TEST REPORT

$\mathbf{\overline{U}}$ Dt&C

DT&C Co., Ltd.

42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17042 Tel : 031-321-2664, Fax : 031-321-1664

1. Report No: DRTFCC1802-0035

- 2. Customer
 - Name : Hyundai MOBIS Co., Ltd.
 - Address : 203 Teheran-ro, Gangnam-gu, Seoul, Korea, 135-977
- 3. Use of Report : FCC Original Grant
- 4. Product Name / Model Name : DIGITAL CAR AUDIO SYSTEM / ADB40GKAN FCC ID : TQ8-ADB40GKAN
- 5. Test Method Used : ANSI C63.10-2013

Test Specification : FCC Part 15 Subpart C.247

- 6. Date of Test : 2017.12.21~ 2018.01.17
- 7. Testing Environment : See appended test report.
- 8. Test Result : Refer to the attached test result.

Affirmation	Tested by	Reviewed by					
Ammadon	Name : JungWoo Kim	Name : GeunKi Son (Signature)					
The tes	st results presented in this test report are limited	only to the sample supplied by applicant and					
the use of	this test report is inhibited other than its purpose	e. This test report shall not be reproduced except					
	in full, without the written appro	val of DT&C Co., Ltd.					
	2018.02.12.						
	DT&C Co	., Ltd.					

If this report is required to confirmation of authenticity, please contact to report@dtnc.net

Test Report Version

Test Report No.	Date	Description
DRTFCC1802-0035	Feb. 12, 2018	Initial issue

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1. General Information

1.1 Testing Laboratory

DT&C Co., Ltd.

The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042. The site is constructed in conformance with the requirements.

- FCC MRA AG	C MRA Accredited lest firm No. : KR0034			
www.dtnc.net	. <u>dtnc.net</u>			
Telephone	Telephone : + 82-31-321-2664			
FAX	:	+ 82-31-321-1664		

1.2 Testing Environment

Ambient Condition		
Temperature	+21 °C ~ +25 °C	
 Relative Humidity 	37 % ~ 43 %	

1.3 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C63.4-2014 and ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95 % level of confidence.

Test items	Measurement uncertainty
Transmitter Output Power1.0 dB (The confidence level is about 95 %, k =	
Conducted spurious emission	1.1 dB (The confidence level is about 95 %, $k = 2$)
Radiated spurious emission (1 GHz Below)	5.1 dB (The confidence level is about 95 %, $k = 2$)
Radiated spurious emission (1 GHz ~ 18 GHz)	5.4 dB (The confidence level is about 95 %, $k = 2$)
Radiated spurious emission (18 GHz Above)	5.3 dB (The confidence level is about 95 %, $k = 2$)

1.4 Details of Applicant

Applicant	:	Hyundai MOBIS Co., Ltd.
Address	:	203 Teheran-ro, Gangnam-gu, Seoul, Korea, 135-977
Contact person	:	Seung Hoon Choe

1.5 Description of EUT

EUT	DIGITAL CAR AUDIO SYSTEM
Model Name	ADB40GKAN
Add Model Name	NA
Serial Number	Identical prototype
Hardware version	1.0
Software version	1.0
Power Supply	DC 14.4 V
Frequency Range	2402 MHz ~ 2480 MHz
Modulation Technique	GFSK, π/4-DQPSK, 8DPSK
Number of Channels	79
Antenna Type /Antenna Gain	Dielectric Chip Antenna / PK : -0.1 dBi

1.6 Declaration by the applicant / manufacturer

- NA

1.7 Information about the FHSS characteristics

- This Bluetooth module has been tested by a Bluetooth Qualification Lab, and we confirm the following :
 - A) The hopping sequence is pseudorandom
 - Note 1 : Pseudorandom Frequency Hopping Sequence Table as below:
 - Channel: 08, 24, 40, 56, 42, 54, 72, 09, 01, 11, 33, 41, 34, 42, 65, 73, 53, 69, 06, 22, 04, 20, 36, 52, 38, 46, 70, 78, 68, 76, 21, 29, 10, 26, 41, 58, 44, 60, 76, 13, 03, 11, 35, 43, 37, 45, 69, 77, 52, 71, 08, 24, 06, 24, 48, 56, 45, 46, 70, 01, 72, 06, 25, 33, 12, 28, 49, 60, 45, 58, 74, 13, 05, 18, 37, 49 etc
 - The System receiver have input bandwidths that match the hopping channel badwidths of Their corresponding transmitters and shift frequencies in synchroniztation with the transmit Ted signals.
 - B) All channels are used equally on average
 - C) The receiver input bandwidth equals the transmit bandwidth
 - D) The receiver hops in sequence with the transmit signal
- 15.247(g) : In accordance with the Bluetooth Industry Standard, the system is designed to comply with all
 of the regulations in Section 15.247 when the transmitter is presented with a continuous data
 (or information) system.
- 15.247(h) : In accordance with the Bluetooth Industry Standard, the system does not coordinate its channels selection / hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.
- 15.247(h) : The EUT employs Adaptive Frequency Hopping (AFH) which identifies sources of interference namely devices operating in 802.11 WLAN and excludes them from the list of available channels. The process of re-mapping reduces the number of test channels from 79 channels to a minimum number of 20 channels.

1.8 Test Equipment List

Туре	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal. Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	17/07/17	18/07/17	US47360812
Spectrum Analyzer	Agilent Technologies	N9020A	17/09/05	18/09/05	MY46471251
BlueTooth Tester	TESCOM	TC-3000C	17/01/11	18/01/11	- 3000C000396
Dide looin lester	TESCOM	10-30000	17/12/26	18/12/26	- 30000000390
DC Power Supply	Agilent Technologies	66332A	17/09/05	18/09/05	MY43000440
DC Power Supply	SM techno	SDP30-5D	17/04/12	18/04/12	305DKA013
Multimeter	FLUKE	17B	17/04/12	18/04/12	26030065WS
Dowor Colittor	Anritsu	K241B	17/01/11	18/01/11	- 1301184
Power Splitter	Annisu	N241D	17/12/27	18/12/27	- 1301184
Signal Generator	Rohde Schwarz	SMBV100A	17/01/04	18/01/04	255571
Signal Generator			17/12/27	18/12/27	
Signal Generator	Rohde Schwarz	SMF100A	17/04/21	18/04/21	102341
Thermohygrometer	BODYCOM	BJ5478	17/04/11	18/04/11	120612-2
Loop Antenna	Schwarzbeck	FMZB1513	16/04/22	18/04/22	1513-128
BILOG ANTENNA	Schwarzbeck	VULB 9160	16/08/05	18/08/05	9160-3362
Horn Antenna	ETS-LINDGREN	3117	16/05/03	18/05/03	00140394
Horn Antenna	A.H.Systems Inc.	SAS-574	17/04/25	19/04/25	154
PreAmplifier	Agilent Technologies	8449B	17/09/05	18/09/05	3008A02108
PreAmplifier	TSJ	MLA-010K01- B01-27	17/03/06	18/03/06	1844539
EMI Test Receiver	Rohde Schwarz	ESR7	17/02/16	18/02/16	101061
High-pass filter	Wainwright	WHKX12-2580- 3000-18000-80SS	17/09/05	18/09/05	3
High-pass filter	Wainwright	WHNX6-6320- 8000-26500- 40CC	17/09/05	18/09/05	1
Power Meter & Wide	Apritou	ML2495A	17/04/11	18/04/11	1306007
Bandwidth Sensor	Anritsu	MA2490A	17/04/11	18/04/11	1249001

Note: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017.

1.9 Summary of Test Results

FCC Part RSS Std.	Parameter	Limit (Using in 2400~ 2483.5 MHz)	Test Condition	Status Note 1
	Carrier Frequency Separation	>= 25 kHz or >= Two thirds of the 20 dB BW, whichever is greater.		с
15.247(a) RSS-247(5.1)	Number of Hopping Frequencies	>= 15 hops		С
1(00-247(0.1)	20 dB Bandwidth	N/A		С
	Dwell Time =< 0.4 seconds			С
15.247(b) RSS-247(5.4)	Transmitter Output Power	For FCC =< 1 Watt , if CHs >= 75 Others =< 0.125 W For IC if CHs >= 75 =< 1 Watt For Conducted Power =< 4 Watt For e.i.r.p, Others =< 0.125 W For Conducted Power. =< 4 Watt For e.i.r.p	Conducted	С
15.247(d) RSS-247(5.5)	Conducted Spurious Emissions	The radiated emission to any 100 kHz of out-band shall be at least 20 dB below the highest in-band spectral density.		с
RSS Gen(6.6)	Occupied Bandwidth (99 %)	N/A		NA
15.247(d) 15.205 & 209 RSS-247(5.5) RSS-Gen (8.9 & 8.10)	Radiated Spurious Emissions	FCC 15.209 Limits	Radiated	C Note2
15.207 RSS-Gen(8.8)	AC Conducted Emissions	FCC 15.207 Limits	AC Line Conducted	NA Note3
15.203 RSS-Gen(8.3)	Antenna Requirements	FCC 15.203	-	С
with OAT	ted emission tests below 30 MHz we	re performed on semi-anechoic cha	mber which is	correlated



1.10 Conclusion of worst-case and operation mode

The EUT has three type of modulation (GFSK, π /4DQPSK and 8DPSK).

Therefore all applicable requirements were tested with all the modulations.

And packet type was tested at the worst case(DH5).

Tested frequency information,

- Hopping Function : Enable

	TX Frequency (MHz)	RX Frequency (MHz)	
Hopping Band	2402 ~ 2480	2402 ~ 2480	

- Hopping Function : Disable

	TX Frequency (MHz)	RX Frequency (MHz)
Lowest Channel	2402	2402
Middle Channel	2441	2441
Highest Channel	2480	2480

2. Maximum Peak Output Power Measurement

2.1 Test Setup

Refer to the APPENDIX I.

2.2 Limit

FCC Requirements

The maximum peak output power of the intentional radiator shall not exceed the following :

- 1. §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 2400-2483.5 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.
- §15.247(b)(1), For frequency hopping systems operating in the 2400 2483.5 MHz employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725 5805 MHz band : 1 Watt.

IC Requirements

1. RSS-247(5.4), For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W.

2.3 Test Procedure

- 1. The RF output power was measured with a spectrum analyzer connected to the RF Antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency, A spectrum analyzer was used to record the shape of the transmit signal.
- 2. The peak output power of the fundamental frequency was measured with the spectrum analyzer using ;
 Span = approximately 5 times of the 20 dB bandwidth, centered on a hopping channel
 RBW ≥ 20 dB BW
 VBW ≥ RBW
 Sweep = auto
 Detector function = peak

Trace = max hold

2.4 Test Results

Modulation	Tested Channel		Average t Power	Peak Output Power		
Woddiation	lesteu Chaimei	dBm	mW	dBm	mW	
	Lowest	0.98	1.25	2.36	1.72	
<u>GFSK</u>	Middle	1.85	1.53	3.25	2.11	
	Highest	0.98	1.25	2.62	1.83	
	Lowest	-0.60	0.87	3.09	2.04	
<u>π/4DQPSK</u>	Middle	0.26	1.06	3.99	2.51	
	Highest	-0.60	0.87	3.38	2.18	
	Lowest	-0.56	0.88	3.61	2.30	
<u>8DPSK</u>	Middle	0.31	1.07	4.53	2.84	
	Highest	-0.61	0.87	3.96	2.49	

Note 1 : The frame average output power was tested using an average power meter for reference only. Note 2 : See next pages for actual measured spectrum plots.



Lowest Channel & Modulation : GFSK



Peak Output Power

Middle Channel & Modulation : GFSK





Highest Channel & Modulation : GFSK



Peak Output Power

Lowest Channel & Modulation : π/4DQPSK





Middle Channel & Modulation : π/4DQPSK



Peak Output Power

Highest Channel & Modulation : π/4DQPSK





Lowest Channel & Modulation : 8DPSK



Peak Output Power

Middle Channel & Modulation : 8DPSK





Highest Channel & Modulation : 8DPSK





3. 20 dB BW & Occupied BW

3.1 Test Setup

Refer to the APPENDIX I.

3.2 Limit

Limit : Not Applicable

3.3 Test Procedure

- 1. The 20 dB bandwidth & Occupied bandwidth were measured with a spectrum analyzer connected to RF antenna Connector(conducted measurement) while EUT was operating in transmit mode. The analyzer center frequency was set to the EUT carrier frequency, using the analyzer.
- 2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using below setting: RBW = 1% to 5% of the 20 dB BW & Occupied BW

VBW ≥ 3 × RBW

Span = between two times and five times the 20 dB bandwidth & Occupied BW

Sweep = auto

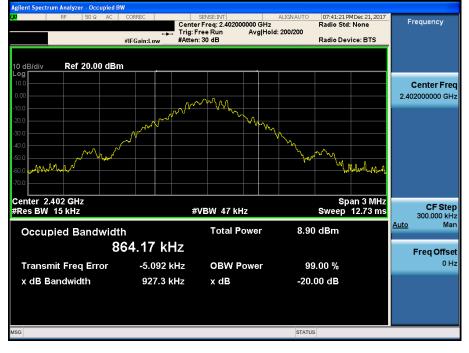
Detector function = peak

Trace = max hold

3.4 Test Results

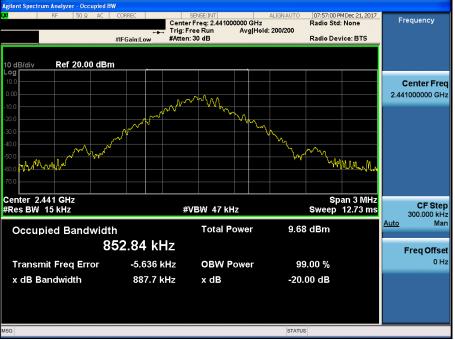
Modulation	Tested Channel	20 dB BW (MHz)	Occupied BW (MHz)	
	Lowest	0.927	-	
<u>GFSK</u>	Middle	0.888	-	
	Highest	0.888	-	
	Lowest	1.313	-	
<u>π/4DQPSK</u>	Middle	1.310	-	
	Highest	1.275	-	
	Lowest	1.258	-	
<u>8DPSK</u>	Middle	1.259	-	
	Highest	1.267	-	

Lowest Channel & Modulation : GFSK



20 dB Bandwidth

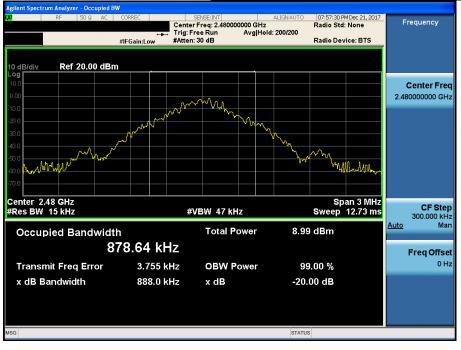
Middle Channel & Modulation : GFSK







Highest Channel & Modulation : GFSK



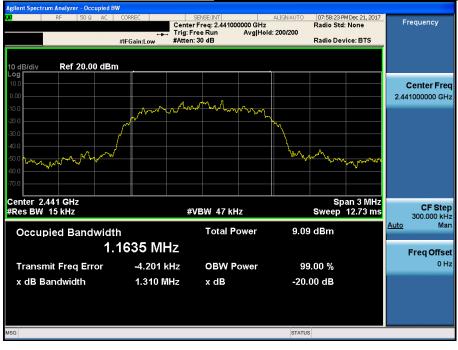
20 dB Bandwidth

07:58:00 PMDec 21, 2017 Radio Std: None Frequency Center Freq: 2.402000000 GHz Trig: Free Run Avg|Hold: 200/200 #Atten: 30 dB #IFGain:Low Radio Device: BTS 0 dB/div Ref 20.00 dBm **Center Freq** 2.402000000 GHz An M Span 3 MHz Sweep 12.73 ms Center 2.402 GHz #Res BW 15 kHz CF Step 300.000 kHz #VBW 47 kHz Man Auto Total Power 8.40 dBm Occupied Bandwidth 1.1600 MHz Freq Offset 0 Hz Transmit Freq Error -6.190 kHz **OBW Power** 99.00 % x dB Bandwidth 1.313 MHz x dB -20.00 dB

Lowest Channel & Modulation : π/4DQPSK



Middle Channel & Modulation : π/4DQPSK



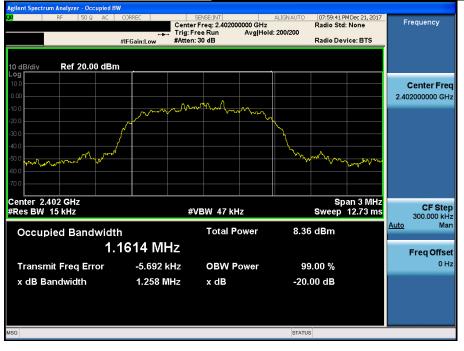
20 dB Bandwidth

Highest Channel & Modulation : π/4DQPSK 07:59:12 PMDec 21, 2017 Radio Std: None Frequency Center Freq: 2.480000000 GHz Trig: Free Run Avg|Hold: 200/200 #Atten: 30 dB #IFGain:Low Radio Device: BTS 0 dB/div Ref 20.00 dBm **Center Freq** 2.48000000 GHz YAA. M M N W. Mon war Span 3 MHz Sweep 12.73 ms Center 2.48 GHz #Res BW 15 kHz CF Step 300.000 kHz #VBW 47 kHz Man Auto Total Power 8.68 dBm Occupied Bandwidth 1.1589 MHz **Freq Offset** 0 Hz Transmit Freq Error -2.639 kHz **OBW Power** 99.00 % x dB Bandwidth 1.275 MHz x dB -20.00 dB

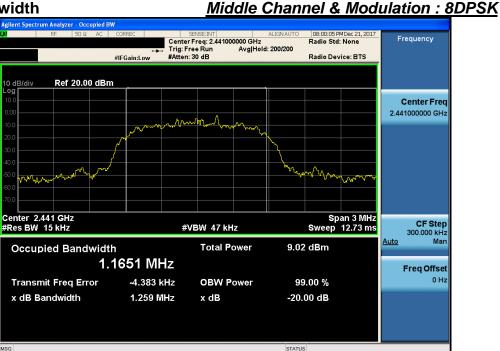




Lowest Channel & Modulation : 8DPSK



20 dB Bandwidth



TRF-RF-237(05)180118



Highest Channel & Modulation : 8DPSK





4. Carrier Frequency Separation

4.1 Test Setup

Refer to the APPENDIX I.

4.2 Limit

Limit : \geq 25 kHz or \geq Two-Thirds of the 20 dB BW whichever is greater.

4.3 Procedure

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

After the trace being stable, the reading value between the peaks of the adjacent channels using the markerdelta function was recorded as the measurement results.

The spectrum analyzer is set to :

Span = wide enough to capture the peaks of two adjacent channels

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.

 $VBW \ge RBW$ Sweep = autoDetector function = peakTrace = max hold

4.4 Test Results

Hopping Mode	Modulation	Peak of center channel (MHz)	Peak of adjacent Channel (MHz)	Test Result (MHz)
Enable	GFSK	2441.013	2442.013	1.000
	π/4-DQPSK	2441.007	2442.007	1.000
	8DPSK	2441.161	2442.161	1.000

AFH mode

Hopping Mode	Modulation Peak of center channel (MHz)		Peak of adjacent Channel (MHz)	Test Result (MHz)
Enable	GFSK	2410.960	2411.960	1.000
	π/4-DQPSK	2410.992	2411.992	1.000
	8DPSK	2411.150	2412.150	1.000

Note 1 : See next pages for actual measured spectrum plots.

- Minimum Standard :

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 2400 - 2483.5 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



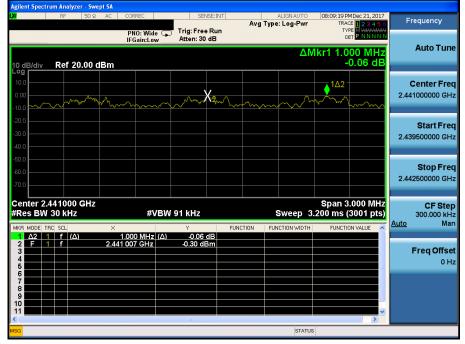
Carrier Frequency Separation (FH)

Hopping mode : Enable & GFSK



Carrier Frequency Separation (FH)

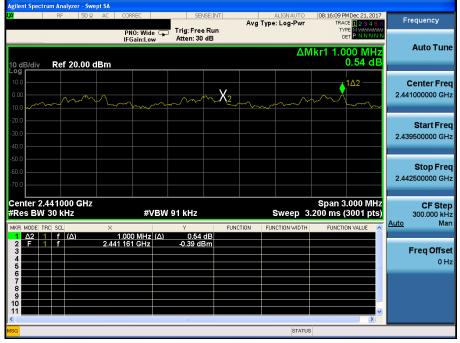
<u>Hopping mode : Enable & π/4DQPSK</u>





Carrier Frequency Separation (FH)

Hopping mode : Enable & 8DPSK





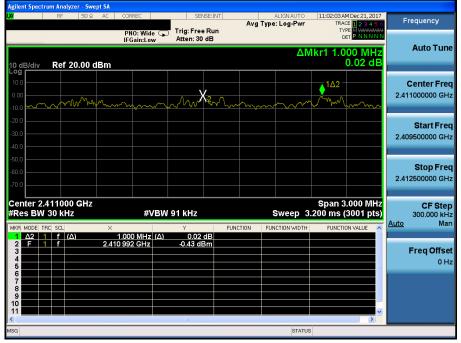
Carrier Frequency Separation (AFH) Hoppi

Hopping mode : Enable & GFSK



Carrier Frequency Separation (AFH)

<u>Hopping mode : Enable & π/4DQPSK</u>





Carrier Frequency Separation (AFH)

Hopping mode : Enable & 8DPSK

<mark>jlent Spectrum Analyzer - Swept SA</mark> RF 50 Ω AC	CORREC	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	11:03:13 AM Dec 21, 2017 TRACE 1 2 3 4 5 6	Frequency
0 dB/div Ref 20.00 dBm	PNO: Wide 🖵 IFGain:Low	Trig: Free Run Atten: 30 dB	ΔM	Ikr1 1.000 MHz -0.03 dB	Auto Tun
og 100 100 100	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		1Δ2 WWWW home from from from from from from from from	Center Fre 2.411000000 G⊢
20.0					Start Fre 2.409500000 G⊦
50.0 50.0					Stop Fre 2.412500000 GF
enter 2.411000 GHz Res BW 30 kHz KR MODE TRC SCL X		Y FUN	Sweep 3	Span 3.000 MHz .200 ms (3001 pts) FUNCTION VALUE	CF Ste 300.000 kł <u>Auto</u> Ma
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	1.000 MHz (Δ) 11 150 GHz	-0.03 dB 1.97 dBm			Freq Offso 0 ⊦
7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8				~	
G		-11	STATUS	,	



5. Number of Hopping Frequencies

5.1 Test Setup

Refer to the APPENDIX I.

5.2 Limit

Limit : >= 15 hops

5.3 Procedure

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

To get higher resolution, two frequency ranges for FH mode within the 2400 ~ 2483.5 MHz were examined.

The spectrum analyzer is set to :

Span for FH mode = 50 MHz	Start Frequency = 2391.5 MHz,	Stop Frequency = 2441.5 MHz
	Start Frequency = 2441.5 MHz,	Stop Frequency = 2491.5 MHz
Span for AFH mode = 30 MHz	Start Frequency = 2396.0 MHz,	Stop Frequency = 2426.0 MHz
		less than 30% of the channel spacing
or the 20 dB bandwidth, v	vhichever is smaller.	
VBW ≥ RBW	Sweep = auto	
Detector function = peak	Trace = max hold	

5.4 Test Results

FH mode

Hopping mode	Modulation	Test Result (Total Hops)
	GFSK	79
Enable	π/4-DQPSK	79
	8DPSK	79

AFH mode

Hopping mode	Modulation	Test Result (Total Hops)
	GFSK	20
Enable	π/4-DQPSK	20
	8DPSK	20

Note 1 : See next pages for actual measured spectrum plots.

- Minimum Standard :

At least 15 hopes

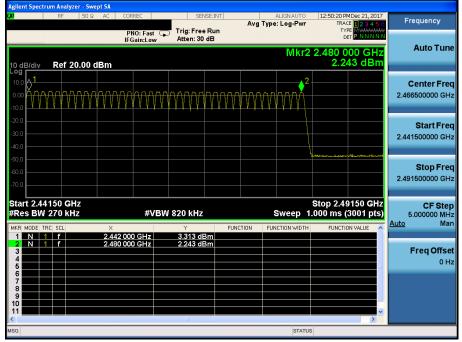
Number of Hopping Frequencies 1(FH)

Hopping mode : Enable & GFSK

Agnetic Spectrum Analyzer - She (X) RF 50 Ω	AC CORREC	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	11:25:51 AM Dec 21, 2017 TRACE 1 2 3 4 5 6 TYPE MWWWWW	Frequency
10 dB/div Ref 20.00 d	PNO: Fast C IFGain:Low IBM	Atten: 30 dB	Mkr2	2.441 000 GHz 3.247 dBm	Auto Tune
Log 10.0 0.00 -10.0					Center Freq 2.416500000 GHz
-20.0 -30.0 -40.0 -50.0					Start Freq 2.391500000 GHz
-60.0					Stop Freq 2.441500000 GHz
Start 2.39150 GHz #Res BW 270 kHz	X		Sweep 1	Stop 2.44150 GHz .000 ms (3001 pts) FUNCTION VALUE	CF Step 5.000000 MHz <u>Auto</u> Man
1 N 1 F 2 N 1 F 3 4 4 5 5 1 7 8 9 9 9 10 1 11 5 4 5 5 1 7 8 1	2.402 000 GHz 2.441 000 GHz	2.370 dBm 3.247 dBm			Freq Offset 0 Hz
MSG			STATUS	5	

Number of Hopping Frequencies 2(FH)







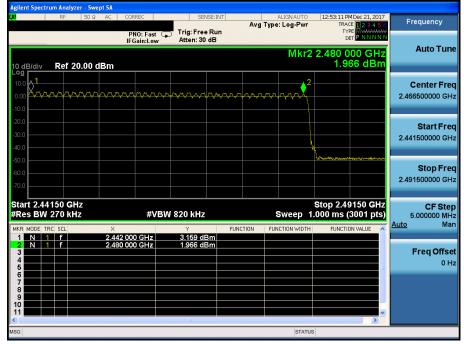
Number of Hopping Frequencies 1(FH)

Hopping mode : Enable & π/4DQPSK

Agitent Spectrum Analyzer - Sv LXI RF 50 9		SENSE:INT	ALIGN AUTO	11:29:14 AM Dec 21, 2017	
W Nr 303		Tala Face Day	Avg Type: Log-Pwr	TRACE 123456 TYPE MWWWWW	Frequency
10 dB/div Ref 20.00	PNO: Fast IFGain:Low dBm		Mkr2	2.441 000 GHz 3.157 dBm	Auto Tune
10.0 0.00		م <u>سم</u> مممم	مممحمم	han han have	Center Fred 2.416500000 GHz
-20.0 -30.0 -40.0					Start Fred 2.391500000 GHz
-50.0 44					Stop Freq 2.441500000 GHz
Start 2.39150 GHz #Res BW 270 kHz	#V ×	BW 820 kHz	Sweep 1	Stop 2.44150 GHz .000 ms (3001 pts)	CF Step 5.000000 MHz <u>Auto</u> Mar
1 N 1 f 2 N 1 f 3 4 5	2.402 000 GHz 2.441 000 GHz	2.385 dBm 3.157 dBm			Freq Offset 0 Hz
6 7 8 9 10 11				~	
K MSG		m	STATU	s	

Number of Hopping Frequencies 2(FH)

Hopping mode : Enable & π/4DQPSK





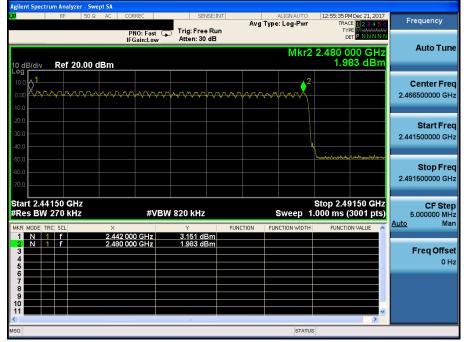
Number of Hopping Frequencies 1(FH)

Hopping mode : Enable & 8DPSK

Agilent Sp					_									
L XI	R	F 50	IΩ AC	CORREC		SEN	JSE:INT	Ava		ALIGN AUTO		M Dec 21, 2017 CE 123456	Frequen	су
				PNO: Fa		Trig: Free			. ,		TY			
				IFGain:L	ow	Atten: 30	dB				0	ET ER DE	Auto	T
										Mkr2		000 GHz	Auto	Tune
10 dB/di	iv Re	ef 20.00) dBm								3.1	49 dBm		
			. 1									2		
10.0			- 1¢ -										Center	
0.00			mmr	$\gamma \alpha \gamma \gamma$	ny ny ny	הלהלעלים	ጚጚ		γv	$\gamma \gamma $	γ	ᡩ᠕᠋ᡎᡘ᠕	2.41650000	0 GHz
-10.0														
-20.0													Start	Freq
-30.0													2.39150000	
-40.0		a	لير										2.39150000	U GHZ
-50.0	and the second	السالممعد												
													Stop	Freq
-60.0													2.44150000	
-70.0														
Start 2	30150	CH7									Stop 2.4	4150 GHz		
#Res B				#	VBW	820 kHz			s			(3001 pts)	5.00000	Step
MKR MODE			×		_	Y	50	NCTION		ICTION WIDTH		ON VALUE	Auto	Man
1 N				02 000 GH	7	2.354 di		NUTION	FUN	CTION WIDTH	FUNCT	UN VALUE		
2 N	1 f			41 000 GH:		3.149 di							Front	-
3													FreqC	0 Hz
5												=		UHZ
6														
8														
9														
11												~		
<	_	_			_	Ш		_	_			>		
MSG										STATUS	5			
-														

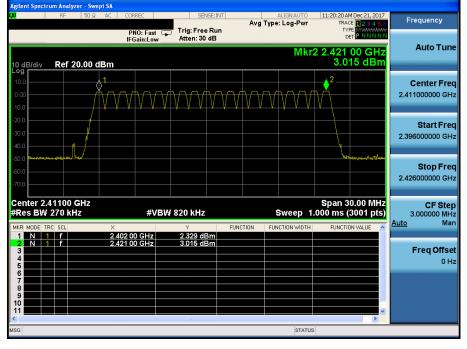
Number of Hopping Frequencies 2(FH)

Hopping mode : Enable & 8DPSK



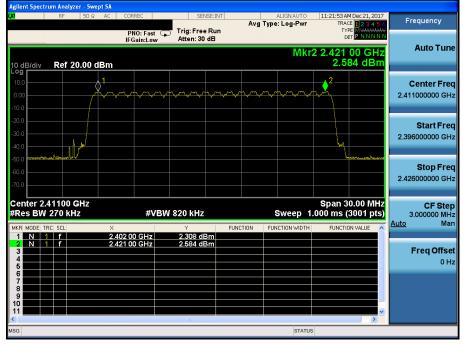
Number of Hopping Frequencies 1(AFH)

Hopping mode : Enable & GFSK



Number of Hopping Frequencies 1(AFH)





Number of Hopping Frequencies 1(AFH)

Hopping mode : Enable & 8DPSK

gilent Spectrum Analyzer - Swept SA				
RF 50 Ω AC		Avg Type: Log-Pwr	11:23:06 AM Dec 21, 2017 TRACE 1 2 3 4 5 6	Frequency
0 dB/div Ref 20.00 dBm	PNO: Fast 🖵 Trig: Free Run IFGain:Low Atten: 30 dB		TYPE MUMANAN DET PNNNNN r2 2.421 00 GHz 2.719 dBm	Auto Tune
		$\sqrt{1}$	2	Center Fre 2.411000000 GH
20.0				Start Fre 2.396000000 GH
50.0 xtructur (147			Visitanduselaar	Stop Fre 2.426000000 GH
Center 2.41100 GHz Res BW 270 kHz	#VBW 820 kHz	Sweep 7	Span 30.00 MHz 1.000 ms (3001 pts)	CF Ste 3.000000 M⊢ <u>Auto</u> Ma
2 N 1 f 2.4 3 -	402 00 GHz 2.127 dBm 421 00 GHz 2.719 dBm			Freq Offse 0 H
7 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9			~	
G		STATU	1.0	

6. Time of Occupancy (Dwell Time)

6.1 Test Setup

Refer to the APPENDIX I.

6.2 Limit

The maximum permissible time of occupancy is 400 ms within a period of 400 ms multiplied by the number of hopping channels employed.

6.3 Test Procedure

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

The spectrum analyzer is set to :

Center frequency = 2441 MHz (AFH: 2411MHz)

Span = zero

RBW = 1 MHz (RBW shall be \leq channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel) Detector function = peak

VBW ≥ RBW

Trace = max hold

6.4 Test Results

FH mode

Hopping mode	Packet Type	Number of hopping Channels	Burst On Time (ms)	Period (ms)	Test Result (sec)
	DH 5	79	2.880	3.750	0.307
Enable	2 DH 5	79	2.880	3.750	0.307
	3 DH 5	79	2.880	3.750	0.307

AFH mode

Hopping mode	Packet Type	Number of hopping Channels	Burst On Time (ms)	Period (ms)	Test Result (sec)
Enable	DH 5	20	2.880	3.750	0.154
	2 DH 5	20	2.880	3.750	0.154
	3 DH 5	20	2.880	3.750	0.154

Note 1 : Dwell Time = 0.4 × Hopping channel × Burst ON time ×

((Hopping rate ÷ Time slots) ÷ Hopping channel)

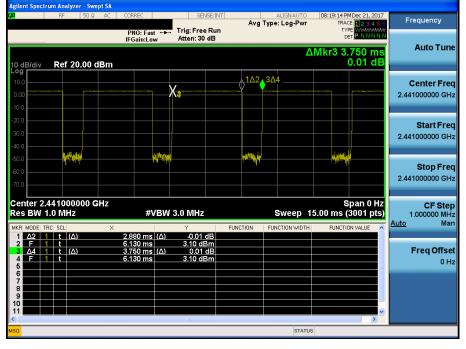
- Time slots for DH5 = 6 slots (TX = 5 slot / RX = 1 slot)
- Hopping Rate = 1600 for FH mode & 800 for AFH mode

Note 2 : See next pages for actual measured spectrum plots.



Hopping mode : Enable & DH5

Time of Occupancy (FH)



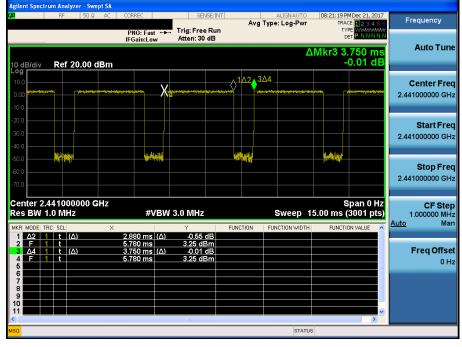
Hopping mode : Enable & 2-DH5

Time of Occupancy (FH) Frequency Avg Type: Log-Pwr Trig: Free Run Atten: 30 dB TYPI DE PNO: Fast +++ Auto Tune ΔMkr3 3.750 ms 0.00 dE 0 dB/div Ref 20.00 dBm **Center Freq** 2.441000000 GHz Start Freq 2.441000000 GHz 1.Phylip distant. Stop Freq 2.441000000 GHz Center 2.441000000 GHz Res BW 1.0 MHz CF Step 1.000000 MHz Man Span 0 Hz Sweep 15.00 ms (3001 pts) #VBW 3.0 MHz Auto FUNCTION FUNCTION WID $f(\Delta)$ Δ2 3.24 dBm 0.00 dB 3.24 dBm 1 t 1 t (Δ) 1 t Freq Offset Ť 0 Hz



Hopping mode : Enable & 3-DH5

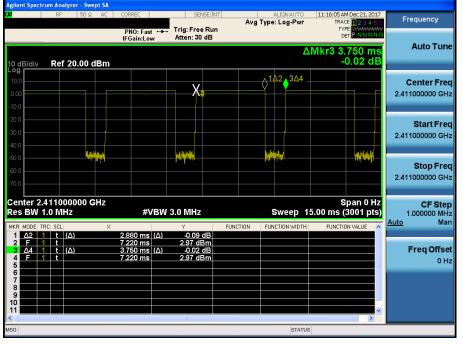
Time of Occupancy (FH)





Hopping mode : Enable & DH5

Time of Occupancy (AFH)



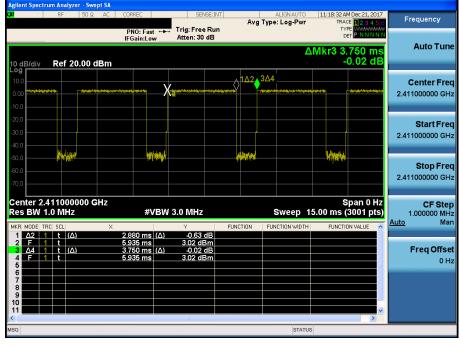
Time of Occupancy (AFH)

Hopping mode : Enable & 2-DH5 Frequency Avg Type: Log-Pwr Trig: Free Run Atten: 30 dB TYPI DE PNO: Fast +++ Auto Tune ΔMkr3 3.750 ms -0.01 dE 0 dB/div Ref 20.00 dBm ♦142 3∆4 **Center Freq** Х 2.411000000 GHz Start Freq 2.411000000 GHz White Stop Freq 2.411000000 GHz Center 2.411000000 GHz Res BW 1.0 MHz CF Step 1.000000 MHz Man Span 0 Hz Sweep 15.00 ms (3001 pts) #VBW 3.0 MHz Auto FUNCTION FUNCTION WID t (Δ) Δ2 3.04 dBn -0.01 dE 3.04 dBn 1 t 1 t (Δ) 1 t s s(∆) 3.750 m 5.710 m Freq Offset . ∆4 F 0 Hz



Hopping mode : Enable & 3-DH5

Time of Occupancy (AFH)





7. Transmitter Radiated Spurious Emissions and Conducted Spurious Emission

7.1 Test Setup

Refer to the APPENDIX I.

7.2 Limit

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval , as permitted under paragraph(b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in section §15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section §15.205(a), must also comply the radiated emission limits specified in section §15.205(c))

According to § 15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Limit (uV/m)	Measurement Distance (meter)
0.009 ~ 0.490	2400/F (kHz)	300
0.490 ~ 1705	24000/F (kHz)	30
1705 ~ 30.0	30	30
30 ~ 88	100 **	3
88 ~ 216	150 **	3
216 ~ 960	200 **	3
Above 960	500	3

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

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

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~ 12.52025	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.57675 ~ 12.57725	156.52475 ~ 156.52525	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	13.36 ~ 13.41	156.7 ~ 156.9	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	16.42 ~ 16.423	162.0125 ~ 167.17	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	16.69475 ~ 16.69525	167.72 ~ 173.2	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.80425 ~ 16.80475	240 ~ 285	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	25.5 ~ 25.67	322 ~ 335.4	2655 ~ 2900		
8.291 ~ 8.294	37.5 ~ 38.25	399.90 ~ 410	3260 ~ 3267		
8.362 ~ 8.366	73 ~ 74.6	608 ~ 614	3332 ~ 3339		
8.37625 ~ 8.38675	74.8 ~ 75.2	960 ~ 1240	3345.8 ~ 3358		
			3600 ~ 4400		

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 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, 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.