TEST REPORT					
	-dong) 406-gil sejaro, eonggi-do, Korea	Report No.: KST-F	CR-170007(1)	KOSTEC Co., Ltd. http://www.kostec.org	
1. Applicant					
•Name : CC	OWON SYSTEMS, Inc				
• Address : 6th	h FI. COWON TOWER	, 689-3,Yeoksam∙	Dong, Gangnam-Gu	, Seoul, South Korea	
2. Test Item					
 Product Name: 	PLENUE R				
Model Name:	PLENUE R				
• Brand:	PLENUE				
• FCC ID:	SXV-PLENUE-R				
3. Manufacturer					
• Name : CO	OWON SYSTEMS, Inc				
Address : 6th	h Fl. COWON TOWER	, 689-3,Yeoksam-	Dong, Gangnam-Gu	, Seoul, South Korea	
4. Date of Test :	2017. 09. 01. ~ 201	7. 09. 05.			
5. Test Method Us	FCC CFR 47, F DA 00-705	Part 15. Subpart C	-15.247		
6. Test Result :	Compliance				
7. Note: None					
Supplementary Info	ormation				
technical standards a	the brand name and FCC as indicated in the measu d in <u>ANSI C 63.10-2013.</u>	ID specified above urement report and	has been shown to cor was tested in accordance	nply with the applicable ce with measurement	
were made under Ch	uracy of data and all mea hief Engineer's supervisio vouch for the qualificatior	on. We assume full	responsibility for the cor	l by KOSTEC Co., Ltd. and mpleteness of these	
The result	s shown in this test repor	t refer only to the sa	ample(s) tested unless	otherwise stated.	
Ammalion	ested by ame : Lee, Mi-Young	, (Signature)	Technical Manager Name : Park, Gyeor	ng-Hyeon (Signature)	
´ 					
2017. 10. 10.					
	ł	OSTEC Co	., Ltd.		



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1. GENERAL INFORMATION

1.1 Test Facility

Test laboratory and address

KOSTEC Co., Ltd. 128(175-20,Annyeong-dong)406-gil sejaro, Hwaseong-si Gyeonggi-do, Korea

Registration information

KOLAS No. : 232 FCC Designation No. : KR0041 IC Registration Site No. : 8305A-1

1.2 Location





1.3 Revision History of test report

Re	. Revisions	Effect page	Reviewed	Date
-	Initial issue	All	Gyeong Hyeon, Park	2017. 09. 15.
1	Add modulation type	5	Gyeong Hyeon, Park	2017. 10. 10.



2. EQUIPMENT DESCRIPTION

The product specification described herein was declared by manufacturer. And refer to user's manual for the details.

Equipment Name	Digital audio player with bluetooth
Model No	PLENUE R
Usage	Digital audio player
Serial Number	Proto type
Modulation type	FHSS (GFSK, π/4 DQPSK, 8DPSK)
Emission Type	F1D/G1D
Maximum output power	1.88 dBm
Operated Frequency	2 402 MHz ~ 2 480 MHz
Channel Number	79
Operation temperature	-10 °C ~ 55 °C
Power Source	DC 3.7 V
Antenna Description	PCB antenna embed in PCB of EUT, max gain :3.5 dBi
	1. The device was operating at its maximum output power for all measurements.
Remark	2. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case (X) is shown in the report.
	3. The above DUT's information was declared by manufacturer. Please refer to the specifications or user manual for more detailed description.
FCC ID	SXV-PLENUE-R



3. SYSTEM CONFIGURATION FOR TEST

3.1 Characteristics of equipment

Digital audio player with bluetooth

3.2 Used peripherals list

Description	Model No.	Serial No.	Manufacture	Remark
Notebook	BCM-1063	2Z7S1Z1	Dell Inc	
Adapter	DA65NM111-00	None	Dell Inc	For notebook

3.3 Product Modification

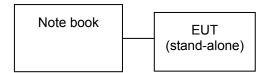
N/A

3.4 Operating Mode

Constantly transmitting with a modulated carrier at maximum power on the low, middle and high channels.

3.5 Test Setup of EUT

The measurements were taken in continuous transmit mode using the test mode which controlled by BlueSuite. The test program and the test Jig and cables were provided by the applicant.





3.6 Parameters of Test Software Setting

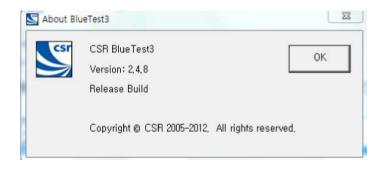
During testing, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

TX Power setting value during test

Dand	TX Power setting value				
Band	Low CH	Middle CH	High CH		
2.4 GHz band	255/50	255/50	255/50		

Test Program

BlueTest3				
Test Mode		- Test Arguments		Close
PAUSE RADIO STATUS RADIO STATUS FULL	Ê	LO Freq, (MHz)	2441	
TXSTART TXDATA1 TXDATA2		Power (Ext,Int)	255 50	Execute
TXDATA3 TXDATA4				Cold Reset
RXSTART1 RXSTART2 RXDATA1	-			Warm Reset
Test Results]			
Save to file	Browse fo	or file Disp	olay : 💿 Standard	C Bit Error
,₩logfile,txt				





3.7 Table for Test condition

Test Items	Channel No	Frequency (MHz)	Operated Condition
Channel Separation	39, 40	2 441, 2 442	Hopping on and continuous modulation setting mode
Number of Hopping Channels	0 ~ 78	2 402 ~ 2 480	Hopping on mode
Time of occupancy	39	2 441	Hopping on mode
	0	2 402	
Peak Output Power	39	2 441	Hopping off and continuous modulation setting mode
	78	2 480	
Rend edge Compliance	0	2 402	Hopping off and continuous
Band-edge Compliance	78	2 480	modulation setting mode
Spurious RF conducted emissions	-	-	Frequency band setting by required
Spurious radiated emissions	-	-	standard (FCC Rules)*

*Note: Channel number is selected lowest, middle, highest channel and also hopping on/off mode operation



3.8 Used Test Equipment List

No.	Instrument	Model	S/N	Manufacturer	Due to cal date	Cal interval	used
1	T & H Chamber	EY-101	90E14260	TABAI ESPEC	2018.09.06	1 year	
2	T & H Chamber	RCT-V-THC-403-1(H)	20030210	R.C.T	2018.09.06	1 year	
3	Spectrum Analyzer	8563E	3846A10662	Agilent Technology	2018.02.02	1 year	
4	Spectrum Analyzer	8593E	3710A02859	Agilent Technology	2018.02.02	1 year	
5	Spectrum Analyzer	FSV30	20-353063	Rohde& Schwarz	2018.02.01	1 year	\square
6	Signal Analyzer	N9010A	MY56070441	Agilent Technologies	2018.05.15	1 year	
7	EMI Test Receiver	ESCI7	100823	Rohde& Schwarz	2018.01.31	1 year	\boxtimes
8	EMI Test Receiver	ESI	837514/004	Rohde& Schwarz	2018.09.05	1 year	\boxtimes
9	Vector Signal Analyzer	89441A	3416A02620	Agilent Technology	2018.02.03	1 year	
10	Network Analyzer	8753ES	US39172348	AGILENT	2018.09.04	1 year	
11	EPM Series Power meter	E4418B	GB39512547	Agilent Technology	2018.02.01	1 year	
12	RF Power Sensor	E9300A	MY41496631	Agilent Technology	2018.02.01	1 year	
13	Microwave Frequency Counter	5352B	2908A00480	Agilent Technology	2018.02.01	1 year	
14	Modulation Analyzer	8901A	3538A07071	Agilent Technology	2018.02.02	1 year	
15	Audio Analyzer	8903B	3514A16919	Agilent Technology	2018.01.31	1 year	
16	Audio Telephone Analyzer	DD-5601CID	520010281	CREDIX	2018.02.02	1 year	
17	Digital storage Oscilloscope	TDS3052	B015962	Tektronix	2018.09.04	1 year	
18	ESG-D Series Signal Generator	E4436B	US39260458	Agilent Technology	2018.02.02	1 year	
19	Vector Signal Generator	SMBV100A	257557	Rohde & Schwarz	2018.02.02	1 year	
20	Signal Generator	SMB100A	179628	Rohde & Schwarz	2018.05.18	1 year	
21	Tracking Source	85645A	070521-A1	Agilent Technology	2018.02.03	1 year	
22	SLIDAC	None	0207-4	Myoung sung Ele.	2018.01.31	1 year	
23	DC Power supply	DRP-5030	9028029	Digital Electronic Co.,Ltd	2018.02.01	1 year	
24	DC Power supply	6038A	3440A12674	Agilent Technology	2018.01.31	1 year	
25	DC Power supply	E3610A	KR24104505	Agilent Technology	2018.01.31	1 year	
26	DC Power supply	UP-3005T	68	Unicon Co.,Ltd	2018.01.31	1 year	
27	DC Power Supply	SM 3004-D	114701000117	DELTA ELEKTRONIKA	2018.01.31	1 year	
28	Dummy Load	8173	3780	Bird Electronic Co., Corp	2018.02.03	1 year	
29	Attenuator	50FH-030-500	140410 9433	JEW Idustries Inc.	2018.02.02	1 year	
30	Attenuator	24-30-34	BX5630	Aeroflex / Weinschel	2017.12.27	1 year	
31	Attenuator	8498A	3318A09485	HP	2018.02.01	1 year	
32	Step Attenuator	8494B	3308A32809	HP	2018.02.02	1 year	
33	Attenuator	18B50W-20F	64671	INMET	2018.02.02	1 year	
34	Attenuator	10 dB	1	Rohde & Schwarz	2018.05.18	1 year	
35	Attenuator	10 dB	2	Rohde & Schwarz	2018.05.18	1 year	
36	Attenuator	10 dB	3	Rohde & Schwarz	2018.05.18	1 year	
37	Attenuator	10 dB	4	Rohde & Schwarz	2018.05.18	1 year	
38	Attenuator	54A-10	74564	WEINSCHEL	2018.05.18	1 year	
39	Attenuator	56-10	66920	WEINSCHEL	2018.05.18	1 year	
40	Power divider	11636B	51212	HP	2018.03.18		
40		KPDSU3W	00070365	KMW	2018.02.01	1 year	
41	3Way Power divider		173834			1 year	
	4Way Power divider	70052651		KRYTAR	2018.02.01	1 year	
43	3Way Power divider	1580	SQ361	WEINSCHEL	2018.05.18	1 year	
44	OSP	OSP120	101577	Rohde & Schwarz	2018.05.19	1 year	
45	White noise audio filter	ST31EQ	101902	SoundTech	2018.09.04	1 year	
46	Dual directional coupler	778D	17693	HEWLETT PACKARD	2018.02.02	1 year	
47	Dual directional coupler	772D	2839A00924	HEWLETT PACKARD	2018.02.02	1 year	
48	Band rejection filter	3TNF-0006	26	DOVER Tech	2018.02.03	1 year	
49	Band rejection filter	3TNF-0008	317	DOVER Tech	2018.02.03	1 year	
50	Band rejection filter	3TNF-0007	311	DOVER Tech	2018.02.03	1 year	



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No.	Instrument	Model	S/N	Manufacturer	Due to cal date	Cal interval	used
51	Band rejection filter	WTR-BRF2442-84NN	09020001	WAVE TECH Co.,LTD	2018.02.02	1 year	\boxtimes
52	Band rejection filter	WRCJV12-5695-5725- 5825-5855-50SS	1	Wainwright Instruments GmbH	2018.05.18	1 year	
53	Band rejection filter	WRCJV12-5120-5150- 5350-5380-40SS	4	Wainwright Instruments GmbH	2018.05.18	1 year	
54	Band rejection filter	WRCGV10-2360-2400- 2500-2540-50SS	2	Wainwright Instruments GmbH	2018.05.18	1 year	
55	Highpass Filter	WHJS1100-10EF	1	WAINWRIGHT	2018.02.02	1 year	
56	Highpass Filter	WHJS3000-10EF	1	WAINWRIGHT	2018.02.02	1 year	
57	Highpass Filter	WHNX6-5530-3000- 26500-40CC	2	Wainwright Instruments GmbH	2018.05.19	1 year	
58	Highpass Filter	WHNX6-2370-7000- 26500-40CC	4	Wainwright Instruments GmbH	2018.05.19	1 year	
59	WideBand Radio Communication Tester	CMW500	102276	Rohde & Schwarz	2018.02.03	1 year	
60	Radio Communication Tester	CMU 200	112026	Rohde & Schwarz	2018.02.03	1 year	
61	Bluetooth Tester	TC-3000B	3000B6A0166	TESCOM CO., LTD.	2018.02.03	1 year	
62	Loop Antenna	6502	9203-0493	EMCO	2019.05.29	2 year	\boxtimes
63	BiconiLog Antenna	3142B	9910-1432	EMCO	2018.04.25	2 year	\boxtimes
64	Trilog-Broadband Antenna	VULB 9168	9168-606	SCHWARZBECK	2018.09.09	2 year	
65	Horn Antenna	3115	2996	EMCO	2018.02.11	2 year	\boxtimes
66	Horn Antenna	BBHA9170	BBHA9170152	SCHWARZBECK	2019.04.25	2 year	\square
67	Antenna Master(3)	AT13	None	AUDIX	N/A	N/A	\boxtimes
68	Turn Table(3)	None	None	AUDIX	N/A	N/A	\square
69	PREAMPLIFIER(3)	8449B	3008A02577	Agilent	2018.02.01	1 year	\square
70	Antenna Master(10)	MA4000-EP	None	inno systems GmbH	N/A	N/A	\boxtimes
71	Turn Table(10)	None	None	inno systems GmbH	N/A	N/A	\square
72	AMPLIFIER(10)	TK-PA6S	120009	TESTEK	2018.01.31	1 year	\boxtimes
73	Antenna Mast	MA2000-EP	None	inno systems GmbH	N/A	N/A	
74	Turn Device	DE3700-RH	None	inno systems GmbH	N/A	N/A	



4. SUMMARY TEST RESULTS

Description of Test	FCC Rule	Reference Clause	Used	Test Result
Peak Output Power	§ 15.247(b)(1)	Clause 5.1	\boxtimes	Compliance
20 dB Bandwidth	§ 15.247(a)(1)	Clause 5.2		Compliance
Channel Separation	§ 15.247(a)(1)	Clause 5.3		Compliance
Number of Hopping Channels	§ 15.247(a)(1)	Clause 5.4		Compliance
Time of Occupancy	§ 15.247(a)(1)	Clause 5.5		Compliance
Conducted Spurious Emissions	§ 15.247(d)	Clause 5.6		Compliance
Radiated Spurious Emissions	§ 15.247(d), § 15.209, and § 15.205	Clause 5.7		Compliance
Antenna Requirement	§ 15.203	Clause 5.8		Compliance
AC Power Conducted emissions	§ 15.207	Clause 5.9		N/A

 $\label{eq:compliance: The EUT complies with the essential requirements in the standard.$

Not Compliance : The EUT does not comply with the essential requirements in the standard.

N/A : The test was not applicable in the standard. ; This test item is not applicable as the product solely employs battery power for operation. The product does not transmit during charging mode.

Procedure Reference

FCC CFR 47, Part 15. Subpart C-15.247 DA 00-705 ANSI C 63.10-2013



5. MEASUREMENT RESULTS

5.1 Peak Output Power

5.1.1 Standard Applicable [FCC §15.247(b)(1)]

For frequency hopping systems operating in the 2 400 ~ 2 483.5 MHz band employing at least 75 nonoverlapping hopping channels, and all frequency hopping systems in the 5 725 ~ 5 850 MHz band : 1 Watt. For all other frequency hopping systems in the 2400 ~ 2483.5 MHz band: 0.125 watts.

5.1.2 Test Environment conditions

• Ambient temperature : (22 ~ 23) °C • Relative Humidity : (48 ~ 50) % R.H.

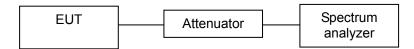
5.1.3 Measurement Procedure

ANSI C63.10: 2013 and FCC Public Notice DA 00-705 Released March 30, 2000: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems. The peak output power was measured using the marker to peak function of the spectrum analyzer.

The spectrum analyzer is set to the as follows :

- Span : approximately 5 times the 20 dB bandwidth
- RBW : > 20 dB bandwidth of the emission being measured
- VBW \geq RBW.
- Sweep time = auto
- Detector = peak.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level.

5.1.4 Test setup



5.1.5 Measurement Result

BDR(GFSK)

Channel	Frequency	Output Power Limit [MHz] [dBm]		Test Results
Channer				iest Results
0	2 402	1.04	30	Compliance
39	2 441	1.37	30	Compliance
78	2 480	1.88	30	Compliance



EDR(π/4DQPSK)

Channal	Frequency	Output Power	Limit	Test Desults	
Channel	[MHz]	[dBm]	[dBm]	Test Results	
0	2 402	-0.08	30	Compliance	
39	2 441	0.35	30	Compliance	
78	2 480	0.80	30	Compliance	

EDR(8DPSK)

Channel	Frequency	Output Power	Limit	Test Results	
Channel	[MHz]	[dBm]	[dBm]	Test Results	
0	2 402	0.13	30	Compliance	
39	2 441	0.55	30	Compliance	
78	2 480	1.04	30	Compliance	



5.1.6 Test Plot

BDR(GFSK)

CH Low

The second secon	2 (8)	Auto FFT		BW 1 MHz BW 3 MHz	.00 dB 🖷	Spectrum 3 0 dBm Offset 2 20 dB = SWT	Spectrum Ref Level 21.0 Att
		AUTO FF1	Mode	DW 3 MHz	20 hs	20 05 - 341	1Pk Max
1.04 dBr 2.40216480 GH	7	M1[1]	N				
							10 dBm
			M1				0 dBm
	-						0 dBm
		-					-10 dBm
	-						-20 dBm
	-						-30 dBm
							Calculation .
	-	-					-40 d8m
							-50 dBm
							-50 GBW
							-60 d8m
				-			-70 dBm
Span 3.0 MHz			ts	1001 p			CF 2.402 GHz
ANN AND AND AND	asuring	Meas		2001)r

CH Middle

Spectrum	Spectrum 3	Spectrum -		8 (X)	u
Ref Level 21.0 Att	0 dBm Offset 2 20 dB = SWT	21.00 dB			
1Pk Max					
			M1[1]	2.44	1.37 dBn 082320 GHa
10 dBm					
		M1			
0 dBm				<u> </u>	
-10 dBm					
-20 dBm-	_				
-30 d8m					
-40 d8m	_				-
-50 d8m					
-50 GBW					
-60 d8m					-
-70 d8m					
-70 08/1					
CF 2.441 GHz		100	1 pts	Spa	an 3.0 MHz
1			Mea	suring	440

Spectrum	Spect	rum 3	× 5	pectrum 4	×	Spectrum 2	×		
Ref Level 21.00 Att	dBm dBm dB			RBW 1 MHz VBW 3 MHz	Mode	Auto FFT			
1Pk Max									
						M1[1]		2.475	1.88 dBn 82920 CH
10 dBm	-								
				M1					
0 dBm		-					-		
	-							-	
-10 dBm	-							-	
-20 dBm									
-30 d8m	-								-
-40 d8m	_					+			
-50 dBm	-			+ +		+ +			-
100.00									
-60 d8m		_				-	-		
-70 d8m									
-70 dBm									
CF 2.48 GHz				1001	nts	1		Sna	in 3.0 MHz
1				1001		Measu	-	CHARMEN (



EDR(π/4DQPSK)

CH Low

9	Spectrum 4 🛛 🗶	3 ×	Spectrum 3	×	ctrum 2	Spe	Spectrum
	e Auto FFT		RBW 1 MHz VBW 3 MHz			1.00 dBm 20 dB	Ref Level 21 Att
							1Pk Max
-0.08 dB 2.40211090 G	-M1[1]						
				-		-	10 dBm
		M1					0 dBm
-		1				-	
		-	+ +	-		-	-10 dBm
							-20 dBm
							-30 d8m
							-40 d8m
				-			-50 dBm
				-			-60 d8m
		-	-	-			-70 d8m
Span 3.0 MH		1 pts	1001			z	CF 2.402 GH

CH Middle

Spectrum	Spec	trum 2	×	Spectr	um 3	X	Spectrur	n 4	×		
Ref Level 21.00 Att	I dBm 20 dB .		21.00 dB 38 µs	RBW VBW		Mode	Auto FFT				
1Pk Max						100000					
							M1[1]			2.440	0.35 dBn 88310 CH
10 dBm	-		-	+	-		-	-	-		
					M1						
0 dBm				-	-		_	-	-	1	
-10 dem				+	-		-	+			
-20 dBm	_			+	_		_	_	_		
-30 dBm	-		-	+	-		-	-	-		
-40 d8m	_			+	-		-	_	_		
-50 dBm	-			-	_		-	-	-		
-60 d8m				+	-			+			
-70 dBm	-				-		-	-			
CF 2.441 GHz					1001 p	ts		1	6	Spa	n 3.0 MHz
The second se							4	easurin		HERRER P.	4,40

	Spectrum 4 🕷	Spectrum 3	Spectrum 2	Spectrum
	Mode Auto FFT	1.00 dB • RBW 1 MHz 38 µs • VBW 3 MHz	1.00 dBm Offset 2: 20 dB - SWT	Ref Level 21 Att
				1Pk Max
0.80 dBr 2.47987410 GH	M1[1]			
				10 dBm
		M1		
				3 dBm
				10 d8m
				20 dBm
-				30 dBm
				40 d8m
				50 dBm
				60 d8m
				70 dBm
Span 3.0 MHz	ts	1001 p		CF 2.48 GHz
C	Measuring		1	



EDR(8DPSK)

CH Low

	4 🛞	Spectrum	pectrum 3	× 5	ctrum 2	Spee	Spectrum
•		Mode Auto FFT	RBW 1 MHz VBW 3 MHz			21.00 dBm 20 dB =	Ref Level Att
							1Pk Max
0.13 dBr 2.40200300 GH		M1[1]					
							10 dBm-
			M1				
	-		- *	-	-		0 dBm
							-10 dBm
							-20 dBm-
							20 000
			-	-			-30 dBm-
							100000000
	-						-40 d8m-
							-50 dBm-
							-60 d8m-
	-		-	-			-70 dBm-
Span 3.0 MHz	-	ts	1001 p	-		Hz	CF 2.402 G

CH Middle

Spectrum	Spec	trum 2	×	Spectr	um 3	× Sp	ectrum 4	×		
Ref Level 21.00 Att	I dBm 20 dB .		21.00 dB 38 µs			Mode Au	to FFT			
1Pk Max						1				
						MI	1]		2.44	0.55 dBn 098500 CH
10 dBm	-		-	-	-				1	
_					ML					
0 dBm	-		-	+				-	1.00	1
-10 dem			-	+	-			-		-
-20 dBm	_			+-	_					
-30 dBm	-			-	-	-				
-40 dBm	_			+-	_					
-50 dBm	_		-	-	_					
-60 d8m	-		-	-	_				-	
-70 d8m	-		-		-					-
CF 2.441 GHz					1001	its			Spa	an 3.0 MHz
The second se							Measu	ring I		4,40

	Spectrum 4 🛛 🛞	Spectrum 3	Spectrum 2 🛛 🏵	
	de Auto FFT	 RBW 1 MHz VBW 3 MHz 		Att 20 dBr
				1Pk Max
1.04 dBr 2.47999100 GH	M1[1]			
				10 dBm
		M		
				3 dBm-
				10 dem
				20 dBm
		-		30 d8m
				40 d8m
-		-	-	50 dBm
				60 d8m
		-		70 dBm
Span 3.0 MHz		1001 pt		CF 2.48 GHz
11 11111111 4/0	Measuring			1 M



5.2 20 dB Bandwidth

5.2.1 Standard Applicable [FCC §15.247(a)(1)]

Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(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. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

5.2.2 Test Environment conditions

• Ambient temperature : (22 ~ 23) °C • Relative Humidity : (48 ~ 50) % R.H.

5.2.3 Measurement Procedure

ANSI C63.10: 2013 and FCC Public Notice DA 00-705 Released March 30, 2000: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.

2. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW \geq 1 % of the 20 dB bandwidth and VBW \geq RBW.

3. Measured the spectrum width with power higher than 20 dB below carrier.

5.2.4 Test setup



5.2.5 Measurement Result

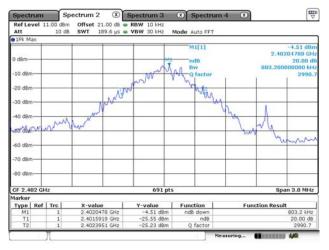
Modulation Type	Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99 % Bandwidth [MHz]	Limit [MHz]	Test Results
	0	2 402	0.80	0.86	-	Compliance
BDR(GFSK)	39	2 441	0.80	0.86	-	Compliance
	78	2 480	0.80	0.86	-	Compliance
	0	2 402	1.20	1.19	-	Compliance
EDR(π/4DQPSK)	39	2 441	1.19	1.19	-	Compliance
	78	2 480	1.19	1.18	-	Compliance
	0	2 402	1.21	1.19	-	Compliance
EDR(8DPSK)	39	2 441	1.25	1.19	-	Compliance
	78	2 480	1.25	1.19	-	Compliance



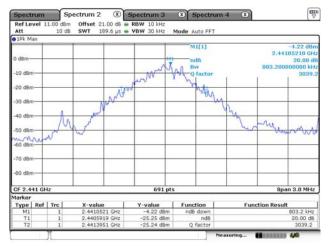
5.2.6 Test Plot (20 dB bandwidth)

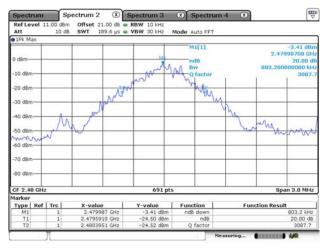
BDR(GFSK)

CH Low



CH Middle

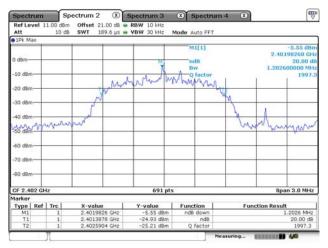




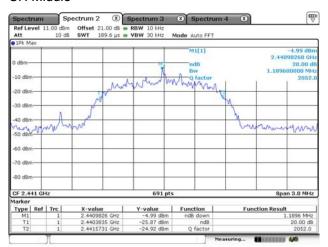


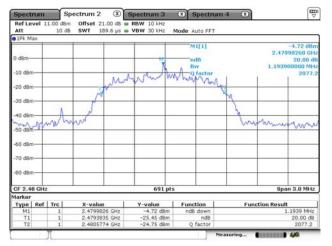
EDR(π/4DQPSK)

CH Low



CH Middle

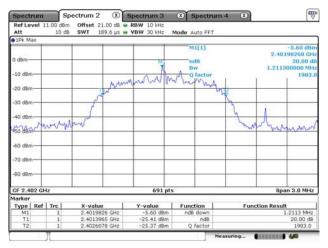




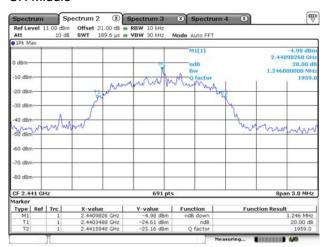


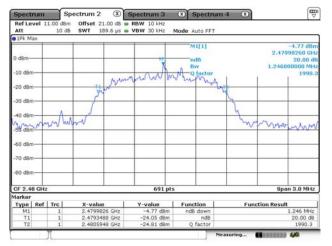
EDR(8DPSK)

CH Low



CH Middle



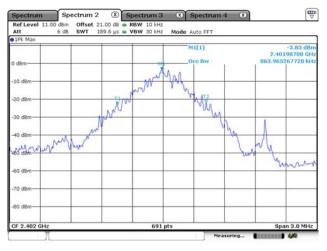




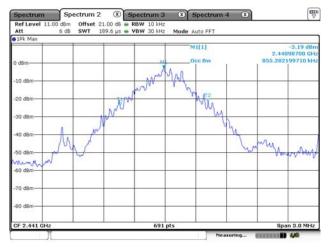
Test Plot (99 % bandwidth)

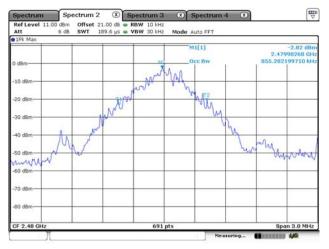
BDR(GFSK)

CH Low



CH Middle

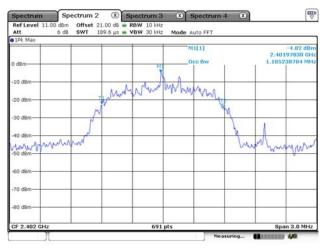




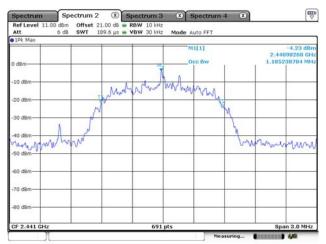


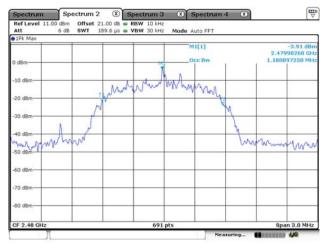
EDR(π /4DQPSK)

CH Low



CH Middle

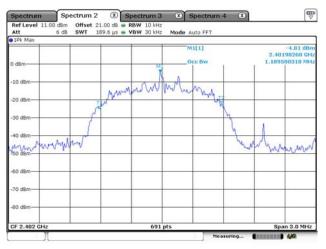




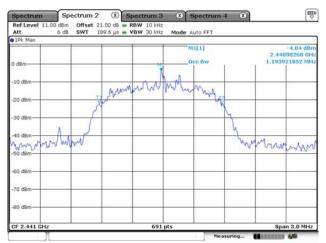


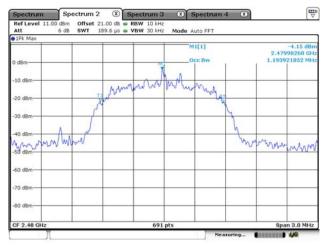
EDR(8DPSK)

CH Low



CH Middle







5.3 Channel Separation

5.3.1 Standard Applicable [FCC §15.247(a)(1)]

Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(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. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

5.3.2 Test Environment conditions

• Ambient temperature : (22 ~ 23) °C • Relative Humidity : (48 ~ 50) % R.H.

5.3.3 Measurement Procedure

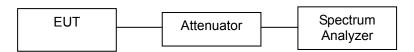
ANSI C63.10: 2013 and FCC Public Notice DA 00-705 Released March 30, 2000: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

- 1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
- 2. The resolution bandwidth of 30 kHz and the video bandwidth of 100 kHz were used.
- 3. After the trace being stable, the reading value between the peak of the adjacent channels using the marker- Delta function was recorded as the measurement results.

The spectrum analyzer is set to the as follows :

- Span : wide enough to capture the peak of two adjacent channels
- RBW : ≥ 1% of the span
- VBW : ≥ RBW
- Sweep : auto
- Detector function : peak
- Trace : max hold

5.3.4 Test setup



5.3.5 Measurement Result

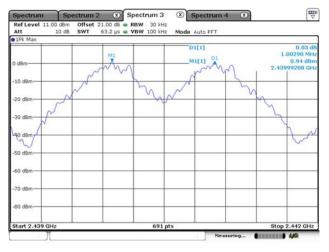
Modulation Type	Channel	Frequency[MHz]	Channel Separation(MHz)	Limit(MHz)	Test Results
BDR(GFSK)	39	2441	1.00	≥0.53	Compliance
EDR(π/4DQPSK)	39	2441	1.00	≥0.80	Compliance
EDR(8DPSK)	39	2441	1.00	≥0.83	Compliance

* Limit : ≥ 25 kHz or two-thirds of the 20 dB bandwidth

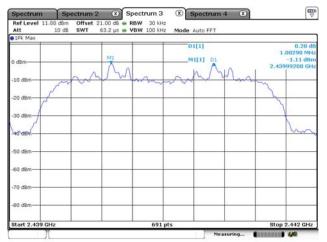


5.3.6 Test plot

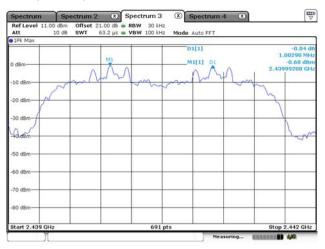
BDR(GFSK)



EDR(π/4DQPSK)



EDR(8DPSK)





5.4 Number of Hopping Channels

5.4.1 Standard Applicable [FCC §15.247(a)(1) / RSS-247, 5.1.4]

Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(1)(iii) Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

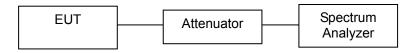
5.4.2 Test Environment conditions

• Ambient temperature : (22 ~ 23) °C • Relative Humidity : (48 ~ 50) % R.H.

5.4.3 Measurement Procedure

ANSI C63.10: 2013 and FCC Public Notice DA 00-705 Released March 30, 2000: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

5.4.4 Test setup



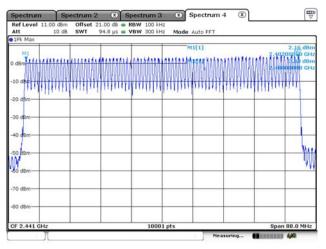
5.4.5 Measurement Result

Modulation Type	Hopping channels number	Limit	Test Results
BDR(GFSK)	79	≥15	Compliance
EDR(π/4DQPSK)	79	≥15	Compliance
EDR(8DPSK)	79	≥15	Compliance



5.4.6 Test plot

BDR(GFSK)



EDR(π/4DQPSK)

Ref Level Att	11.00 dBm 10 dB	Offset 2 SWT	1.00 dB 🖷 R 94.8 µs 🖷 🕅	BW 100 kH		Auto FFT			
1Pk Max	10.08	341	94.0 h> 🖷 🕯	BW 300 KF	ie Mode	AUTO FFT			
					M	2[1]			4.48 dBn
MI		in		mm			mann	111121480	парада сн
dBm	MMM	WWW	WWWW	MMMA	WWWWWWWW	MMM	www	MMM	data dBr
1					10000		1.00000000		
10 dBm-									
0 dBm-									
-mab Us									4
dam-		-	-	-		-			
									1
meb 0									N N
50 dBm					-	-			-
70 dBm-							-	-	-
30 dBm			-						-
tart 2.397	GHz			1000	1 ots			Stop	2.485 GHz

EDR(8DPSK)

Spectrum	and the second se	ectrum 2	and the second se	BW 100 k		Spectrum	4 ∞[∇
Att	11.00 dBm 10 dB	SWT	21.00 dB 🖷 🛙			Auto FFT			
1Pk Max	10.00					Note III			
MI			10.00		N	12[1]		1000000	4.mbdBr
Ten			www	14114143				ឈាណ	THE CH
0 dBm	VVVVVVV	MANAN	WWWWW	******	******	WWWWW	*****	VVVV2.48	200000 CH
10000							1	p contraction	and the second
10 dBm-									
20 dBm									
30 dBm-									
30 OBm-									1
40 d8m-		-					0		1.1.1
1 oum									V
dam-									1
60 dBm		-	-			-		-	-
1111111111									
70 d8m-		<u> </u>		<u> </u>					
-80 dBm		-	-	-	-	-			-
start 2.39	7 GHz		-	1000	1 pts	-	-	Stop	2.485 GHz



5.5 Time of Occupancy

5.5.1 Standard Applicable [FCC §15.247(a)(1) / RSS-247, 5.1.2]

(1)(iii) 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.

5.5.2 Test Environment conditions

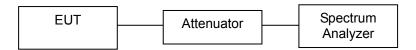
• Ambient temperature : (22 ~ 23) °C • Relative Humidity : (48 ~ 50) % R.H.

5.5.3 Measurement Procedure

ANSI C63.10: 2013 and FCC Public Notice DA 00-705 Released March 30, 2000: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled. After used the marker-delta function to determine the dwell time.

5.5.4 Test setup



5.5.5 Measurement Result

Burst width	per one hop (ms)	Test	Results	
(T	ïme slot)		Dwell time (ms)	Limit	Result
	DH1	0.391	0.125	≤ 0.4	Compliance
BDR(GFSK)	DH3	1.652	0.264	≤ 0.4	Compliance
	DH5	2.928	0.312	≤ 0.4	Compliance
	2DH1	0.399	0.128	≤ 0.4	Compliance
EDR(π/4DQPSK)	2DH3	1.652	0.264	≤ 0.4	Compliance
	2DH5	2.928	0.312	≤ 0.4	Compliance
	3DH1	0.399	0.128	≤ 0.4	Compliance
EDR(8DPSK)	3DH3	1.652	0.264	≤ 0.4	Compliance
	3DH5	2.928	0.312	≤ 0.4	Compliance

Note:

DH1 Packet permit maximum 1600 / 79 / 2 hops per second in each channel (1 time slot RX, 1 time slot TX). DH3 Packet permit maximum 1600 / 79 / 4 hops per second in each channel (3 time slots RX, 1 time slot TX). DH5 Packet permit maximum 1600 / 79 / 6 hops per second in each channel (5 time slots RX, 1 time slot TX).

Therefore, dwell Time can be calculated as follows:

Data Packet	Dwell Time(s)
DH1/2DH1/3DH1	1600/79/2*0.4*79*(MkrDelta)/1000
DH3/2DH3/3DH3	1600/79/4*0.4*79*(MkrDelta)/1000
DH5/2DH5/3DH5	1600/79/6*0.4*79*(MkrDelta)/1000



5.5.6 Test plot

BDR(GFSK)

DH1

Att SGL TF	G: VID		m Offset 3 B - SWT	21.00 dB 4 5 ms 4	RBW 1 MHz VBW 3 MHz			
0 dBm			M1	01	12	D2[1] M1[1]	1	1.46 df 1.25362 m -1.54 dBn 1.25362 m
-10 dBn -20 dBn -30 dBn	+							
	14040	NULMA	DOO dBm	helder	hong	homan	Vacan	harportrajabeter
-70 dBn -80 dBn	+							
CF 2.4	F1 GH	z	1		691 pts			500.0 µs/
Marker Type M1 D1	Ref M1	1	35	362 ms 91.3 µs	Y-value -1.54 dBm 1.42 dB	Function	Fun	ction Result
D2	M1	1	1.25	362 ms	1.46 dB		Ready	AN 4141111

DH3

Spect			Spectrum 2 🛞	Spectrum 3	Spectr	um 4 🛞	Em ▽
Ref Le Att SGL TR				8 • RBW 1 MHz 5 • VBW 3 MHz			
1Pk C	rw						
			M1		D2[1]		0.01 df 2.5072 m
o dBm-	_	_	-	D1 02	MILI		-0.09 dBn
				IT T	terfall.		2 5072 m
-10 dBn	+	-					
-20 dBn							
-20 GBR	-						
-30 dBn	-						
-40 dBn		RG -39.	000 dBm				
-50 dBn			M			1	
-50 000	·	4	ranting	history		manipal	MANNA
-60 dBn				-			
-70 dBn	1						
-80 d8n	-						
	1						
CF 2.4	41 GH	IZ		691 pt	C.		1.0 ms/
Marker						2	
Туре	Ref		X-value	Y-value	Function	Funct	ion Result
M1		1	2.5072 ms	-0.09 dBm			
D1 D2	M1 M1	1	1.6522 ms 2.5072 ms	-0.04 dB			
02	1011	-	2.5072 ms	0.01 08		Ready	AND IN CO. 100

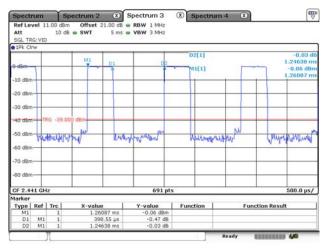
DH5

Spect Ref Le			Spectrur Bm Off	n 2 X	RBW 1 MHz	× [5]	pectru	m4 🗶	
Att SGL TF			dB 🖷 SW	T 20 ms e	BAR 3 WHS				
1Pk Cl	rw						0000		X S S S S S S S S S S S S S S S S S S S
			MI	D1 00	-	D2	[1]		0.02 df 3.7681 m
0 dBm-	+		1	1 1		MI	[1]		-0.09 dBn 3.7391 ms
-10 dBn	+	-				- 1			3,7391 m
-20 dBri	+	_		_	-	_			
-30 dBn	-	-							
-40 d8n	-	iG -39	.000 dBm=						
-50 dBn	1		1					100	
<00 d8n	1	dr.	·	three		ren		WA4	Parv
-60 dBn	+		+	-					
-70 dBn	+		-	-	-			-	
-80 d8n	+		_	_			_		
CF 2.4	41 GH	2			691 pt	s			2.0 ms/
Marker									
Type	Ref	Trc	X-1	value	Y-value	Funct	ion	Functio	on Result
M1		1		3.7391 ms	-0.09 dBm				
D1 D2	M1 M1	1		2.9275 ms 3.7681 ms	-0.14 dB 0.02 dB				
02	111		_	3.1001 ms	0.02 08	1		Ready	



EDR(π/4DQPSK)

2DH1



2DH3

Spect				Spectrue		Spect	rum 4 (X	
SGL TR	G: VID	10		dB - RBW 1 ms - VBW 3					
1Pk Cl	W.			_			-		-0.05 dBn
			M1	DI	-	M1[1]			-0.05 dBm 2.5072 ms
0 dBm-			1	4	100	D1[1]	7 1		-0.25 dE
							1 12		1 6522 m
-10 dBm	-				_				
-20 dBrr									
-20 0011									
neb 06-	-	_			_			_	
-40 dBm		KG -39	.000 dBm						
-50 dBm			M						- Andrewski A
*30 UBI			round	Port -	14		hylleba		where
-60 dBm	-							_	-
								1	
-70 dBm	-						-		-
-80 d8m									
-80 08/1					_	-			
CF 2.4	F1 GH	z			691 pts	2			1.0 ms/
Marker				100	1.1		2		
Type	Ref		X-value	Y-valı		Function	8	Function Resu	lt
M1		1	2,5072		IS dBm				
D1	M1	1	1.6522		.25 dB		-		
D2	M1	1	2.5072	ns -0	.01 dB				

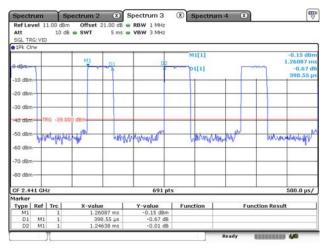
2DH5

Spect Ref Le			Spectr		×	 RBW 		X	Spe	ctrum	4	*	a
Att SGL TR		10	dB 🖷 St			 KBW VBW 							
e 1Pk C	rw									1000			72.77792
-0 dBm			MI		D1 0	12			D2[1]	-	2.11		0.02 d 3.7681 n
o dom			1		Ť				MILI	1			-0.15 dB
-10 dBr	n+	-		-	-								3,7391 0
-20 dBn	n	-		-	-	+	-		-				
-30 dBn	n	-		_	_		_	-	-				
-40 dBn	n - 19	KG -39	.000 dBm	-	-		_	-	-		+		
-50 dBn			1		11								1
-50 000	·	14	W I		Sec.	1		MAN			GAN		1240
-60 dBn	n		+	-		+	-		-		1	-	
-70 dBr	n		-	-		-	-		-		-		
-80 dBr			+-			-	-		-		-		
CF 2.4	41 GH	z		-			691 pt	5					2.0 ms/
Marker	Ş					2				- 62			
Туре	Ref		x	-value			alue	FL	unction	1		Functio	on Result
M1 D1	MI	1			91 ms 75 ms		-0.33 dB	-					
D1	M1 M1	1	_		B1 ms		0.02 dB						
		1									Ready	111	COLUMN 440



EDR(8DPSK)

3DH1



3DH3

Spect		Ĩ	Spectrum 2	Court & print of the	Spectrum 3	🗴 Spe	ctrum 4	×	2	Em ▽
Ref Le Att SGL TF	G: VID	10	Bm Offset dB a SWT		BBW 1 MHz BW 3 MHz					
1Pk C	rw					4.000	_			74077647
			M1			D2[1				0.02 df 2.5072 ms
e dem-			-	~~~~~	D1 02	MILL	-	-		-0.08 dBn
					IT I		· .			2 5072 m
-10 dBn	n-+-	_						_	-	
-20 dBr										
-20 GBR										
-30 dBn	n							_		_
-40 dBn	n - T	RG -39	9.000 dBm	-				_	_	
F					N					A Comment
-50 d8n	n		managental		Managar		hur	10		1000 march
-60 dBn					<u> </u>					
	° 1									
-70 dBn	n				+ +				-	
					1 1					
-80 d8n	0									
CF 2.4	41 GH	z			691 pt	s				1.0 ms/
Marker							- 32			
Туре	Ref	Trc	X-val		Y-value	Function	60 I	F	unction Resu	alt
M1		1		5072 ms	-0.08 dBm					
D1	M1	1		6522 ms	-0.32 dB		-			
D2	M1	1	2	5072 ms	0.02 dB	<u>j</u>				
02	M1	1	2	.5072 ms	0.02 d8	9	Re	ady	COLUMN	1 4,40

3DH5

Spect Ref Le		1.00 d		set 21.00 dB	 RBW 1 MHz 	*	Spectru	m 4 🙁	
Att SGL TF	G:VID		dB 🖷 SW	T 20 ms	VBW 3 MHz				
1Pk Cl	rw.						and the second		744 (4.3
		_	MI	D1 0	2	D	2[1]		0.04 dB 3.7681 ms
0 dBm	-	-	1	1		TM	1(1)		-0.11 dBm
-10 dBn	+								3,7391 ms
-20 dBn	+	-	-		-				
-30 dBn	-	_							
-40 dBn	T	RG -39	.000 dBm=						
-50 dBn	S 12		1		<u> </u>				
*30 UBI	· –	1		Arch		2444		atrea	142
-60 dBn	+		-	-	-				
-70 dBn	+		-		+ +		-	-	
-80 dBri	+		_						
CF 2.4	41 GH	Iz			691 p	ats			2.0 ms/
Marker									
Type	Ref		Х-	value	Y-value	Func	tion	Functio	on Result
M1		1		3.7391 ms	-0.11 dBn				
D1 D2	M1 M1	1		2.9275 ms 3.7681 ms	0.01 d8 0.04 d8				
		17	_			- 1	-	Ready	AM



5.6 Conducted Spurious Emissions (Band-edge)

5.6.1 Standard Applicable [FCC §15.247(d) / RSS-247, 5.5]

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 RF conducted.

5.6.2 Test Environment conditions

• Ambient temperature : (22 ~ 23) °C • Relative Humidity : (48 ~ 50) % R.H.

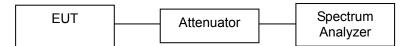
5.6.3 Measurement Procedure

(1) The transmitter output was connected to the spectrum analyzer through an attenuator.

(2) Conducted spurious emission the bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=100 KHz and VBW=300KHz.

(3) Below -20dB of the highest emission level in operating band.

5.6.4 Test setup



5.6.5 Measurement Result

			Test Results							
Setting Cha	nnel	Measured	value [dB]	Limit [dB]	Result					
		Hop on	Hop off		Result					
BDR(GFSK)	CH 0	-41.95	-37.20		Compliance					
BDR(GFSR)	CH 78	-55.31	-55.33		Compliance					
EDR(π/4DQPSK)	CH 0	-40.91	-39.30	≤ 20 than PSD level	Compliance					
EDR(11/4DQF3R)	CH 78	-55.72	-54.73		Compliance					
EDR(8DPSK) -	CH 0	-43.14	-40.42		Compliance					
	CH 78	-56.40	-55.34		Compliance					

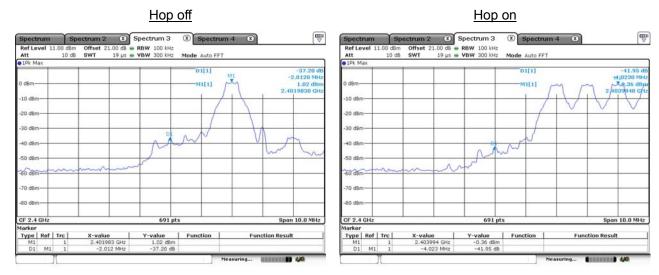
Note: The following plots show that there are no conducted spurious emissions exceeding the 20dB down criteria. Plots are also presented showing the band edge compliance.



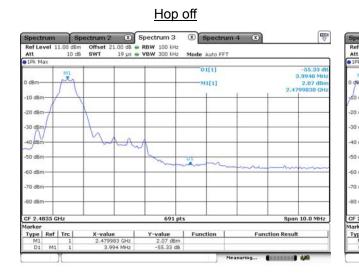
5.6.6 Test Plot (Band-edge)

BDR(GFSK)

CH Low



CH High



Spectrum 3 Ref Level 11.00 dBm Offset 21.00 dB m RBW 100 kHz Spectrum 4 🔳 Mode Auto FFT 10 dB SWT 19 µs . 300 kHz O 1Pk Ma D1[1] -55.31 0 4.9638 M 0.56 di 789850 C M. 11[1] 2.47 an de 50 dF D1 70 df 80 d8r CF 2.4835 GH 691 pt Span 10.0 MH Type Ref Trc X-value 2.478985 GHz 4.9638 MHz Function T Y-value Function Result D1 M1 55.31 dB

Hop on

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EDR(π/4DQPSK)

CH Low



CH High



<u>Hop on</u>

Spectrum	Sp	ectrum 2 🛛 🕱	Spectrum 3	Spectra	um 4 🙁	
Ref Level 1		Offset 21.00 dB			_	
Att 1Pk Max	10 dB	SWT 19 µs (VBW 300 kHz	Mode Auto FF	T	
o demo	m			D1[1] M1[1]		-55.72 dE 5.2680 MHz 0.52 dBn 2.4789850 GHz
-10 dBm					-	
-20 d8m						
-30 dBm		had				
-40 dBm						
-50 dBm		5	Ann	01		
-60 d8m					mun	
-70 dBm						
-80 d8m						
CF 2.4835 G	Hz		691 pts			Span 10.0 MHz
larker						
	Trc	X-value	Y-value	Function	Functio	in Result
M1 D1 M1	1	2.478985 GHz 5.268 MHz	0.52 dBm -55.72 dB			
	1				Measuring 🚺	44



Report No.: KST-FCR-170007(1)

EDR(8DPSK)

CH Low



CH High



Hop on

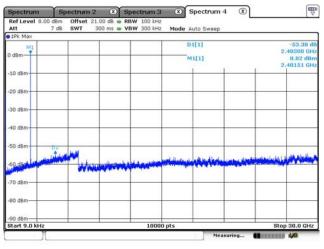
Spectrum	Spectrur	n2 🗶	Spectrum 3	(X) Spect	rum 4 💌	
Ref Level 11.0	0 dBm Offs		RBW 100 kHz VBW 300 kHz	Mode Auto F	FT	obar-
1Pk Max				Hode Hoter		
MI	m			D1[1] M1[1]		-56,40 df 5,1520 MH 0,52 dBn 2,4788260 GH
-10 dBm					-	
-20 dBm		_			_	
-30 dBm					_	
-40 dBm	N	m_				
-50 dBm		2	my	01	_	
-60 d8m	_	_	- und	nam	m	
-70 dBm						
-80 d8m						
CF 2.4835 GHz			691 pt	5		Span 10.0 MHz
Marker	12	1022			36 - C	100
Type Ref Tr		value	Y-value	Function	Fun	ction Result
M1 D1 M1	1 2.	478826 GHz 5.152 MHz	0.52 dBm -56.40 dB			
M				1.1	Measuring	Annana 480



Test Plot (Conducted spurious emissions)

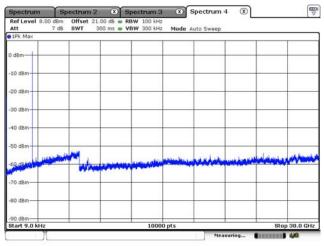
BDR(GFSK)

CH Low



CH Middle

Spectrum	Spectrum 2	Spectrum 3	Spectrum	4 🗷	CTT V
Ref Level 8.00 Att		d8 💩 RBW 100 kHz ns 💩 VBW 300 kHz			
1Pk Max					1.01.000
D dBm			D1[1] 		-54.58 d 2.44060 GH 1.40 dBr 2.44051 GH
10 dBm-		-	-		2.44051 GH
20 dBm		-			
-30 dBm	_			-	
40 dBm					
50 dBm	D1				
en de internet	and since the	with the second	in the second	-	and the state of the
70 dBm	214 Aris -				
-80 dBm					
90 dBm		1000	Date		Stop 30.0 GHz
Start 9.0 KHZ		1000		suring	stop 30.0 GHz

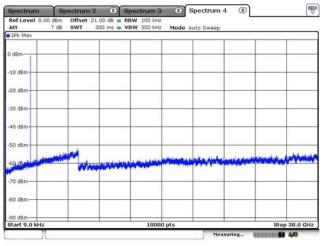


Note: It is not recorded on the report that the reading of emissions are attenuated more than 20 dB below the permissible limits

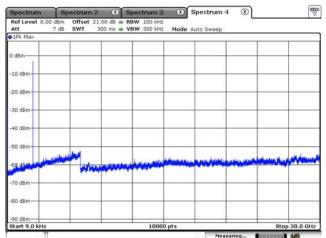


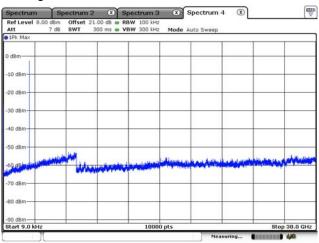
EDR(π/4DQPSK)

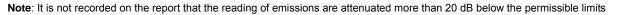
CH Low



CH Middle



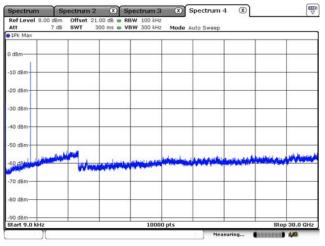




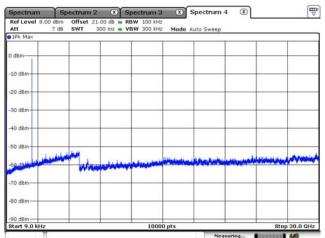


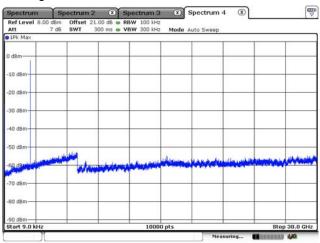
EDR(8DPSK)

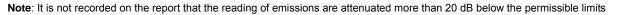
CH Low



CH Middle









5.7 Spurious RF Radiated emissions

5.7.1 Standard Applicable [FCC §15.247(d)]

All other emissions outside these bands shall not exceed the general radiated emission limits specified in §15.209(a). And according to §15.33(a)(1), for an intentional radiator operates below 10 GHz, the frequency Range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, Whichever is lower. In addition, radiated emissions which fall in the restricted bands, as defined in Sec.15.205(a), must also comply with the radiated emission limits specified in Sec. 15.209(a)

§15.209 limits for radiated emissions measurements (distance at 3 m)

Frequency Band [MHz]	DISTANCE [Meters]	Limit [<i>µ</i> ∕/m]	Limit [dB µV/m]	Detector				
0.009 ~ 0.490	300	2400/F(kHz)	67.6-20log(F)	Peak				
0.490 ~ 1.705	30	24000/F(kHz)	87.6-20log(F)	Peak				
1.705 ~ 30.0	30	30	29.54	Peak				
30 - 88	3	100 **	40.00	Quasi peak				
88 - 216	3	150 **	43.52	Quasi peak				
216 - 960	3	200 **	46.02	Quasi peak				
Above 960	3	500	54.00	Average				
Above 1000	3	74.0 dB	µ//m (Peak), 54.0 dBµ//m	(Average)				
** fundamental emissions from intentional radiators operation 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 Section 15.231 and 15.241								

§15.205. Restrict Band of Operation for FCC

[MHz]	[MHz]	[MHz]	[GHz]
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505**	16.694 75 - 16.695 25	608 - 614	5.35 - 5.46
2.173 5 - 2.190 5	16.804 25 - 16.804 75	960 – 1 240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1 300 – 1 427	8.025 - 8.
4.177 25 - 4.177 75	37.5 -38.25	1 435 – 1 626.5	9.0 - 9.2
4.207 25 - 4.207 75	73 - 74.6	1 645.5 – 1 646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1 660 – 1 710	10.6 - 12.7
6.267 75 - 6.268 25	108 - 121.94	1 718.8 -1 722.2	13.25 - 13.4
6.311 75 - 6.312 25	123 - 138	2 200 – 2 300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2 310 – 2 390	15.35 - 16.2
8.362 - 8.366	156.524 75 - 156.525 25	2 483.5 – 2 500	17.7 - 21.4
8.376 25 - 8.38 6 75	156.7 - 156.9	2 690 – 2 900	22.01 - 23.12
8.414 25 - 8.414 75	162.012 5 - 167.17	3 260 – 3 267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3 332 – 3 339	31.2 - 31.8
12.519 75 - 12.520 25	240 - 285	3 345.8 – 3 358	36.43 - 36.5
12.576 75 - 12.577 25	322 - 335.4	3 600 - 4 400	Above 38.6
13.36 - 13.41			

** Until February 1, 1999, this restricted band shall be 0.490-0.510



5.7.2 Test Environment conditions

• Ambient temperature : (22 ~ 23) °C • Relative Humidity : (48 ~ 50) % R.H.

5.7.3 Measurement Procedure

The measurements procedure of the Spurious RF Radiated emissions is as following describe method.

1. The EUT was placed on the top of a rotating table (0.8 meters for below 1 GHz and 1.5 meters for above 1 GHz) above the ground at a 3 meter camber. The table was rotated 360 degree to determine the position of the highest radiation.

2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna master.

The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both Horizontal and vertical polarizations of the antenna are set to make the measurement.
 For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotating table was turned from 0 - 360 degrees to find the maximum reading.
 The measuring receiver was set to peak detector and specified bandwidth with max hold function.

6. Low, Middle and high channels were measured, and radiation measurements are performed in X, Y, Z axis positioning. And found the worst axis position and only the test worst case mode is recorded in the report.
The measurement results are obtained as described below:

- Result($dB\mu/m$) = Reading($dB\mu/m$) + Antenna factor(dB/m)+ CL(dB) + other applicable factor (dB)
- The resolution bandwidth of test receiver/spectrum analyzer is 1 Mb and the video bandwidth is 3 Mb for RMS Average (Duty cycle < 98 %) for Average detection (AV) at frequency above 1 GHz, then the measurement results was added to a correction factor (10 log(1/duty cycle)).
- The resolution bandwidth of test receiver/spectrum analyzer is 1 Mb and the video bandwidth is 10 Hz (Duty cycle ≥ 98 %) for Average detection (AV) at frequency above 1 GHz.
- According to §15.33 (a)(1), Frequency range of radiated measurement is performed the tenth harmonic.

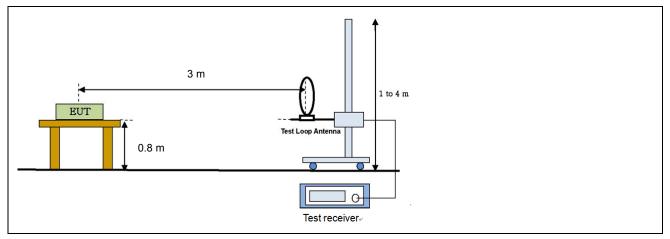
5.7.4 Measurement Uncertainty

Radiated Emission measurement: Below 1 GHz : 4.32 dB (CL: Approx 95 %, *k*=2) Above 1 GHz : 4.14 dB (CL: Approx 95 %, *k*=2)

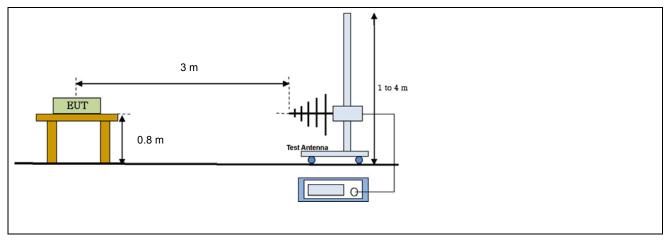


5.7.5 Test Configuration

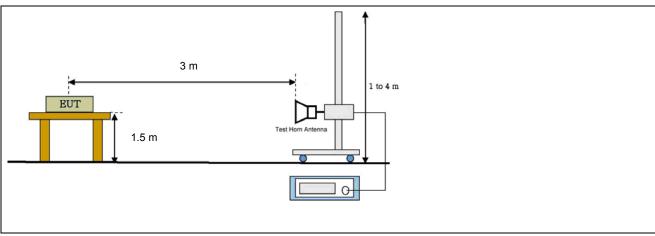
Radiated emission setup, Below 30 MHz



Radiated emission setup, Below 1 000 MHz



Radiated emission setup, Above 1 GHz





5.7.6 Measurement Result

After having pre-scan all modulation mode, found the GFSK modulation which it was worst case, so only the worst case's data on the test report.

Above 1 GHz

CH Low (2 402 MHz)

Freq.	·		Table	,	Antenn	а	CL	AMP	AMP (dB μ /				Mgn. (dB)		Result
(GHz)	РК	AV	(Deg)	Height (m)	Pol. (H/V)	Fctr. (^{dB} /m)	(dB)	(dB) (dB)	PK	AV	PK	AV	PK	AV	Result
2.389*	50.73	34.75	180	1.0	V	28.87	2.90	-30.68	51.82	35.84	74	54	22.18	18.16	Compliance
2.389*	49.26	34.03	180	1.0	Н	28.87	2.90	-30.68	50.35	35.12	74	54	23.65	18.88	Compliance

* Restrict band emissions.

CH Middle (2 441 MHz)

Freq.			Table	/	Antenn	а	CL	AMP	Meas Result (dB⊭∛/m)	Meas Result (dB⊭∛/m)		Limit (dB⊭⁄/m)		gn. B)	Result
(GHz)	РК	AV	(Deg)	Height (m)	Pol. (H/V)	Fctr. (^{dB} /m)	(dB)	(dB)	PK	AV	PK	AV	PK	AV	Result
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Compliance
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Compliance

* There were no spurious emissions

CH High (2 480 MHz)

F	req.			Table	,	Antenn	а	CL	AMP	Meas Result (dB⊭∛/m)						Mgn. (dB)		Result
(0	GHz)	PK	AV	(Deg)	Height (m)	Pol. (H/V)	Fctr. (^{dB} /m)	(dB)	(dB) (dB)	PK	AV	PK	AV	PK	AV	Result		
2.	493*	45.01	31.80	170	1.0	Н	29.30	2.96	-30.53	46.74	33.53	74	54	27.26	20.47	Compliance		
2.	493*	44.10	31.48	170	1.0	V	29.30	2.96	-30.53	45.83	33.21	74	54	28.17	20.79	Compliance		

* Restrict band emissions.

*Note

Above 1 GHz is measured average and peak detector mode on Spectrum analyzer in accordance with FCC Rule15.35

• Limit: 54 dB ///m(Average), 74 dB ///m(Peak), Attenuated more than 20 dB below the permissible value.

• It is not recorded on the report that the reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to measured.

• For the below 30 MHz and above 2.493 GHz, measured any other signal is not detected on test receiver

• The transmitter radiated spectrum was investigated from 9 kHz to 26.5 GHz.



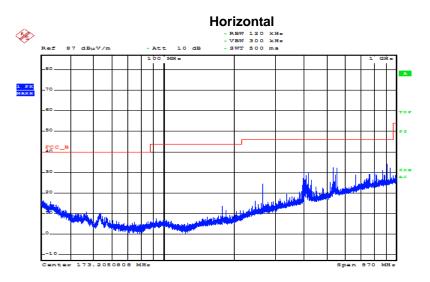
Below 1 GHz

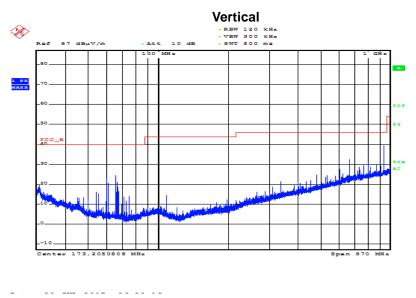
Freq.	Reading		н		Factor		Limit	Result
[MHz]	[dB <i>µ</i> V]	POL	[m]	ANT. [^{dB} /m]	CABLE [dB]	AMP. [d ^B]	[dB⊭V/m]	[dB#V/m]
400.08	45.62	Н	3.3	16.91	5.22	-40.54	46.00	27.21
417.09	44.78	Н	3.3	17.21	5.34	-40.63	46.00	26.69
533.39	44.77	Н	2.7	19.31	6.02	-39.88	46.00	30.23
552.36	42.96	Н	2.9	19.74	6.13	-39.76	46.00	29.07
666.97	39.62	V	2.5	21.78	6.82	-39.05	46.00	29.16
912.06	36.10	Н	1.3	24.69	7.99	-37.86	46.00	30.93

*Result = Reading + antenna factor + cable loss + AMP.

*Reading: test receiver reading value *POL = antenna Polarization / H = antenna Height *Receiving Antenna Mode : Horizontal, Vertical *ANT. = antenna factor / CABLE = used cable loss/AMP.: Gain of the Amplifier

*Test site : 10 m Semi-Anechoic chamber







5.8 Antenna requirement

5.8.1 Standard applicable [FCC §15.203]

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by responsible party shall be used with the device.

The use of a permanently attached antenna or of an antenna that user a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

5.8.2 Antenna details

Frequency Band	Antenna Type	Gain [dBi]	Results
2.4 GHz	Chip antenna	3.5	Compliance



5.9 AC Power Conducted emissions

5.9.1 Standard Applicable [FCC §15.207(a) / RSS-Gen 8.8]

For intentional radiator that is designed to be connected to the public utility(AC)power line, the radio frequency. Voltage that is conducted back onto the AC power line on any frequencies hopping mode within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line Impedance stabilization network(LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

§15.207 limits for AC line conducted emissions;

Frequency of Emission(ML)	Conducted Limit (dBµV)		
Frequency of Emission(M [™])	Quasi-peak	Average	
0.15 ~ 0.5	66 to 56 *	56 to 46 *	
0.5 ~ 5	56	46	
5 ~ 30	60	50	

* Decreases with the logarithm of the frequency

5.9.2 Test Environment conditions

• Ambient temperature : (22 ~ 23) °C • Relative Humidity : (48 ~ 50) % R.H.

5.9.3 Measurement Procedure

EUT was placed on a non- metallic table height of 0.8 m above the reference ground plane. Cables connected to EUT were fixed to cause maximum emission. Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the Maximum signal strength.

5.9.4 Used equipment

Equipment	Model No.	Serial No.	Manufacturer	Next cal date	Cal interval	Used
Test receiver	ESCS30	100111	Rohde & Schwarz	2018. 01. 31	1 year	\boxtimes
LISN	ESH2-Z5	100044	R&S	2018. 01. 31	1 year	
	ESH3-Z5	100147	R&S	2018. 01. 31	1 year	\boxtimes

*Test Program: "ESXS-K1 V2.2"

Measurement uncertainty

Conducted Emission measurement: 4.48 dB (CL: Approx 95 %, k=2)



5.9.5 Measurement Result

N/A

Freq.	Factor [dB]		POL	QP		CISPR AV			
				Limit	Reading	Result	Limit	Reading	Result
[MHz]	LISN	CABLE +P/L	FUL	[dB <i>µ</i> ∕/]	[dB⊭V]	[dB <i>µ</i> V]	[dB <i>µ</i> V]	[dB <i>µ</i> V]	[dB#V]

* LISN: LISN insertion Loss, Cable: Cable Loss, P/L:pulse limiter factor

* L: Line. Live, N: Line. Neutral

* Reading: test receiver reading value (with cable loss & pulse limiter factor)

* Result = LISN + Reading