

# **TEST REPORT**

<b>KCTL Inc.</b> 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-31-285-0894 FAX: 82-505-299-8311 <u>www.kctl.co.kr</u>		Report No.: KR18-SRF0045 Page (1) of (72)	KCTL	
1. Client				
∘ Name	: Hyundai Mobis Co	., Ltd.		
<ul> <li>Address</li> </ul>	: 203, Teheran-ro, C	Gangnam-gu, Seoul,	South Korea, 135-977	
<ul> <li>Date of Receiption</li> </ul>	ot : 2018-03-15			
2. Use of Report	:-			
3. Name of Produc	t and Model : DISP	LAY CAR SYSTEM /	ADBC0DQEE	
<ul> <li>4. Manufacturer and</li> <li>5. FCC ID</li> <li>6. Date of Test</li> <li>7. Test Standards</li> <li>8. Test Results</li> </ul>	: 2018-03-28 to 201 : FCC Part 15 Subp	ADBC0DQEE 8-03-30		
Affirmation Name	: Euijung Kim (Signatur	Technical Manag re) Name : Jongha (	Oan	
	KCTL	Inc	2018-04-04	
	KUIL	. mc.		
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### **REPORT REVISION HISTORY**

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

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# [Contents]

1. Client information	
2. Laboratory information	
3. Description of E.U.T	6
3.1 Basic description	6
3.2 General description	6
3.3 Test frequency	7
3.4 Test Voltage	7
4. Summary of test results	8
4.1 Standards & results	8
4.2 Uncertainty	
5. Test results	9
5.1 Antenna Requirement	9
5.2 Maximum Peak Output Power	
5.3 Carrier Frequency Separation	
5.4 20 dB Channel Bandwidth	
5.5 Number of Hopping Channels	33
5.6 Time of Occupancy(Dwell Time)	38
5.7 Spurious Emission, Band edge and Restricted bands	
6. Test equipment used for test	72

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# 1. Client information

Applicant:	Hyundai Mobis Co., Ltd.
Address:	203, Teheran-ro, Gangnam-gu, Seoul, South Korea, 135-977
Telephone number:	+82 31 260 0098
Facsimile number:	+82 31 899 1788
Contact person:	Seunghoon Choe / csh@mobis.co.kr

Manufacturer:	Hyundai Mobis Co., Ltd.	
Address:	95, Sayang 2-Gil, Munbaek-Myeon, Jincheon-Gun,	
	Chungcheongbuk-Do 27862 Korea	



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# 2. Laboratory information

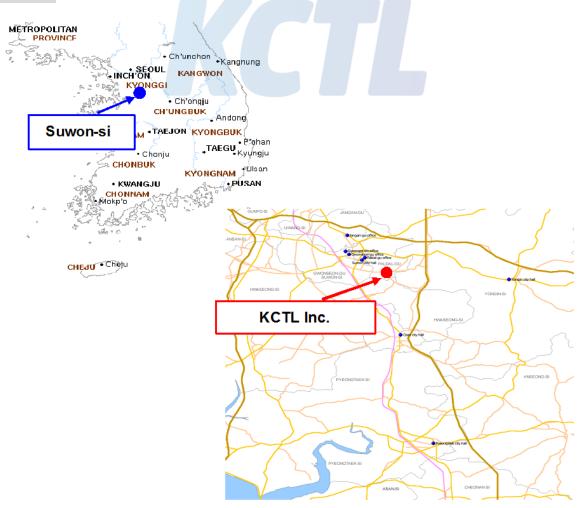
### <u>Address</u>

### KCTL Inc.

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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	Hyundai Mobis Co., Ltd.
Address of Applicant	203, Teheran-ro, Gangnam-gu, Seoul, South Korea, 135-977
Manufacturer	Hyundai Mobis Co., Ltd.
Address of Manufacturer	95, Sayang 2-Gil, Munbaek-Myeon, Jincheon-Gun, Chungcheongbuk-Do 27862 Korea
Type of equipment	DISPLAY CAR SYSTEM
Basic Model	ADBC0DQEE
Variant Model <sup>1)</sup>	ADB10DQEG, ADB10DQEE, ADB11DQEE
Serial number	N/A

<sup>1)</sup> Variant model names are different only for sofeware.

### 3.2 General description

Frequency Range	2 402 MHz ~ 2 480 MHz		
Type of Modulation	GFSK, π/4DQPSK, 8DPSK		
The number of channels	79 channel		
Type of Antenna	Chip Antenna		
Antenna Gain	-0.1 dBi		
Transmit Power	<b>5.54</b> dBm		
Power supply	DC 14.40 V		
Product SW/HW version	DEEV.EUR.0000.V094.180119.DAU_A		
Radio SW/HW version	DEEV.EUR.0000.V094.180119.DAU_A		
Test SW Version	Bluetooth Tester v1.40		
RF power setting in TEST SW	ower 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 Młz
Middle frequency	<b>2 441</b> Młz
Highest frequency	2 480 MHz

### 3.4 Test Voltage

Mode	Voltage	
Nominal Voltage	DC 14.40 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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Page (8) of (72)



# 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		NA (Note <sub>2</sub> )	
Note <sub>1):</sub> C = Complies, NC = Not Complies, NT = Not Tested, NA = Not Applicable Note <sub>2):</sub> This test is not applicable because the EUT falls into the automotive device and it's not to be connected to the public utility(AC) power line.				

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

# 4.2 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 MHz ~ 300 MHz:	<b>+4.94</b> dB, <b>-5.06</b> dB	
		<b>+4.93</b> dB, <b>-5.05</b> dB	
Radiated Spurious Emissions	300 Mz ~ 1 000 Mz:	<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 Chip 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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Report No.: KR18-SRF0045 Page (12) of (72)



## 5.2.3 Test Result

### - Complied

#### - GFSK

Channel	Frequency [Mt/2]	Result [dBm]	Limit [dBm]	Margin [dB]	Average Power [dBm]
Lowest	2 402	4.43	20.97	16.54	2.51
Middle	2 441	3.43	20.97	17.54	1.46
Highest	2 480	3.73	20.97	17.24	1.88

#### - π/4DQPSK

Channel	Frequency [ᢂᡌ]	Result [dBm]	Limit [dBm]	Margin [dB]	Average Power [dBm]
Lowest	2 402	5.14	20.97	15.83	1.02
Middle	2 441	4.23	20.97	16.74	0.04
Highest	2 480	4.63	20.97	16.34	0.38
- 8DPSK					

#### - 8DPSK

Channel	Frequency [ᢂᡌ]	Result [dBm]	Limit [dBm]	Margin [dB]	Average Power [dBm]
Lowest	2 402	5.54	20.97	15.43	1.03
Middle	2 441	4.83	20.97	16.14	0.06
Highest	2 480	5.14	20.97	15.83	0.38

#### NOTE:

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

2. It was measured by power sensor.



## 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	Frequency [Mtz]	Carrier frequency separation [Mtz]	Limit
Lowest	2 402	1.001	≥25 kl or two-thirds of the 20 dB bandwidth
Middle	2 441	1.001	≥25 ຟ₂ or two-thirds of the 20 dB bandwidth
Highest	2 480	1.001	≥25 ຟ₂ or two-thirds of the 20 dB bandwidth

#### - $\pi/4DQPSK$

Channel	Frequency [Mtz]	Carrier frequency separation [Mb]	Limit
Lowest	2 402	1.001	≥25 ຟ₂ or two-thirds of the 20 dB bandwidth
Middle	2 441	1.001	≥25 ຟ₂ or two-thirds of the 20 dB bandwidth
Highest	2 480	1.001	≥25 ຟ₂ or two-thirds of the 20 dB bandwidth

#### - 8DPSK

Channel	Frequency [Mtz]	Carrier frequency separation [Mtz]	Limit
Lowest	2 402	1.001	≥25 kll₂ or two-thirds of
LOWESI	2 402	1.001	the 20 dB bandwidth
Middle	2 441	1.001	≥25 kll₂ or two-thirds of
IVIIGUIE	2 44 1	1.001	the 20 dB bandwidth
Highest	2 480	1.001	≥25 kl or two-thirds of
riignest	2 400	1.001	the 20 dB bandwidth

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

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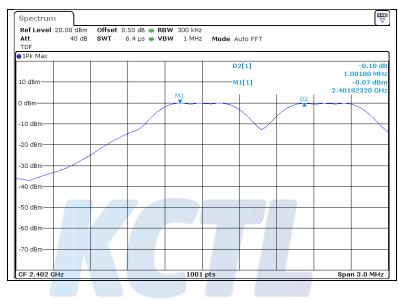


### 5.3.4 Test Plot

Figure 1. Plot of the Carrier Frequency Separation

### - GFSK

Lowest Channel (2 402 Mz)



### Middle Channel (2 441 Mb)

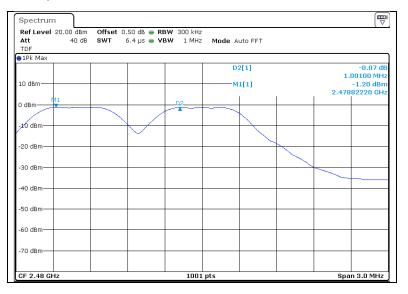
0 dBm		
10 dBmM1[1]		
0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm		0.09 d 1.00100 MH -0.73 dBr 114090 GH
-30 dBm	D2	1
-40 dBm		
-50 dBm		
-60 dBm		+
-70 dBm		+

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Page (16) of (72)

#### Highest Channel (2 480 Mz)



#### - π/4DQPSK

Lowest Channel (2 402 Mz)

Spectrum	1							[
	20.00 dBm			BW 300 kHz				
Att TDF	40 dB	SWT	6.4 µs 👄 V	BW 1 MHz	Mode A	uto FFT		
101 101 Max								
-					D	2[1]		-0.10
								1.00100 Mi
10 dBm					M	1[1]		0.01 dB 2.40182320 GF
				M1		1	D2	2.40102320 G
0 dBm			-					
		/						
-10 dBm								
-20 dBm		/						
-30 dBm								
-40 dBm								
-50 dBm								
-60 dBm								
-70 dBm								
CF 2.402 C			1	1001	nte	1		Span 3.0 MH

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Page (17) of (72)

#### Middle Channel (2 441 Mz)

Ref Level 20.00 Att TDF	40 dB SWT	0.50 dB <b>● RBW</b> 300 k 6.4 µs <b>● VBW</b> 1 M		
1Pk Max			D2[1]	0.12 dE
			02[1]	1.00100 MH
10 dBm			M1[1]	-0.65 dBn
			M1	2.44114090 GH: D2
) dBm				
10 dBm				
20 dBm				
30 dBm				
40 dBm				
40 dbill				
-50 dBm				
60 dBm				
70 dBm				
/u asm				

### Highest Channel (2 480 Mz)

Spectrum Ref Level		Offset	1.50 dB 👄 E	RBW 300 kHz	_		-		T T
Att	40 dB	SWT		VBW 1 MHz	Mode Au	ito FFT			
TDF									
1Pk Max									-0.09 c
					D2	[1]		1	-0.09 c 00100 MF
10 dBm					M1	[1]			-1.11 dB
								2.478	82820 GF
0 dBm	1			<u>n2</u>					
		$\sim$							
-10 dBm							<u> </u>		
-20 dBm							$\rightarrow$		
								Į	
-30 dBm									
-40 dBm									
-50 dBm									
-60 dBm									
-70 dBm									

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### - 8DPSK

Lowest Channel (2 402 Mtz)

	20.00 dBm 40 dB	0.50 dB 👄 R 6.4 µs 👄 V		Mode Auto FFT		
∋1Pk Max						
				D2[1]		-0.13 d 1.00100 MH
10 dBm				M1[1]		0.02 dBr
						2.40182620 GH
0 dBm			M1		D2	
-10 dBm-						
-20 dBm						
-30 dBm						
-40 dBm					+	
-50 dBm						
-60 dBm						
-70 dBm		 -			1	

### Middle Channel (2 441 Mz)

Ref Level 20.00	dBm Offset	0.50 dB 👄 F	RBW 300 kHz				
Att	40 dB <b>SWT</b>	6.4 µs 👄 <b>\</b>	BW 1 MHz	Mode Au	to FFT		
●1Pk Max							
				D2	[1]		0.16
10 dBm				M1	m		00100 M -0.67 dE
						2.441	14090 G
0 dBm				M1		 D2	
			T	1	~		
-10 dBm							
-20 dBm							
-30 dBm							
-30 08/11							
-40 dBm							
-50 dBm							
-60 dBm							
-70 dBm							

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Page (19) of (72)

#### Highest Channel (2 480 Mz)

Att TDF	0.00 dBm 40 dB	SWT	6.4 µs 🖷 🕻	BW 300 kHz BW 1 MHz	Mode Auto	FFT			
1Pk Max					D2[1 M1[:				-0.08 df .00100 MH: -1.11 dBn 383120 GH:
D dBm				N2				2.470	
-10 dBm						$\rightarrow$			
-20 dBm							$\nearrow$		
-30 dBm									
-40 dBm									
60 dBm									
-70 dBm									





# 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) [₩₺]
	Lowest	2 402	1.040	0.908
GFSK	Middle	2 441	1.043	0.911
	Highest	2 480	1.040	0.914
	Lowest	2 402	1.283	1.151
π/4DQPSK	Middle	2 441	1.283	1.154
	Highest	2 480	1.283	1.154
	Lowest	2 402	1.286	1.154
8DPSK	Middle	2 441	1.286	1.151
	Highest	2 480	1.286	1.154

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



### 5.4.4 Test Plot

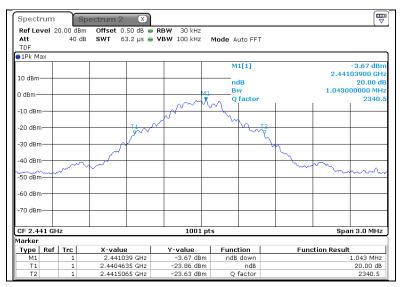
Figure 2. Plot of the 20 dB Channel Bandwidth & Occupied Bandwidth (Conducted)

#### - GFSK\_20 dB Channel Bandwidth

Lowest Channel (2 402 Mtz)



Middle Channel (2 441 Mz)

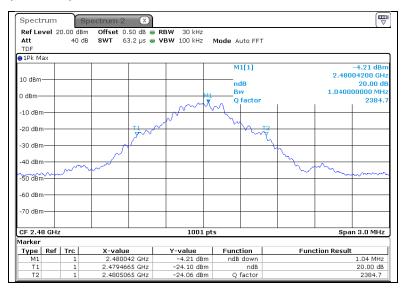


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Page (24) of (72)

#### Highest Channel (2 480 Mz)



#### - π/4DQPSK\_20 dB Channel Bandwidth

#### Lowest Channel (2 402 Mz)

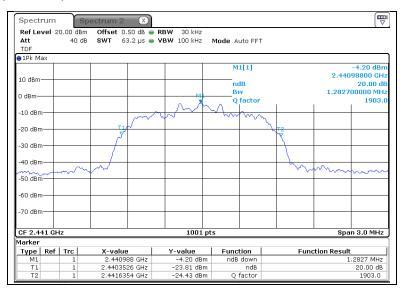


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Page (25) of (72)

#### Middle Channel (2 441 Mz)



#### Highest Channel (2 480 Mz)

Spectrum	i Si	pectrum 2 🛛 🗴	)			Ē
Ref Level Att TDF	20.00 dBn 40 dB			Mode Auto FFT		
∋1Pk Max						
10 dBm				M1[1]		-4.74 dBn 2.47998800 GH 20.00 dl
0 dBm				Bw Q factor		1.282700000 MH 1933.
-10 dBm				how		
-20 dBm		J.			- <del>\ 1</del> 2	
-30 dBm						
-40 dBm	m				~~~	m
-60 dBm						
-70 dBm						
CF 2.48 GH	z		1001 pt	s		Span 3.0 MHz
Marker						
Type Ret M1	f Trc	2.479988 GHz	Y-value -4.74 dBm	Function ndB down	Fund	tion Result 1.2827 MHz
T1	1	2.479988 GHZ 2.4793526 GHz	-4.74 dBm	ndB down ndB		20.00 dB
T2	1	2.4806354 GHz	-24.88 dBm	Q factor		1933.4

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

Lowest Channel (2 402 Mz)



#### Middle Channel (2 441 Mtz)

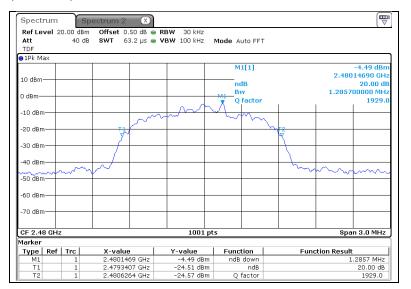


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Page (27) of (72)

#### Highest Channel (2 480 Mz)





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#### - GFSK\_Occupied Bandwidth

Lowest Channel (2 402 Mtz)



#### Middle Channel (2 441 Mz)

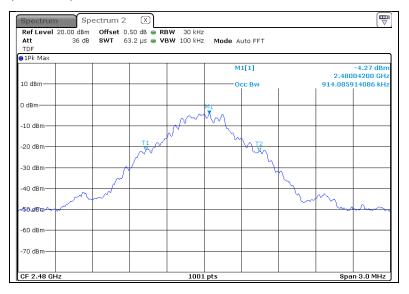


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Page (29) of (72)

#### Highest Channel (2 480 Mz)



### -π/4DQPSK\_Occupied Bandwidth

Lowest Channel (2 402 Mz)



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Page (30) of (72)

#### Middle Channel (2 441 Mz)



### Highest Channel (2 480 Mz)

Spectrum	Spe	ctrum 2	×						l ∎ ∀
Ref Level 20.1 Att			50 dB 🗕 RE 8.2 µs 🖷 VI	3W 30 kHz 3W 100 kHz	Mode A	uto FFT			
TDF									
●1Pk Max									-4.80 dBn
					IVI	1[1]			-4.80 aBn 98500 GH:
10 dBm					0	cc Bw			46154 MH
0 dBm				M					
					- ^				
-10 dBm					<u> </u>	~			
		т	1 mm	rv I	ĥw				
-20 dBm			z/			Y			
		1					5		
-30 dBm							1		
-40 dBm									
	$\Delta $	$\sim$					$\sim$		
~50 dBm ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	<u>v</u> 4								mon
-60 dBm									
-70 dBm									
CF 2.48 GHz				1001	pts			Spa	n 3.0 MHz

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#### - 8DPSK\_Occupied Bandwidth

Lowest Channel (2 402 Mtz)



#### Middle Channel (2 441 Mtz)



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Page (32) of (72)

#### Highest Channel (2 480 Mz)







# 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
π/4DQPSK	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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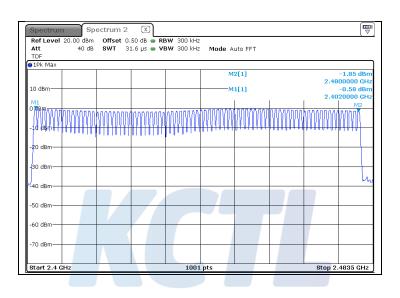


### 5.5.4 Test Plot

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

### Non-AFH Mode

### - GFSK



### - π/4DQPSK

Spectrum		ectrum 2		BW 300 kHz					
Att	0.00 dBm 40 dB			(BW 300 kHz /BW 300 kHz		the FET			
TDF	40 UB	3111	51.0 µs 🖷 ۱	<b>10 W</b> 300 KH2	MOUE A	ulo FFT			
1Pk Max									
					M	2[1]			-1.90 dBm
								2.48	00000 GH2
10 dBm				-	M	1[1]			-0.44 dBm
M1							1	2.40	20000 GH2
	NANA				SABAMAD.	a a na		M habd da	M2
100000000	NOTION OF A	140400	NAAAAAA	www.		0	wwwwww	νγνααννα	υγνγη
LO dBm				-					
20 dBm									
20 0.0									
30 dBm									
30 UBIII									
-40 dBm									64
-40 asm									
-50 dBm									
-60 dBm									
-70 dBm									
/0 00111									

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Page (36) of (72)

### - 8DPSK

Att TDF	40 dB	SWT 3	1.6 µs 🖶 Vi	3W 300 kHz	Mode A	uto FFT						
1Pk Max						2[1] 1[1]	-2.39 dBm 2.4800000 GHz -1.38 dBm 2.4020000 GHz					
WWW	www.	งงงงกงงง	www	ATAAAAA	www	www	MMMM	MMM	M2 MMX			
10 dBm												
20 dBm												
30 dBm												
40 dBm									hhr			
-50 dBm												
-60 dBm												
-70 dBm												

### AFH Mode

#### - GFSK

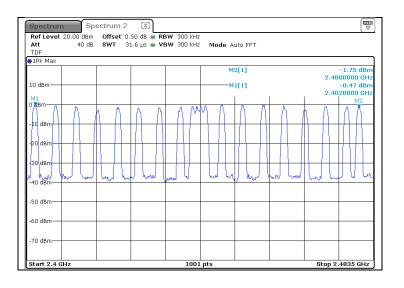
Ref Level	20.00	dBm	Offs	et 0.	50 d	dB 🥃	RB	W 3	00	kHz														
Att	4	40 dB	SWT	3	1.6	us 😑	VE	<b>W</b> 3	00	kHz		Mo	de A	uto	FFT									
TDF 1Pk Max																								
													M	2[:	u							-1	.74	dBn
																					2.4			GH
10 dBm													M	1[:	u –									dBn ) GH:
M1														1			1		T		2.4	120		1 GH2 12
Bm	n		۸	n	n		n		1	nn.	n		n –	h	1	Δ		n	h		ñ	+	n	X
1. 1	- <u>(</u>		1	n –	Π		N		1	m	n		n –			II.		η –			11 -			
-10 dBm				H.			Π			11	Ħ					tt					H-	+	+	
11. 11							Ш	- 1								Ц		1			Π.			
-20 dBm														H		H		-	#		r	+		
11[]					11				Н					Н		Ιì		1				П	Тſ	
30 dBm									11			Π		П					1			Ħ	Ħ	
40 d8m-	m	word	Inn	In	IJ.	w	_ (	Just .	Ų			W	- h.	II.	- hund		and	hom	4	had	5	1	μ	Im
-40 dBm								,	-			-		Y					+			T		
-50 dBm																						1		
-60 dBm																								
-ou u8m																								
70 d0m																								
-70 dBm																						1		

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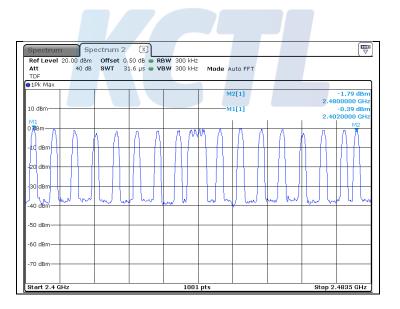


Page (37) of (72)

### - π/4DQPSK



### - 8DPSK





### 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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Report No.: KR18-SRF0045 Page (40) of (72)



### 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	0.382	800.000	79	0.122	0.400
DH3	2 441	1.640	400.000	79	0.262	0.400
DH5	2 441	2.888	266.667	79	0.308	0.400
2-DH1	2 441	0.389	800.000	79	0.124	0.400
2-DH3	2 441	1.644	400.000	79	0.263	0.400
2-DH5	2 441	2.891	266.667	79	0.308	0.400
3-DH1	2 441	0.389	800.000	79	0.124	0.400
3-DH3	2 441	1.641	400.000	79	0.263	0.400
3-DH5	2 441	2.893	266.667	79	0.309	0.400
AFH						

### - AFH

Modulation	Frequency [ᢂᡌ]	Reading [ms]	Hopping rate [hop/s]	Number of Channels	Result [s]	Limit [s]
DH1	2 441	0.382	400.000	20	0.061	0.400
DH3	2 441	1.640	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	2.893	133.333	20	0.154	0.400
3-DH1	2 441	0.389	400.000	20	0.062	0.400
3-DH3	2 441	1.639	200.000	20	0.131	0.400
3-DH5	2 441	2.893	133.333	20	0.154	0.400

#### NOTE 1. Non AFH

Result = Number of Transmission in 31.6s x Length of Trnasmission Test period = 0.4 [seconds / channel] × 79 [channel] = 31.6 [seconds]

#### NOTE 2. AFH

Result = Number of Transmission in 8s x Length of Trnasmission 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)

Att         40 db • SWT         500 µs • VBW 1 MHz           TRG:VID TDF         10 dbm         D2[1]           10 dBm         M1[1]         0 dBm           -10 dBm         TRG -10.000 dBm	
1Pk Max       D2[1]         10 dBm       M1[1]         0 dBm       FI1         -10 dBm       TRG         -20 dBm       -20 dBm         -90 dBm       -40 dBm         -50 dBm       -50 dBm	
10 dBm M1[1] 0 dBm TRG -10.000 dBm	-
0 dBm 11 -10 dBm TRG -10.000 dBm	0.04 (
11 0 dBm 11 0 dBm 10	382.000
D dBm TRG -10.000 dBm	-0.71 dB 500
-10 dBm TRG -10.000 dBm	D2
-20 dBm	
-50 dBm	 
-50 dBm	
-40 dBm	 
-40 dBm	
-50 dBm	 Harriber
-50 dBm	
-60 dBm	
-ou asm	
-70 dBm	
CF 2.441 GHz 1001 pts	50.0 μs

DH3 (2 441 Mz)

Spectrum Spectrum 2 X Ref Level 20.00 dBm Offset 0.50 dB	RBW 1 MHz	
Att 40 dB 👄 SWT 1.9 ms	VBW 1 MHz	
TRG:VID TDF 1Pk Max		
	D2[1]	-0.05 d
	52(2)	1.63980 m
10 dBm	M1[1]	-0.61 dBi
M1		-1.40 µ
D dBra		D2
-10 dBm TRG -10.000 dBm		
-20 dBm		
-30.48m		wydy digter
-40 dBm		
-50 dBm		
-60 dBm		
-70 dBm		
CF 2.441 GHz	1001 pts	190.0 µs/

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Page (42) of (72)

DH5 (2 441 Mz)

Ref Level 20.0 Att		0.50 dB   RBW 1 MHz 3.4 ms  VBW 1 MHz		
TRG: VID TDF	40 UB 🖶 SWI	3.4 ms 🖶 VBW 1 MH2		
1Pk Max				
			D2[1]	-0.20 di
10 dBm			201513	2.88760 m -0.57 dBn
			M1[1]	-0.57 dBn 550 n
M1 0 dBm				D2
D UBIII Commence				•
-10 dBm TRG	-10.000 dBm			
	-10.000 dBm			
-20 dBm				
-20 ub II				
00.40				
-30 049 m				Managerough
-40 dBm				
-40 uBIII				
-50 dBm				
-50 dBm				
60 d0m				
-60 dBm				
-70 dBm				

### - π/4DQPSK\_Non AFH mode

2-DH1 (2 441 Mz)

Ref Level Att		Offset SWT		RBW 1 MHz VBW 1 MHz					
ALL TRG: VID TE		Swi	500 µs 🖷	VBW IMHZ					
1Pk Max									
					D	2[1]			-0.39
									888.500
10 dBm					M	1[1]			-1.60 dE 500
	M1						l	I I	
0 dBm				Landreak	Minimuliane	dial-an	Ummenun	umun	2
				An blick of	00010 000 ····				
-10 dBm	_								
-20 dBm	TRG -21.00	0 dBm							
									Ļ
-3Q~d8m <del>Jun</del>	+390								hardy
-40 dBm									
-50 dBm									
-60 dBm									
-70 dBm									
CF 2.441 G		1	1	1001			I		50.0 µ:

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Page (43) of (72)

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

Att		SWT	1.9 ms 👄 V	BW 1 MHz					
TRG: VID TD 1Pk Max	F								
					D	2[1]			-0.70 di
									.64440 m
10 dBm					M	1[1]			-1.46 dBn -1.40 μ
o den									. ·
	_7µn,nimitru	ept-souddinadadryth-	-Topp-dellero-alle-a	MMMANAMA	Manyana	፦{ <b>፟ኯኇ</b> ፞ኯቍጚኯኯ <sub>፟</sub> ኯዀኯ	Wirkold II-white Mirwy	Mphinesurfleaffelly	¥
-10 dBm									
20 dBm	IRG -21 00	l dBm							
BB•dBm									Laghert Manual
<b>°</b>									- Contraction of the second
-40 dBm									
-50 dBm									
-60 dBm									
oo usm									
-70 dBm									
Jo dom									

### 2-DH5 (2 441 Mz)

Spectrum Ref Level 20.00	Spectrum 2 dBm Offset 0.	50 dB • RBW 1 MH			
		.5 ms • VBW 1 MH			
<ul> <li>1Pk Max</li> </ul>					
10 dBm			D2[1] M1[1]		-1.50 dB .89100 ms -0.50 dBm
	under and a second s	an fill of an an antipolitical statements	an a well have been a served the server of t	Mar harana wana ya mana	 -500 ns
-10 dBm					
-20 dBm TRG	-21.000 dBm				
_38,d8,r+					and many the
-40 dBm					
-50 dBm					
-60 dBm					
-70 dBm					
CF 2.441 GHz		100	11 pts		350.0 µs/

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### - 8DPSK\_Non AFH mode

3-DH1 (2 441 Mz)

Ref Level 20 Att		offset ● SWT	0.50 dB 👄 F 500 µs 👄 V						
TRG: VID TDF	40 UB	- 3WI	500 µs 🖶 🕯						
●1Pk Max									
					D	2[1]			-1.34 c
									389.000 J
10 dBm					M	1[1]			-1.33 dB
M1									1
0 dBm				www.v.w.alinte	arminilana	MANULAR	Mandand	Mymerrit	
				w.t.c.w. 01101		01 <b>v</b> .		I T	
-10 dBm									
-20 dBm	G -21.000	) dBm							
C30.dBm									Wallound
-40 dBm									
-50 dBm									
-60 dBm									
-70 dBm									
			1	1					

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

		e swt	1.9 ms 👄 🍾	BW 1 MHz					
TRG: VID TE	JF								
					D	2[1]			-1.66 0
									.64110 m
10 dBm					M	1[1]			-0.57 dB 500 r
M1 0 dBn									
o ubii		yandah Martitlantha	and have write	htert All Adjoration	ar-superiorated the	undertalisation	Huselundepan	an a	14 <sup>2</sup>
-10 dBm									
-20 d6m	TRG -22.00								
	TRG -22.00	J asm							
-30 d8m									1
									Yok/MAT40
-40 dBm									
-50 dBm									
-60 dBm									
-00 0011									
			1						

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Page (45) of (72)

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

Att		e swt	3.4 ms 😑 🕯	/BW 1 MHz					
TRG: VID TDF									
1Pk Max						2[1] 1[1]			-1.85 dl .89340 m -0.55 dBn 600 n
D dBm	14.8-184-0.4-0	Arta colorada hat	LPL and adjuster Law	and a later of the second	ditation and second distant.	Mittan & officer Lar	and distant difference	el managhan de la fa	22
-10 dBm									
20 dBm-TR	G -22.000	I dBm							
-30 dBm									hallmark
-40 dBm									
-50 dBm									
-60 dBm									
-70 dBm									

### - GFSK\_AFH mode

DH1 (2 441 Mz)

TRG: VID TDF		500 µs 👄 <b>V</b>			
∋1Pk Max					
			D2[1]		0.07 c 382.000 j
10 dBm			 M1[1]		-0.73 dB
м	1		1	1 1	500 i
0 dBm			 	~~~~	D2
-10 dBm TR					
-10 abin   R	.G -10.000 dBm				
-20 dBm					
130 dBm			 		munik
,					Brease Carlo
-40 dBm			 		
50 ID					
-50 dBm					
-60 dBm					

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Page (46) of (72)

DH3 (2 441 Mz)

Ref Level 20. Att	40 dB 👄 SWT	D.50 dB		
TRG: VID TDF				
1Pk Max				
			D2[1]	-0.08 dE
10 dBm			M1[1]	1.63980 m -0.60 dBn
			(na[a]	550 n
M1 D dBm				D2
10 dBm TRG	6 -10.000 dBm			
	-10.000 ubiii			
-20 dBm				
-20 06111				
201df m				
-301.d6m				~ two-theball
-40 dBm				
40 ubili				
-50 dBm				
-50 UBIII				
-60 dBm				
-00 ubm				
-70 dBm				

DH5 (2 441 Mtz)

Spectrum 2 X				
Ref Level 20.00 dBm Offset 0.50 dB 👄				
	VBW 1 MHz			
TRG: VID TDF				
0 1Pk Max				
		D2[1]		-0.12 dB
10 dBm		M1[1]		2.89100 ms -0.62 dBm
10 000		wittil.		-0.02 uBin -2.00 µs
		1	1 1	n2
U aBm				*
-10 dBm TRG -10.000 dBm				
-20 dBm				
-30 dBith				What you have the
phane -				Ob United Street
-40 dBm				
-50 dBm				
oo abiii				
-60 dBm				
-00 UBIII				
-70 dBm				
CF 2.441 GHz	1001 pts		I	350.0 µs/

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#### - π/4DQPSK\_AFH mode

2-DH1 (2 441 Mt)

Ref Level 20. Att	40 dB 曼 SW1	et 0.50 dB 👄 1	VBW 1 MHz					
TRG: VID TDF	40 GD 🥌 GW	300 µs 🧉	1011 10012					
●1Pk Max								
				D	2[1]			-1.04 (
10 dBm				M	1[1]			388.500 -0.95 dB
					-1-1			500
0 dBm				An and An				
		<u>`</u>	.urundpollu	4 Minutary	h-ANNA MULT	MAMPA A	production and the second s	
-10 dBm								
-20 dBm	-21.000 dBm-							
528vdBm								Inforder Medical
								And Configuration.
-40 dBm								
-50 dBm								
-60 dBm								
-00 0811								
-70 dBm								
		1	1	1				

### 2-DH3 (2 441 Mz)

	20.00 dBm 40 dB			RBW 1 MHz VBW 1 MHz					
TRG: VID TD		- awi	2 1115 🖶	VOW INNZ					
∋1Pk Max									
					D	2[1]			-0.83
									L.64190
10 dBm					M	1[1]			-1.15 di
M1								1	-850
0 dBm		Notes allowing the	warting himse	-	d technikadus metho	Alderediation	ladadat santa na mining	-	<u>-</u>
	000111110	11 World - 11	, 140 0 C C C		100 THE D	Die Flucture in	Ito be to one of the		Î.
-10 dBm									
-20 dBm	70. 01.000								
	RG -21.000	i asm							
20 40									
-30 d8m									Upierstrik
-40 dBm									
-50 dBm									
-60 dBm			+						
			1						
			1						
-70 dBm									

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Page (48) of (72)

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

Att TRG: VID T		e swt	3.4 ms 👄 <b>V</b>	<b>D</b> 2 Miliz					
1Pk Max									
					D	2[1]			-1.23 d
10 dBm					M	1[1]			2.89340 m -0.74 dBr
						1(1)			-2.00 µ
0 dBm									02
		- walk have	wallensoneda	an-holiser-theoli		arrallian and hard and a start and the	al-aldriferralition	ere selekvælkun	
-10 dBm —									
-20 dBm —	TRG -21.00	l dem							
	180 -21.00								
-30 dB.m									huddyward
ANNY TOTAL									hand in the start
-40 dBm—									
-50 dBm—									
-60 dBm—									+
-70 dBm									

#### - 8DPSK\_AFH mode

3-DH1 (2 441 Mz)

	20.00 dBm			RBW 1 MHz					
Att TRG: VID_1	40 dB	e swt	500 µs 👄	VBW 1 MHz					
1Pk Max	DF								
					DS	2[1]			-1.04 0
								:	389.000
10 dBm					M	1[1]			-1.49 dB
							1		500 (
0 dBm	M1			The set of the states	d well a line	ما العمر الم	at a collect	hinternet	2
				anah shih. Alih	like i daharan	Pd housed from	a too an too an an an an an an	un an	
-10 dBm—									
-20 dBm-	TRG -21.000	) dBm	-						
30.dBmm	and a								h
u.									Wethered
-40 dBm									
-50 dBm									
-60 dBm									
-70 dBm									

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Page (49) of (72)

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

Att	40 dB	SWT	1.9 ms 👄 V	BW 1 MHz						
TRG:VID T	DF									
1Pk Max										
					D	2[1]				1.38 dE 920 m
10 dBm					M	1[1]				520 m 54 dBn
						-1-1				500 n
M1 0 dBm-										
	hilled and the second	rlunulficturique	andformational	nnoodrillypplay	off on the shall	enno-enno-enno	Murulpurphy	pullow well filled to	unit	
-10 dBm										
10 0011									11	
-20 dBm										
-20 UBI I	TRG -22.00	) dBm								
00 40										
-30 dBm										unnul
										00 01 w 410
-40 dBm										
-50 dBm										
-60 dBm										
-70 dBm									-	

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

Spectrum		ctrum 2	×						
Ref Level 20				RBW 1 MHz					
Att TRG: VID TDF	40 dB 🖷	SWT	3.4 ms 😑 🕚	BW 1 MHz					
1RG: VID TDF						_			
		_			D2	[1]			-1.47 dF
								2	.89340 m
10 dBm					M1	[1]			-0.62 dBn
M1									600 n:
0 40	al allocation and	en an breakling.	LIN ALL AND ALKARA	and Hubble	direction second at a	International National Area	and an and an	Manggradulus	<u>p2</u>
	and find a . D. die	o anadili anglabilid	առը ի գարելի	an a , avallat a stats e	les and the and the	a a h-sho bara u	a condition on bit		1
-10 dBm									
-20 dBm									
TF	G -22.000	dBm							
-30 dBm									
what									Mahadorat
-40 dBm									
io abiii									
-50 dBm									
-50 abiii									
-60 dBm									
-ou usin									
70 40									
-70 dBm									
CF 2.441 GH	7			1001	nts				340.0 µs/



### 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 ( $\mu$ V/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
Mtz 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 8.41425 - 8.41475	MHz 16.42 - 16.423 16.69475 - 16.69525 16.80425 - 16.80475 25.5 - 25.67 37.5 - 38.25 73 - 74.6 74.8 - 75.2 108 - 121.94 123 - 138 149.9 - 150.05 156.52475 - 156.52525 156.7 - 156.9	Mb 399.9 - 410 608 - 614 960 - 1240 1300 - 1427 1435 - 1626.5 1645.5 - 1646.5 1660 - 1710 1718.8 - 1722.2 2200 - 2300 2310 - 2390 2483.5 - 2500 2690 - 2900 3260 - 3267	$\begin{tabular}{ c c c c c c } \hline & & & & & & & & & & & & & & & & & & $
12.29 - 12.293 12.51975 - 12.52025	162.0125 - 167.17 167.72 - 173.2	3332 - 3339 3345.8 - 3358	31.2 - 31.8 36.43 - 36.5
12.57675 - 12.57725 13.36 - 13.41	240 - 285 322 - 335.4	3600 - 4400	Above 38.6

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  ${\rm Mb}$  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 ₩±.
  - 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: 8DPSK)

#### Highest Channel (2 480 Mb)

Frequency	Receiver Bandwidth	Pol. [V/H]	Reading	Cable Loss	Amp Gain	Antenna Factor	Factor			Margin		
[MHz]	[kHz]	[v/n]	[dB(µV)]	[dB]	[dB]	<b>[</b> dB <b>]</b>	[dB]	μub(μv/III)]	[dB( <i>µ</i> V/m <b>)</b> ]	[dB]		
Quasi-Peak	Quasi-Peak DATA. Emissions below 30 Mb											
	Not Detected											
Quasi-Peak	Quasi-Peak DATA. Emissions below 1 🕀											
46.49	120	Н	48.40	1.40	-30.83	15.68	-13.75	34.65	40.00	5.35		
66.62	120	Н	47.20	1.70	-31.02	12.43	-16.89	30.31	40.00	9.69		
105.54	120	Н	31.40	2.20	-35.34	17.07	-16.07	15.33	43.50	28.17		
286.32	120	Н	41.50	3.78	-35.15	18.93	-12.44	29.06	46.00	16.94		
458.26	120	Н	33.80	4.90	-35.74	22.63	-8.21	25.59	46.00	20.41		
767.32	120	V	32.30	6.47	-34.83	25.47	-2.89	29.41	46.00	16.59		

NOTE 1. Factor = Cable loss + Amp 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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Page (57) of (72)



#### - Above 1 🕀 data

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

Frequency	Receiver Bandwidth	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	Factor	Result	Limit	Margin	
[MHz]	[kHz]	[V/H]	[dB(µV)]	[dB]	[dB]	[dB]	[dB]	[dB( <i>µN</i> /m)]	[dB( <i>µ</i> V/m <b>)</b> ]	[dB]	
Peak DATA. Emissions above 1 🕸											
1 797.97	1 000	V	78.51	3.23	-63.18	26.99	-32.96	45.55	74.00	28.45	
3 247.42	1 000	V	75.36	4.30	-62.04	30.37	-27.37	47.99	74.00	26.01	
2 388.99 <sup>1)</sup>	1 000	V	69.37	3.70	-63.14	28.54	-30.90	38.47	74.00	35.53	
4 804.09 <sup>1)</sup>	1 000	V	72.09	5.34	-60.75	32.80	-22.61	49.48	74.00	24.52	
15 036.56	1 000	Н	60.79	9.77	-55.96	40.20	-5.99	54.79	74.00	19.21	
21 768.69	1 000	V	48.12	12.00	-49.44	45.00	7.56	55.68	74.00	18.32	
26 042.59	1 000	V	46.79	13.70	-46.62	45.70	12.78	59.57	74.00	14.43	
Average DATA. Emissions above 1 🕮											
2 388.99 <sup>1)</sup>	1 000	V	58.82	3.70	-63.14	28.54	-30.90	27.92	54.00	26.08	
4 803.88 <sup>1)</sup>	1 000	V	68.75	5.34	-60.75	32.80	-22.61	46.14	54.00	7.86	
<sup>1)</sup> Restricted	hand										

1) Restricted band.

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

		-								
Frequency	Receiver Bandwidth	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	Factor	Result	Limit	Margin
[MHz]	[kHz]	[V/H]	[dB(µV)]	[dB]	[dB]	[dB]	[dB]	[dB( <i>µ</i> N/m)]	[dB( <i>µ</i> V/m <b>)</b> ]	[dB]
Peak DATA.	Emissions	above 1	GHz							
1 797.81	1 000	V	76.84	3.23	-63.18	26.99	-32.96	43.88	74.00	30.12
3 289.14	1 000	Н	76.39	4.32	-62.01	30.48	-27.21	49.18	74.00	24.82
4 882.03 <sup>1)</sup>	1 000	Н	72.21	5.39	-60.78	32.84	-22.55	49.66	74.00	24.34
14 504.59	1 000	V	60.79	9.67	-54.86	40.65	-4.54	56.25	74.00	17.75
21 645.97	1 000	V	48.71	12.00	-49.46	45.00	7.54	56.25	74.00	17.75
25 998.23	1 000	V	45.82	13.70	-46.59	45.70	12.81	58.62	74.00	15.38
Average DA	TA. Emissio	ons abov	re1G⊞z							
4 881.96 <sup>1)</sup>	1 000	Н	69.44	5.39	-60.78	32.84	-22.55	46.89	54.00	7.11
1) Deetwieteel					•					

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www.kctl.co.kr

Report No.: KR18-SRF0045



Page (58) of (72)

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

Receiver Bandwidth	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	Factor	Result	Limit	Margin
[kHz]	[V/H]	[dB(µV)]	[dB]	[dB]	[dB]	[dB]	[dB( <i>µN</i> /m)]	[dB( <i>µ</i> V/m <b>)</b> ]	[dB]
Emissions	above 1	GHz							
1 000	V	80.35	3.23	-63.18	27.00	-32.95	47.39	74.00	26.61
1 000	V	88.83	3.80	-63.02	28.81	-30.41	58.42	74.00	15.58
1 000	V	81.81	3.77	-63.09	28.72	-30.60	51.21	74.00	22.79
1 000	V	75.47	5.44	-60.67	32.88	-22.35	53.11	74.00	20.89
1 000	Η	60.61	9.70	-55.25	40.52	-5.03	55.58	74.00	18.42
1 000	V	46.99	12.10	-49.53	45.00	7.57	54.56	74.00	19.44
1 000	V	46.69	13.30	-46.91	45.50	11.89	58.58	74.00	15.42
A. Emissio	ns abov	e 1 GHz							
1 000	V	56.40	3.77	-63.09	28.72	-30.60	25.80	54.00	28.20
1 000	V	72.88	5.44	-60.67	32.88	-22.35	50.53	54.00	3.47
	Bandwidth [klt/] Emissions 1 000 1 000 1 000 1 000 1 000 1 000 <b>CA. Emissio</b> 1 000	Bandwidth [ktz]         Pol. [V/H]           Emissions above 1           1 000         V           1 000         V	Bandwidth [klb]         Pol.         Reading [dB(,dV)]           Emissions above 1 Gbz           1 000         V         80.35           1 000         V         88.83           1 000         V         88.83           1 000         V         81.81           1 000         V         81.81           1 000         V         75.47           1 000         V         46.99           1 000         V         46.69           CA. Emissions above 1 Gbz         1 Gbz           1 000         V         56.40           1 000         V         72.88	Bandwidth         Pol.         Reading         Loss           [Mb]         [V/H]         [dB(µV)]         [dB]           Emissions above 1 Gbz           1 000         V         80.35         3.23           1 000         V         88.83         3.80           1 000         V         81.81         3.77           1 000         V         81.81         3.77           1 000         V         75.47         5.44           1 000         V         46.99         12.10           1 000         V         46.69         13.30           CA. Emissions above 1 Gbz         1000         V         56.40         3.77           1 000         V         72.88         5.44	Bandwidth         Pol.         Reading         Loss         Gain           [Mb]         [V/H]         [dB(AV)]         [dB]         [dB]           Emissions above 1 Gbz           1 000         V         80.35         3.23         -63.18           1 000         V         88.83         3.80         -63.02           1 000         V         81.81         3.77         -63.09           1 000         V         75.47         5.44         -60.67           1 000         V         46.99         12.10         -49.53           1 000         V         46.69         13.30         -46.91           CA. Emissions above 1 Gbz         Cbc.40         3.77         -63.09           1 000         V         56.40         3.77         -63.09           1 000         V         72.88         5.44         -60.67	Bandwidth         Pol.         Reading         Loss         Gain         Factor           [Mb]         [V/H]         [dB(µV)]         [dB]         [dB]         [dB]         [dB]         [dB]           Emissions above 1 Gbz         State         State	Bandwidth [Mb]         Pol.         Reading [dB]         Loss [dB]         Gain [dB]         Factor [dB]         Factor [dB]         Factor [dB]         Factor [dB]           Emissions above 1 Cbz           1 000         V         80.35         3.23         -63.18         27.00         -32.95           1 000         V         88.83         3.80         -63.02         28.81         -30.41           1 000         V         81.81         3.77         -63.09         28.72         -30.60           1 000         V         75.47         5.44         -60.67         32.88         -22.35           1 000         V         75.47         5.44         -60.67         32.88         -22.35           1 000         V         46.99         12.10         -49.53         45.00         7.57           1 000         V         46.69         13.30         -46.91         45.50         11.89           CA. Emissions above 1 Cbz         Color         32.88         5.44         -60.67         32.88         -22.35	Bandwidth [Mb]         Pol.         Reading [dB]         Loss [dB]         Gain [dB]         Factor [dB]         Factor         Factor [dB]         Facto	Bandwidth [Mb]         Pol.         Reading [dB]         Loss [dB]         Gain [dB]         Factor [dB]         Factor [dB] <thf< td=""></thf<>

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

#### π/4DQPSK\_Lowest channel (2 402 Mb)

Frequency	Receiver Bandwidth	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	Factor	Result	Limit	Margin
[MHz]	[kHz]	[V/H]	[dB(µV)]	[dB]	[dB]	[dB]	[dB]	[dB( <i>µ</i> N/m)]	[dB( <i>µ</i> V/m <b>)</b> ]	[dB]
Peak DATA.	Emissions	above 1	GHz							
1 798.91	1 000	V	76.78	3.23	-63.19	27.00	-32.96	43.82	74.00	30.18
2 535.00	1 000	Н	82.00	3.81	-63.02	28.82	-30.39	51.61	74.00	22.39
2 389.06 <sup>1)</sup>	1 000	Н	68.89	3.70	-63.14	28.54	-30.90	37.99	74.00	36.01
4 199.63 <sup>1)</sup>	1 000	V	70.24	4.92	-60.84	32.50	-23.42	46.82	74.00	27.18
4 803.64 <sup>1)</sup>	1 000	Н	70.75	5.34	-60.75	32.80	-22.61	48.14	74.00	25.86
21 782.77	1 000	Н	47.44	12.10	-49.54	45.00	7.56	55.00	74.00	19.00
25 824.25	1 000	V	46.60	13.50	-46.70	45.60	12.40	59.00	74.00	15.00
Average DA	TA. Emissio	ons abov	ve 1 GHz							
2 388.861)	1 000	Н	56.83	3.70	-63.14	28.54	-30.90	25.93	54.00	28.07
4 199.87 <sup>1)</sup>	1 000	V	59.46	4.92	-60.84	32.50	-23.42	36.04	54.00	17.96
4 804.01 <sup>1)</sup>	1 000	Н	63.79	5.34	-60.75	32.80	-22.61	41.18	54.00	12.82

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Report No.: KR18-SRF0045



Page (59) of (72)

#### π/4DQPSK\_Middle channel (2 441 Mb)

			-	-						
Frequency	Receiver Bandwidth	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	Factor	Result	Limit	Margin
[MHz]	[kHz]	[V/H]	[dB(µV)]	[dB]	[dB]	[dB]	[dB]	[dB( <i>µ</i> V/m <b>)</b> ]	[dB( <i>µ</i> V/m <b>)</b> ]	[dB]
Peak DATA.	Emissions	above 1	GHz							
1 793.67	1 000	V	78.24	3.23	-63.18	26.97	-32.98	45.25	74.00	28.75
3 286.64	1 000	V	78.53	4.32	-62.01	30.47	-27.22	51.30	74.00	22.70
4 882.48 <sup>1)</sup>	1 000	V	72.19	5.39	-60.78	32.84	-22.55	49.65	74.00	24.35
15 080.06	1 000	Н	60.33	9.79	-56.04	40.08	-6.17	54.17	74.00	19.83
21 629.23	1 000	V	48.48	12.00	-49.47	45.00	7.53	56.01	74.00	17.99
26 008.06	1 000	V	45.81	13.70	-46.60	45.70	12.80	58.62	74.00	15.38
Average DA	TA. Emissio	ons abov	e 1 GHz							
4 882.05 <sup>1)</sup>	1 000	V	65.36	5.39	-60.78	32.84	-22.55	42.81	54.00	11.19
<sup>1)</sup> Restricted	band									

Restricted band.

#### π/4DQPSK\_Highest channel (2 480 Mz)

Frequency	Receiver Bandwidth	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	Factor	Result	Limit	Margin
[MHz]	[kHz]	[V/H]	[dB(µV)]	[dB]	[dB]	[dB]	[dB]	[dB( <i>µ</i> N/m)]	[dB( <i>µ</i> V/m <b>)</b> ]	[dB]
Peak DATA.	Emissions	above 1	GHz							
1 802.11	1 000	Н	76.51	3.24	-63.19	27.01	-32.94	43.58	74.00	30.42
3 322.50	1 000	Н	88.40	4.35	-61.96	30.57	-27.04	61.37	74.00	12.63
2 484.22 <sup>1)</sup>	1 000	V	75.60	3.77	-63.09	28.72	-30.60	45.00	74.00	29.00
4 959.97 <sup>1)</sup>	1 000	Н	72.94	5.44	-60.67	32.88	-22.35	50.58	74.00	23.42
14 858.48	1 000	Н	59.53	9.73	-55.60	40.40	-5.47	54.06	74.00	19.94
21 618.34	1 000	V	47.23	12.00	-49.47	45.00	7.53	54.76	74.00	19.24
26 016.30	1 000	Н	46.45	13.70	-46.60	45.70	12.80	59.25	74.00	14.75
Average DA	TA. Emissio	ns abov	e 1 0±2							
2 484.22 <sup>1)</sup>	1 000	V	56.51	3.77	-63.09	28.72	-30.60	25.91	54.00	28.09
4 959.94 <sup>1)</sup>	1 000	Н	68.38	5.44	-60.67	32.88	-22.35	46.03	54.00	7.97

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Report No.: KR18-SRF0045



Page (60) of (72)

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

Frequency	Receiver Bandwidth	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	Factor	Result	Limit	Margin
[MHz]	[kHz]	[V/H]	[dB(µV)]	[dB]	[dB]	[dB]	[dB]	[dB( <i>µ</i> N/m <b>)</b> ]	[dB( <i>µ</i> V/m <b>)</b> ]	[dB]
Peak DATA.	Emissions	above 1	GHz							
1 807.50	1 000	V	76.05	3.24	-63.17	27.03	-32.90	43.15	74.00	30.85
3 242.11	1 000	Н	81.39	4.29	-62.03	30.35	-27.39	54.01	74.00	19.99
2 388.98 <sup>1)</sup>	1 000	V	69.91	3.70	-63.14	28.54	-30.90	39.01	74.00	34.99
4 803.64 <sup>1)</sup>	1 000	Н	71.25	5.34	-60.75	32.80	-22.61	48.64	74.00	25.36
14 639.17	1 000	V	59.42	9.69	-55.13	40.55	-4.89	54.52	74.00	19.48
21 814.91	1 000	Н	47.51	12.10	-49.54	45.00	7.56	55.08	74.00	18.92
26 260.94	1 000	V	45.90	13.70	-46.69	45.60	12.61	58.51	74.00	15.49
Average DA	TA. Emissio	ons abov	e 1 GHz							
2 388.88 <sup>1)</sup>	1 000	V	58.66	3.70	-63.14	28.54	-30.90	27.76	54.00	26.24
4 803.98 <sup>1)</sup>	1 000	Н	63.24	5.34	-60.75	32.80	-22.61	40.63	54.00	13.37
1) Postricted	a a sa al									

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

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

			,							
Frequency	Receiver Bandwidth	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	Factor	Result	Limit	Margin
[MHz]	[kHz]	[V/H]	[dB(µN)]	[dB]	[dB]	[dB]	[dB]	[dB( <i>µN</i> /m)]	[dB( <i>µ</i> V/m <b>)</b> ]	[dB]
Peak DATA.	Emissions	above 1	GHz							
1 596.72 <sup>1)</sup>	1 000	V	81.34	3.04	-63.41	26.19	-34.18	47.16	74.00	26.84
3 281.56	1 000	Н	78.28	4.32	-62.02	30.46	-27.24	51.04	74.00	22.96
4 881.58 <sup>1)</sup>	1 000	V	72.02	5.39	-60.78	32.84	-22.55	49.47	74.00	24.53
14 519.09	1 000	V	60.35	9.67	-54.89	40.64	-4.58	55.77	74.00	18.23
21 728.84	1 000	V	47.83	12.00	-49.45	45.00	7.55	55.38	74.00	18.62
25 799.55	1 000	Н	47.30	13.50	-46.76	45.60	12.34	59.65	74.00	14.35
Average DA	TA. Emissio	ons abov	e 1 GHz							
1 596.72 <sup>1)</sup>	1 000	V	56.29	3.04	-63.41	26.19	-34.18	22.11	54.00	31.89
4 881.97 <sup>1)</sup>	1 000	V	65.03	5.39	-60.78	32.84	-22.55	42.48	54.00	11.52
1) Postrictod	hond									

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www.kctl.co.kr

Report No.: KR18-SRF0045



Page (61) of (72)

#### 8DPSK\_Highest channel (2 480 Mz)

Frequency	Receiver Bandwidth	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	Factor	Result	Limit	Margin
[MHz]	[kHz]	[V/H]	[dB(µV)]	[dB]	[dB]	[dB]	[dB]	[dB( <i>µ</i> N/m)]	[dB( <i>µ</i> V/m)]	[dB]
Peak DATA.	Emissions	above 1	GHz							
1 800.23	1 000	V	73.98	3.23	-63.18	27.00	-32.95	41.03	74.00	32.97
3 325.94	1 000	Н	73.97	4.35	-61.95	30.58	-27.02	46.96	74.00	27.04
2 483.83 <sup>1)</sup>	1 000	V	86.58	3.77	-63.09	28.72	-30.60	55.98	74.00	18.02
4 959.52 <sup>1)</sup>	1 000	V	74.18	5.44	-60.67	32.88	-22.35	51.82	74.00	22.18
14 646.42	1 000	Н	60.23	9.70	-55.16	40.55	-4.91	55.32	74.00	18.68
21 820.48	1 000	V	48.02	12.10	-49.53	45.00	7.57	55.58	74.00	18.42
25 895.44	1 000	V	46.81	13.60	-46.73	45.70	12.57	59.38	74.00	14.62
Average DA	ΓΑ. Emissio	ns abov	e 1 GHz							
2 484.91 <sup>1)</sup>	1 000	V	57.53	3.77	-63.09	28.72	-30.60	26.93	54.00	27.07
4 959.99 <sup>1)</sup>	1 000	V	68.47	5.44	-60.67	32.88	-22.35	46.12	54.00	7.88
1) Restricted						-				

1) Restricted band.



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Report No.: KR18-SRF0045 Page (62) of (72)

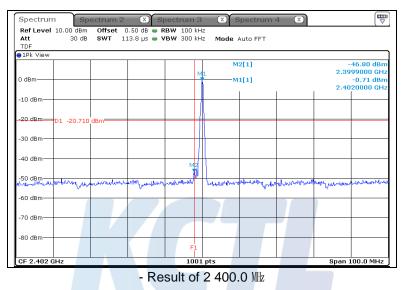


### 5.7.4 Test Plot

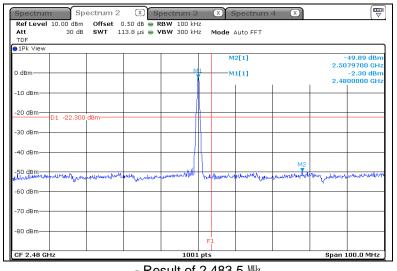
Figure 5. Plot of the Band Edge (Conducted)

### - GFSK (Without hopping)

Lowest Channel (2 402 Mz)



#### Highest Channel (2 480 Mz)

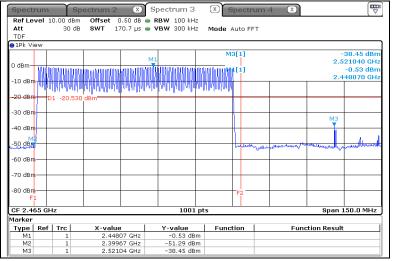


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Page (63) of (72)



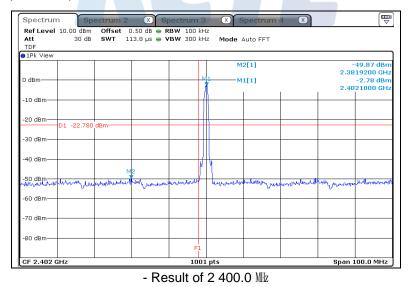
#### - GFSK (With hopping)



- Result of 2 400.0 Mz - 2 483.5 Mz

### - π/4DQPSK (Without hopping)

Lowest Channel (2 402 Mz)

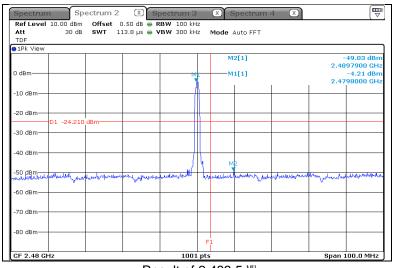


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Page (64) of (72)

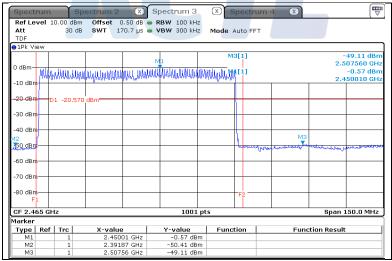


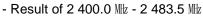
Highest Channel (2 480 Mz)



- Result of 2 483.5 Mb

### - π/4DQPSK (With hopping)

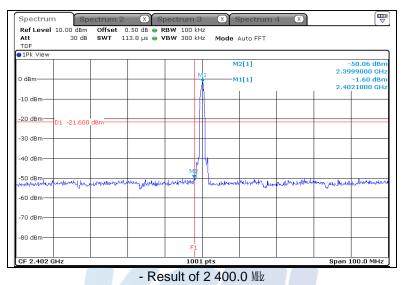




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#### - 8DPSK (Without hopping)

Lowest Channel (2 402 Mz)



#### Highest Channel (2 480 Mz)

	10.00 dBm		0.50 dB 👄 R							
Att TDF	30 dB	SWT 1	l13.8 µs 👄 V	' <b>BW</b> 300 KH	Z	Mode 4	Auto FFT			
101 1Pk View										
0 dBm					-		2[1] 1[1]		2.4	-49.17 dBn 861900 GH: -3.25 dBn
							I	I	2.4	798000 GH:
-10 dBm										
-20 dBm—	D1 -23.250	dBm								
00 d0	01 20,200									
-30 dBm										
-40 dBm										
50 dBm				4	1	M2				
and the second	all allen in	engel-your	in white	show when the	hu	wyww	numeral web	Alexander	When where the	pontenentillanni
-60 dBm—										
-70 dBm										
-80 dBm										
					F	1				

#### - Result of 2 483.5 Mb

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1 Page (66) of (72)

### - 8DPSK (With hopping)

Spect			pectrum 2 🛛 🛞	Spectrum 3	X Spe	ectrum	4 X		
	vel 1	0.00 dBrr		🖷 RBW 100 kHz					
Att		30 dE	SWT 170.7 μs	👄 VBW 300 kHz	Mode Aut	O FFT			
TDF									
⊖1Pk Vi	ew								
					M3[1	L]			-48.79 dBm
0 dBm-	_							2.3	532730 GHz
	MM	աստո	Magnagnarand	MAANMAANMAANA	UUM WAR	1]		_	-0.18 dBm
-10 dBn		0	and a Mandlance of a state.				1	2.4	451210 GHz
									1
20 dBn	D	1 -20.18	0 dBm						
					1				
-30 dBn									
-40 dBn									МЗ
M2	Ϋ́				11				M 3
-50 den					6	and the second	Call Contraction and and and and and and and and and an	manner	partition and the second
-60 dBn									
-00 001									
-70 dBn									
. 2 0.011									1
-80 dBn					E	2			
F	1				'	Ī			1
CF 2.4	65 GH	z		1001 p	ts			Span	150.0 MHz
Marker									
Туре	Ref	Trc	X-value	Y-value	Functio	n	Fun	ction Resul	t
M1		1	2.45121 GHz	-0.18 dBm					
M2		1	2.39802 GHz	-50.91 dBm					
MЗ		1	2.53273 GHz	-48.79 dBm					

- Result of 2 400.0 Mz - 2 483.5 Mz



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Figure 6. Plot of the Spurious RF conducted emissions

### - GFSK

Lowest Channel (2 402 Mz)

Spectrum	Spe	ectrum (	2 🗙 S	pectrum 3	× s	pectrum	4 🛛		E
Ref Level Att	10.00 dBm 30 dB	Offset SWT	0.50 dB 👄 R 265 ms 👄 V	BW 100 kHz BW 300 kHz	Mode A	uto Sweep	_		
TDF									
●1Pk View									
					M	2[1]			41.98 dBr 3.4740 GH
0 dBm 🕂 🔻					M	1[1]			-0.87 dBr
									2.3970 GH
-10 dBm									
-20 dBm	D1 -20.870								
	DI -20.870	abm-							
-30 dBm									
50 abiii									
-40 dBm						м	2		
io abiii						KAN WAND	An I was		e and Pak
50 d9m	were with and all	alter Marshe	the ment to	Mark	story on protonions	han A dare a	were when	Munn	Property.
Northalament	Sarth.	N.							
-60 dBm									
-oo usiii									
-70 dBm									
-/ 0 UBIII									
00 40									
-80 dBm									
Start 30.0	MHz			1001	pts			Stop	26.5 GHz

### Middle Channel (2 441 Mz)

Ref Level 1				BW 100 kHz					
Att TDF	30 dB	SWT	265 ms 👄 🗸	BW 300 kHz	Mode A	uto Sweep			
1DF 1Pk View									
					M	2[1]		-	41.42 dBn
M1								10	5.6500 GH
0 dBm					M	1[1]			-1.59 dBn 2.4500 GH:
						1	I	1	
-10 dBm									
00 40									
-20 dBm	1 -21.590	dBm							
-30 dBm									
-50 0511									
-40 dBm						M2			
				and when the start and		AND MY	leverteday .	1.6	with the
-50 dBm	Jephilo word	young	La mather Sugar	april when the startes	and have	0	- lyt	www.	M
ward									
-60 dBm									
-70 dBm									
-80 dBm									
				1					

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Page (68) of (72)

#### Highest Channel (2 480 Mz)

Att	10.00 dBm 30 dB	Offset 0 SWT 2	65 ms 🖷 🛛	3W 100 kHz 3W 300 kHz		uto Sweep			
TDF			_						
1Pk View	[		1			0[1]			40 50 dB
					IVI.	2[1]			42.50 dBm 5.5880 GHz
D dBm 🕂 🌱					M	1[1]			-1.94 dBm
						1	I	2	2.4760 GHz
-10 dBm									
-20 dBm	D1 -21.940	dBm	-						
-30 dBm									
-40 dBm									M2
		manually	Jack all addressing a	م ارد ا	and them	moment	mounter	akh ward	he way them
-50 dBm	and the state	" Lun	WILLAND MILLAND	MANN		,	υψι	n n minu	. v
-60 dBm									
-70 dBm									1
o ubili									
-80 dBm									

### - π/4DQPSK

```
Lowest Channel (2 402 Mb)
```

Spectrum	Spectru	m 2 🛛 🗴 🤅	Spectrum 3	Spectrum	4 🗵	
Ref Level 10.00	dBm Offs	et 0.50 dB 👄 I	RBW 100 kHz			
Att TDF	30 dB <b>SW</b> 1	265 ms 👄 '	VBW 300 kHz	Mode Auto Sweep		
●1Pk View						
				M2[1]	_	-42.26 dBm
M1						16.6230 GH
0 dBm				M1[1]		-0.94 dBn
				1	1 1	2.3970 GH
-10 dBm						
-20 dBm01 -;	20.940 dBm-					
-30 dBm						
-40 dBm				M2		
				Www.maren	M. LAN AND .	Lundplac
-50 dBm	and the and a strateging of	June with the Marth	mound	mark marked to mark	MAR WALL	My MAN AND VIL
and the second second		bur had a				
co.do.u						
-60 dBm						
-70 dBm						
-80 dBm						
Start 30.0 MHz			1001			Stop 26.5 GHz

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Page (69) of (72)

#### Middle Channel (2 441 Mz)

Ref Level 10		Offset 0.		<b>W</b> 100 kHz			_		
Att	30 dB	SWT 20	55 ms 👄 🛛 🛛	300 kHz	Mode A	uto Sweep			
1DF 1Pk View									
					M	2[1]		-	41.75 dBn
M1								10	5.5440 GH
0 dBm					M	1[1]			-1.35 dBn 2.4500 GH:
-10 dBm									
-10 0011									
-20 dBm-01									
	-21.350 dt	sm							
-30 dBm									
						M2			
-40 dBm									4.1
	. whe water we	whithing .	, ibbs	IL LAND	www.www	MARKAN	and the way	Muncher	while the
-50 dBm		Huday	արուներդեր					n o p sage care	
-60 dBm									
-oo usiil									
-70 dBm									
-80 dBm									

### Highest Channel (2 480 Mb)

Spectrum	P	ectrum 2		pectrum 3		pectrum -	4 🛛		
Ref Level		Offset (		3W 100 kHz					
Att TDF	30 dB	SWT	265 ms 👄 🗸	BW 300 kHz	Mode A	uto Sweep			
1DF 1Pk View							-	_	
					M	2[1]		-	42.20 dBm
. m Mi								16	5.7030 GHz
) dBm — 🙀					M	1[1]			-1.93 dBm
									2.4760 GHz 
10 dBm			-						
20 dBm-	D1 -21.930	dBm							
30 dBm									
-40 dBm						M2			
	1 Acres	when		a show b	all hope and	HAR MANY	howevery. L	WK. CI	h morely you
50 dBm	A copy the all the could be a set of the could	- white	and the second second second	PROVINCY			YV	a. a turrutu ta	r 0
A CHARTER OF									
-60 dBm									
-70 dBm									
80 dBm									
Start 30.0			1	1001					26.5 GHz

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Page (70) of (72)



#### - 8DPSK

Lowest Channel (2 402 Mtz)

Spectrum Ref Level		ectrum 1 Offset		bectrum 3 3W 100 kHz		pectrum			
Att	30 dB	SWT	265 ms 👄 ۷	3W 300 kHz	Mode A	uto Sweep			
TDF									
1Pk View						0[1]			41.97 dBn
					IVI.	2[1]			41.97 aBh 5.6230 GH
) dBm M1			_		M	1[1]			-3.50 dBn
Ţ								2	2.3970 GH
-10 dBm									
-20 dBm									
	01 -23.500	dBm							
-30 dBm									
-40 dBm						M2			
		L WALL				MARINA	www.mm .	whenh	. north range
-40 aBm	فبهما للتعود وليتعا للتعوين كمطروبا	In In	non mappine have	and the manufactor of the	n AM North	r 1 -	1 The Lewis	www.www.wy	pvr · · ·
Howald									
-60 dBm									
-70 dBm									
-80 dBm								ļ	
	Hz				pts				26.5 GHz

### Middle Channel (2 441 Mz)

Spectrum		ect <mark>ru</mark> m 2		bectrum 3	× S	pectrum -	4 🛛	_	(₩
Ref Level		Offset		3W 100 kHz					
Att TDE	30 dB	SWT	265 ms 👄 ۷	SW 300 KHZ	Mode A	uto Sweep			
1DF 1Pk View									
JIFK VIGW					M	2[1]			41.21 dBn
									5.5970 GH
0 dBm 🕂					M	1[1]			-1.73 dBn
									2.4500 GH:
-10 dBm			-						
-20 dBm	01 -21.730	dD							
	51 -21.730	ивш							
-30 dBm									
-40 dBm						M2			
			an and the second		. da a	Maria	MAN W	ik is	altoune
-50 dBm	Contraction of the second	C. alexandre	المربية المحالين المراجع	welly and the for	and all the sum	n dia i	were the	WWWWWW	N
1 walnut with a wall									
-60 dBm									
-70 dBm									
-80 dBm									
Start 30.0 /	MHz			1001	pts			Stop	26.5 GHz

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Page (71) of (72)

### Highest Channel (2 480 Mz)

Ref Level : Att	10.00 dBm 30 dB	Offset 0. SWT 2		3W 100 kHz 3W 300 kHz					
TDF	30 QB	5WI 2	65 ms 🖷 Vi	SW 300 KHZ	Mode A	uto Sweep			
1Pk View									
					M	2[1]			42.33 dBm
a Jan Mi									3.2100 GHz
0 dBm					M	1[1]			-1.99 dBm 2.4760 GHz
								l Î	
-10 dBm									
-20 dBm	01 -21.990	dBm							
00.40									
-30 dBm									
10 10						M2			
-40 dBm						LAN A MA	السبب ال	. 1	a she dan
E0 dDm	الماليك ملاحلها المار	approximited which	L. manager a	MARTIN	ally of Maria	Pra l'Aller a.	winny	when when	N HINA WAS
-40 dBm	No.	with the second se	p						
-60 dBm									
-oo abiii									
-70 dBm									
/ C GDIII									
-80 dBm									
00 00111									



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### 6. Test equipment used for test

	Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
	Spectrum Analyzer	R & S	FSV30	100810	18.08.01
	Spectrum Analyzer	R&S	FSV40	100988	19.01.05
	DC Power Supply	Agilent	E3632A	MY40007371	18.07.06
	Bluetooth Tester	TESCOM	TC-3000B	3000B640056	19.01.31
	Power Divider	Aeroflex/ Weinschel,Inc	1580-1	PE430	18.09.28
	Wideband Power Sensor	R&S	NRP-Z81	102398	19.01.31
•	ATTENUATOR	R & S	DNF Dämpfungsglied 10 dB in N-50 Ohm	31212	18.05.15
	EMI TEST RECEIVER	R&S	ESCI	100732	18.08.24
	Bi-Log Antenna	SCHWARZBECK	VULB 9163	552	18.05.10
	Amplifier	SONOMA INSTRUMENT	310N	186280	18.04.06
	Amplifier	SONOMA INSTRUMENT	310N	284608	18.08.24
	ATTENUATOR	HP	8491B	22891	18.08.05
	Horn antenna	ETS.lindgren	3116	00086635	18.04.25
	Horn antenna	ETS.lindgren	3115	62589	18.11.21
	AMPLIFIER	L-3 Narda-MITEQ	AMF-7D-01001800 -22-10P	2003683	18.06.12
	AMPLIFIER	L-3 Narda-MITEQ	JS44-18004000-33- 8P	2000997	18.08.09
	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	18.05.15
	Vector Signal Generator	R & S	SMBV100A	257566	19.01.05
	Signal Generator	R&S	SMR40	100007	18.05.15
	Cable Assembly	RadiAll	2301761768000PJ	17.30.38	-
	Cable Assembly	gigalane	RG-400	-	-
	Cable Assembly	HUBER+SUHNER	SUCOFLEX 104	MY4342/4	-