1 232.21 <sup>1)</sup>	1 000	V	69.32	2.69	-60.77	24.75	-	-33.33	36.00	74.00	38.00		
2 977.42	1 000	Н	67.33	4.12	-59.37	29.66	-	-25.59	41.73	74.00	32.27		
2 324.48 <sup>1)</sup>	1 000	Н	74.13	3.66	-59.09	28.42	-	-27.01	47.12	74.00	26.88		
4 803.76 <sup>1,2)</sup>	1 000	V	64.90	5.34	-61.69	32.80	-	-23.55	41.35	74.00	32.65		
14 932.34	1 000	V	57.92	9.74	-60.07	40.35	-	-9.98	47.95	74.00	26.05		
20 541.421)	1 000	V	47.20	11.60	-48.92	44.50	-	7.18	54.38	74.00	19.62		
25 904.20	1 000	Н	42.16	13.60	-46.71	45.70	-	12.59	54.75	74.00	19.25		
Average DA	TA. Emiss	ions abo	ove 1 GHz										
1 232.21 <sup>1)</sup>	1 000	V	55.97	2.69	-60.77	24.75	-	-33.33	22.64	54.00	31.36		
2 324.48 <sup>1)</sup>	1 000	Н	54.22	3.66	-59.09	28.42	-	-27.01	27.21	54.00	26.79		
4 803.76 <sup>1,2)</sup>	1 000	V	55.25	5.34	-61.69	32.80	-	-23.55	31.70	54.00	22.30		
20 541.421)	1 000	V	33.52	11.60	-48.92	44.50		7.18	40.70	54.00	13.30		
<sup>1)</sup> Restricted	d band												

<sup>1)</sup> Restricted band.

<sup>2)</sup> Harmonic

### 8DPSK \_Middle channel (2 441 Mz)

				4				_			
Frequency	Receiver Bandwidth	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	DCCF	Factor	Result	Limit	Margin
[MHz]	[kHz]	[V/H]	[dB(µV)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB(µV/m)]	dB(µV/m)]	[dB]
Peak DATA	. Emission	s above	1 GHz								
1 695.74 <sup>1)</sup>	1 000	V	69.17	3.13	-60.19	26.58	-	-30.48	38.69	74.00	35.31
2 519.30	1 000	V	71.30	3.80	-59.10	28.79	-	-26.51	44.79	74.00	29.21
4 882.001,2)	1 000	V	71.98	5.39	-61.23	32.84	-	-23.00	48.98	74.00	25.02
10 897.59 <sup>1)</sup>	1 000	V	62.63	8.37	-62.54	38.17	-	-16.00	46.63	74.00	27.37
19 926.53 <sup>1)</sup>	1 000	V	47.83	11.40	-48.68	44.10	-	6.82	54.65	74.00	19.35
23 787.851)	1 000	V	45.73	12.70	-48.78	45.10	-	9.02	54.75	74.00	19.25
Average DA	TA. Emiss	ions abo	ove 1 🕮								
1 695.74 <sup>1)</sup>	1 000	V	55.41	3.13	-60.19	26.58	-	-30.48	24.93	54.00	29.07
4 882.001,2)	1 000	V	57.49	5.39	-61.23	32.84	-	-23.00	34.49	54.00	19.51
10 897.59 <sup>1)</sup>	1 000	V	48.57	8.37	-62.54	38.17	-	-16.00	32.57	54.00	21.43
19 926.53 <sup>1)</sup>	1 000	V	34.18	11.40	-48.68	44.10	-	6.82	41.00	54.00	13.00
23 787.851)	1 000	V	31.92	12.70	-48.78	45.10	-	9.02	40.94	54.00	13.06
<sup>1)</sup> Restricted	hand										

<sup>1)</sup> Restricted band.

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#### 8DPSK\_Highest channel (2 480 1社)

			(	/							
Frequency	Receiver Bandwidth	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	DCCF	Factor	Result	Limit	Margin
[MHz]	[kHz]	[V/H]	[dB(µV)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB(µV/m)]	[dB(µV/m)]	[dB]
Peak DATA. Emissions above 1 础											
2 401.25	1 000	V	70.04	3.71	-59.25	28.56	-	-26.98	43.07	74.00	30.93
2 557.89	1 000	V	70.98	3.82	-59.12	28.86	-	-26.44	44.55	74.00	29.45
2 489.63 <sup>1)</sup>	1 000	V	84.05	3.77	-59.11	28.73	-	-26.61	57.44	74.00	16.56
4 959.97 <sup>1,2)</sup>	1 000	V	71.06	5.44	-60.80	32.88	-	-22.48	48.58	74.00	25.42
14 680.41	1 000	V	59.19	9.70	-60.74	40.52	-	-10.52	48.67	74.00	25.33
19 669.20 <sup>1)</sup>	1 000	V	47.44	11.30	-48.56	43.90	-	6.64	54.08	74.00	19.92
24 673.56	1 000	V	44.14	12.80	-47.85	45.10	-	10.05	54.19	74.00	19.81
Average DATA. Emissions above 1 强											
0 400 601)	1 000	11	E0 E4	0 77	EO 11	00 70	1	00.04	24 00	E4 00	00 40

2 489.63 <sup>1)</sup>	1 000	V	58.51	3.77	-59.11	28.73	-	-26.61	31.90	54.00	22.10
4 959.97 <sup>1,2)</sup>	1 000	V	58.60	5.44	-60.80	32.88	-	-22.48	36.12	54.00	17.88
19 669.20 <sup>1)</sup>	1 000	V	34.43	11.30	-48.56	43.90	-	6.64	41.07	54.00	12.93

<sup>1)</sup> Restricted band.

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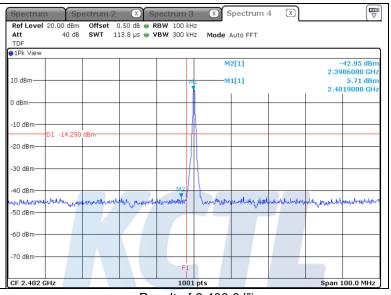


### 5.7.4 Test Plot

Figure 5. Plot of the Band Edge (Conducted)

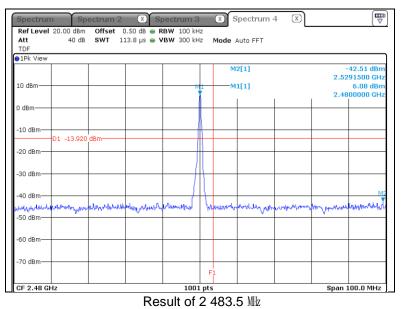
### - GFSK (Without hopping)

Lowest Channel (2 402 Mtz)



- Result of 2 400.0 Mb

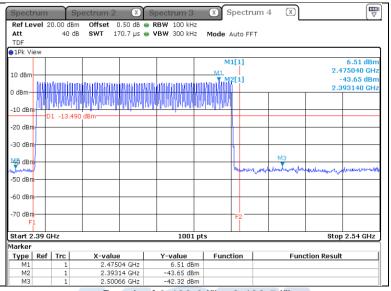
Highest Channel (2 480 Mz)



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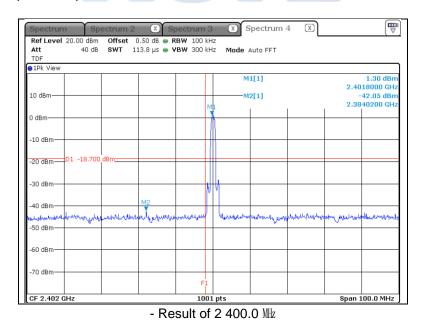
### - GFSK (With hopping)



- Result of 2 400.0 Mz - 2 483.5 Mz

### - 8DPSK (Without hopping)

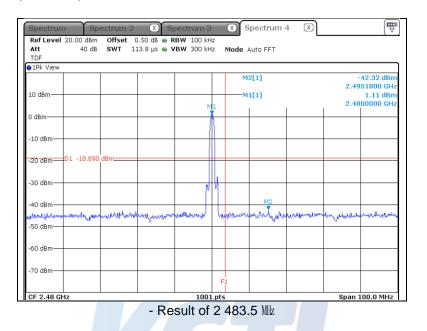
Lowest Channel (2 402 Mz)



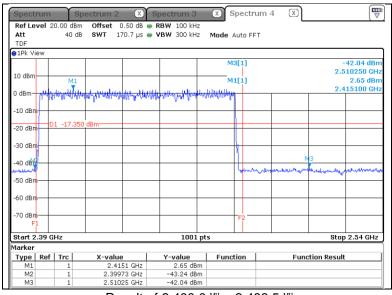
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#### Highest Channel (2 480 Mz)



### - 8DPSK (With hopping)



- Result of 2 400.0 MHz - 2 483.5 MHz

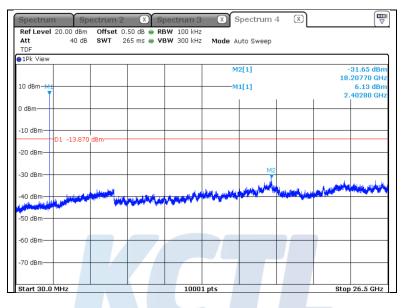
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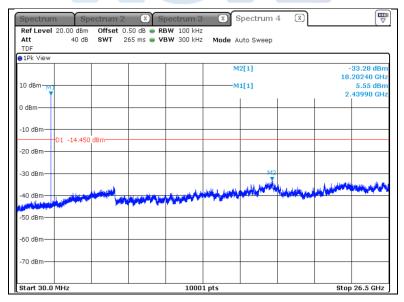
Figure 6. Plot of the Spurious RF conducted emissions

### - GFSK

Lowest Channel (2 402 Mtz)



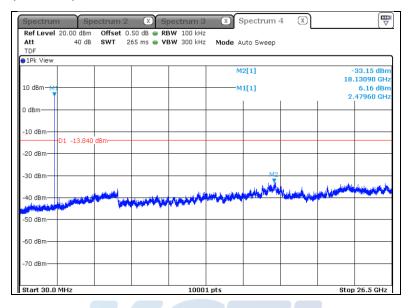
Middle Channel (2 441 Mz)



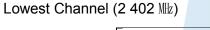
65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-31-285-0894 FAX: 82-505-299-8311 www.kctl.co.kr Report No.: KR18-SRF0111 Page (58) of (62)

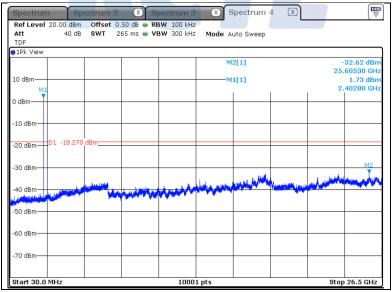


#### Highest Channel (2 480 Mz)



#### - 8DPSK

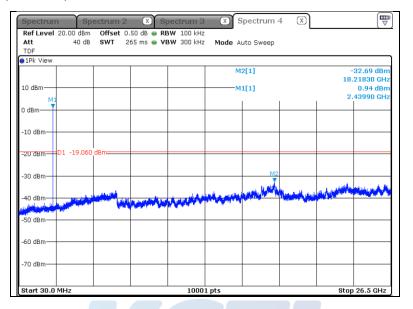




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#### Middle Channel (2 441 Mz)



Highest Channel (2 480 Mbz)

	40 dB <b>SWT</b>	265 ms 👄 VBV		de Auto Sweep			
1Pk View							
				M2[1]			32.22 dBn 20770 GH
10 dBm				-M1[1]			0.86 dBn
MI				I.		2.	47960 GH:
0 dBm							
-10 dBm							
10 ubiii							
-20 dBm D1	-19.140 dBm===						
-30 dBm				M2			
				Market Million and and and and and and and and and an	LE LAND LA	and the second second	And Ar
		لي حذب المراجع المراجع المراجع	AND A REAL OF		and the second		
-40 dBm							
المال المصالي المسالي							
-50 dBm							
المال المصالي المسالي							



### 5.8 Conducted Emission

### 5.8.1 Regulation

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 50  $\mu$ H/50  $\Omega$  line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of amignion (NW)	Conducted I	imit (dBµV)
Frequency of emission (Mb)	Quasi-peak	Average
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 – 30	60	50

\* Decreases with the logarithm of the frequency.

According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

### 5.8.2 Measurement Procedure

### d

- 1) The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
- Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω/50µH LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.
- 3) Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
- 4) The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 № to 30 №.
- 5) The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 klz or to QUASI-PEAK and AVERAGE within a bandwidth of 9 klz. The EUT was in transmitting mode during the measurements.

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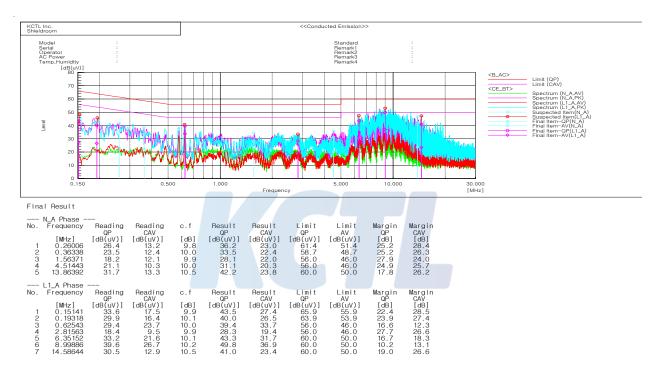


### 5.8.3 Test Result

- Complied

Figure 6. plot of Conducted Emission

- Conducted Worst Case : GFSK\_Highest channel (2 480 Mz)



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### 6. Test equipment used for test

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
Spectrum Analyzer	R & S	FSV40	100988	19.01.05
Wideband Power Sensor	R & S	NRP-Z81	102398	19.01.31
Bluetooth Tester	TESCOM	TC-3000C	3000C000270	19.08.02
ATTENUATOR	R & S	DNF Dämpfungsglied 10 dB in N-50 Ohm	0003	19.01.31
Power Divider	Aeroflex /Weinschel, Inc.	1580-1	RZ184	19.08.02
EMI TEST RECEIVER	R & S	ESCI	100732	19.08.23
Bilog Antenna	SCHWARZBECK	VULB 9168	583	20.04.13
COAXIAL FIXED ATTENUATOR	AGILENT	8491B-003	2708A18758	20.05.04
Amplifier	SONOMA INSTRUMENT	310N	186280	19.04.05
ATTENUATOR	Weinschel ENGINEERING	1	AE7348	19.05.14
Horn antenna	ETS.lindgren	3116	00086632	19.04.20
Horn antenna	ETS.lindgren	3117	155787	18.10.20
AMPLIFIER	L-3 Narda-MITEQ	AMF-7D-01001800- 22-10P	2003683	19.05.15
AMPLIFIER	L-3 Narda-MITEQ	JS44-18004000-33- 8P	2000997	19.08.02
LOOP Antenna	R & S	HFH2-Z2	100355	20.01.31
Antenna Mast	Innco Systems	MA4640-XP-ET	-	-
Turn Table	Innco Systems	DT2000	79	-
Antenna Mast	Innco Systems	MA4000-EP	303	-
Turn Table	Innco Systems	DT2000	79	-
Highpass Filter	WT	WT-A1698-HS	WT160411001	19.05.14
Vector Signal Generator	R & S	SMBV100A	257566	19.01.05
Signal Generator	R&S	SMR40	100007	19.05.15
Cable Assembly	RadiAll	2301762000PJ	1724.66	-
Cable Assembly	gigalane	RG-400	-	-
Cable Assembly	HUER+SUHNER	SUCOFLEX 104	MY4342/4	-
TWO-LINE V-NETWORK	R&S	ENV216	101352	19.05.24