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Applicant	:	Emerson Radio C	orp.
		35 Waterview Bly	vd, Parsippany, New Jersey 07054, United States
Supplier / Manufacturer	:	He Xun Electroni	cs Co., Ltd.
			Queens Village, Zhenlong Town, Huiyang District, ngdong Province, China
Description of Sample(s)	:	Submitted sample	e(s) said to be
		Product:	SmartSet Alarm Clock Radio with Bluetooth Speaker, USB Charge out and Fast Wireless Charger
		Brand Name:	Emerson
		Model No.:	ER100401
		FCC ID:	2ALCVER100401
Date Samples Received	:	2020-10-23	
Date Tested	:	2020-10-20 to 202	20-12-10
Investigation Requested	•	with FCC 47CFR	Magnetic Interference measurement in accordance [Codes of Federal Regulations] Part 15 and ANSI FCC Certification.
Conclusions	:	Communications The tests were pe	oduct <u>COMPLIED</u> with the requirements of Federal Commission [FCC] Rules and Regulations Part 15. rformed in accordance with the standards described tion 2.2 in this Test Report.
Remarks	:	Bluetooth FHSS	(GFSK / π /4-DQPSK)
		For additional mo	Dr. LEE Kam Childepuisate Authorized Signatory

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Authorized Signatory



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1.0 General Details

1.1 Test Laboratory

The Hong Kong Standards and Testing Centre Ltd.EMC Laboratory10 Dai Wang Street, Taipo Industrial Estate, New Territories, Hong KongTelephone:852 2666 1888Fax:852 2664 4353

1.2 Equipment Under Test [EUT] Description of Sample(s)

Product:

1104400	
	Charge out and Fast Wireless Charger
Manufacturer:	He Xun Electronics Co., Ltd.
	Shi Wu Factory, Queens Village, Zhenlong Town, Huiyang
	District, Huizhou city, Guangdong Province, China
Brand Name:	Emerson
Model Number:	ER100401
Additional Model Number:	ER100402, ER100403
Rating:	12.0Vd.c. by AC adapter
The AC/DC adapter was provided	by the applicant with following details:
Brand name: KEERDA, Model no	D.: DZ048BHL120300U, Input: 100-240Va.c. 50/60Hz 1.5A,
Output: 12.0Vd.c. 3.0A	

SmartSet Alarm Clock Radio with Bluetooth Speaker, USB

1.2.1 Description of EUT Operation

The Equipment Under Test (EUT) is a SmartSet Alarm Clock Radio with Bluetooth Speaker. The transmission signal is digital modulated with channel frequency range 2402-2480MHz. The R.F. signal was modulated by IC; the type of modulation used was frequency hopping spread spectrum Modulation.

- **1.3 Date of Order** 2020-10-23
- **1.4** Submitted Sample(s): 1 Sample
- **1.5 Test Duration** 2020-10-20 to 2020-12-10
- **1.6 Country of Origin** China

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1.7 RF Module Details

Module Model Number:	AC6925B
Module FCC ID:	N/A
Module Transmission Type:	Bluetooth V5.0 EDR
Modulation:	FHSS (GFSK / π /4-DQPSK)
Data Rates:	1MBps: GFSK
	2 MBps: π/4-DQPSK
Frequency Range:	2400-2483.5MHz
Carrier Frequencies:	2402MHz - 2480MHz
Carrier Frequencies:	2402MHz – 2480MHz

Module Specification (specification provided by manufacturer)

1.8 Antenna Details

Antenna Type:	PCB antenna
Antenna Gain:	0dBi

1.9 Channel List

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	42	2444
1	2403	43	2445
2	2404	44	2446
3	2405	45	2447
4	2406	46	2448
5	2407	47	2449
6	2408	48	2450
7	2409	•••	
8	2410	67	2469
9	2411	68	2470
		69	2471
33	2435	70	2472
34	2436	71	2473
35	2437	72	2474
36	2438	73	2475
37	2439	74	2476
38	2440	75	2477
39	2441	76	2478
40	2442	77	2479
41	2443	78	2480

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2.0 <u>Technical Details</u>

2.1 Investigations Requested

Perform Electromagnetic Interference measurements in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15 Regulations and ANSI C63.10:2013 for FCC Certification. According FCC KDB 558074 DSS Measurement Guidance, Duty cycle \geq 98%.

2.2 Test Standards and Results Summary Tables

EMISSION Results Summary						
Test Condition	Test Requirement	Test Method	Class /	/ Test Result		
			Severity	Pass	Failed	N/A
Maximum Peak Conducted Output Power	FCC 47CFR 15.247(b)(1)	ANSI C63.10: 2013	N/A	\boxtimes		
Radiated Spurious Emissions	FCC 47CFR 15.209	ANSI C63.10: 2013	N/A	\boxtimes		
AC Mains Conducted Emissions	FCC 47CFR 15.207	ANSI C63.10: 2013	N/A			
Number of Hopping Frequency	FCC 47CFR 15.247 (b)(1)	ANSI C63.10: 2013	N/A			
20dB Bandwidth	FCC 47CFR 15.247(a)(2)	ANSI C63.10: 2013	N/A			
Hopping Channel Separation	FCC 47CFR 15.247(a)(1)	ANSI C63.10: 2013	N/A			
Band-edge measurement (Radiated)	FCC 47CFR 15.247(d)	ANSI C63.10: 2013	N/A			
Pseudorandom Hopping Algorithm	FCC 47CFR 15.247(a)(1)	N/A	N/A			
Time of Occupancy (Dwell Time)	FCC 47CFR 15.247(a)(1)(iii)	ANSI C63.10: 2013	N/A			
Antenna requirement	FCC 47CFR 15.203	N/A	N/A	\square		

Note: N/A - Not Applicable

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2.3 Table for Test Modes

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate in the table below is the worst case rate with respect to the specific test item.

Investigation has been done on all the possible configurations for searching the worst cases.

The device was realized by test software.

The following table is a list of the test modes shown in this test report.

Test Items	Mode	Data Rate
Maximum Peak Conducted Output Power	GFSK / π/4-DQPSK	1MBps / 2MBps
Hopping Channel Separation	GFSK / π/4-DQPSK	1MBps / 2MBps
Number of Hopping Frequency	GFSK / π/4-DQPSK	1MBps / 2MBp
Time of Occupancy(Dwell Time)	π/4-DQPSK (DH1 / DH3 / DH5)	2MBps
Radiated Spurious Emissions	GFSK / π/4-DQPSK	1MBps / 2MBps
Band-edge compliance of Conducted Emission	GFSK / π/4-DQPSK	1MBps / 2MBps

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3.0 Test Results

3.1 Emission

3.1.1 Maximum Peak Conducted Output Power

Test Requirement:FCC 47CFR 15.247(b) (1)Test Method:ANSI C63.10: 2013Test Date:2020-10-23Mode of Operation:Tx mode

Ambient Temperature: 25° C

Relative Humidity: 51%

Atmospheric Pressure: 101 kPa

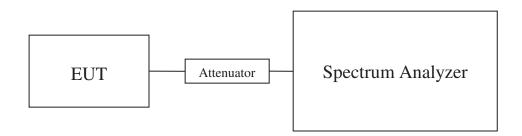
Test Method:

A temporary antenna connector was soldered to the RF output. The RF output of the EUT was connected to the spectrum analyzer. All the attenuation or cable loss will be added to the measured maximum output power. The results are recorded in Watt.

Spectrum Analyzer Setting:

RBW = 3 MHz, VBW= 3MHz, Sweep = Auto, Span: Approximately five times the 20 dB bandwidth Detector = Peak, Trace = Max. hold

Test Setup:



Note: a temporary antenna connector was soldered to the RF output.

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Limits for Maximum Peak Conducted Output Power [FCC 47CFR 15.247]:

The maximum peak output power shall not exceeded the following limits: For frequency hopping systems employing at least 75 hopping channels: 1 Watt For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 Watts For Digital Transmission systems in 2400-2483.5 MHz Band: 1 Watt

Results of Bluetooth Communication mode (GFSK) (Fundamental Power): Pass

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.000966
T	
Transmitter Frequency (MHz)	Maximum conducted output power (Watt)

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.000918

Results of Bluetooth Communication mode (π /4-DQPSK) (Fundamental Power): Pass

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.001119

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)	
2441	0.001057	
Transmitter Frequency (MHz)	Maximum conducted output power (Watt)	

0.001067

Calculated measurement uncertainty	:	30MHz to 1GHz	1.7dB
		1GHz to 18GHz	1.7dB

Remark:

2480

1. All test data for each data rate were verified, but only the worst case was reported.

2. The EUT is programmed to transmit signals continuously for all testing.

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Test plot of Maximum Peak Conducted Output Power :

Bluetooth Communication mode (GFSK, 2402MHz)

Spectrun	n								
	20.20 dBm		.20 dB 🔵 R						`
Att	40 dB	SWT	1 ms 🔵 V	BW 3 MHz	Mode Aut	to Sweep			
●1Pk Max									
					M	1[1]			-0.15 dBm
								2.401	84670 GHz
10 dBm									
0 dBm				M1					
0 ubiii							F		
-10 dBm									
-20 dBm									
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Bluetooth Communication mode (GFSK, 2441MHz)

Spectrum					
Ref Level 20.2	20 dBm Offset	0.20 dB 🔵 RBW			
Att	40 dB SWT	1 ms 👄 VBW	3 MHz Mode Aut	o Sweep	
●1Pk Max					
			м	1[1]	-0.39 dBm 2.44096810 GHz
10 dBm					
0 dBm			M1		
					+
-10 dBm					
-20 dBm					
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Bluetooth Communication mode (GFSK, 2480MHz)

Spectrum							
Ref Level 20.20 d		20 dB 😑 RBV					
	dB SWT	1 ms 😑 🛛	🖌 3 MHz	Mode Auto Sweep	p		
●1Pk Max							
				M1[1]			-0.37 dBm 91060 GHz
10 dBm							
0 dBm			M1				
-10 dBm							
-20 dBm							
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Bluetooth Communication mode ( $\pi/4$  DQPSK, 2402MHz)

Ref Level         20.20 dBm         Offset         0.20 dB         RBW 3 MHz           Att         40 dB         SWT         1 ms         VBW 3 MHz         Mode Auto Sweep           1Pk Max         M1[1]         0.49 dBm         2.40176480 GHz           10 dBm         M1         0.49 dBm         2.40176480 GHz           0 dBm         M1         0         0         0           40 dB         M1         0         0         0         0           10 dBm         M1         0         0         0         0         0           20 dBm         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         <	Spectrum			
●1Pk Max 0 dBm 0 dBm -20 d			Mode Auto Sweep	<b>`</b>
10 dBm       M1       A       A       A         0 dBm       M1       A       A       A         10 dBm       A       A       A       A         -10 dBm       A       A       A       A         -20 dBm       A       A       A       A       A	●1Pk Max			
0 dBm     M1			M1[1]	
-10 dBm -20	10 dBm			
-10 dBm -20		M1		
-20 dBm	0 dBm			
-20 dBm	10-70.00			
	-10 UBIII			
	-20 dBm			
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Bluetooth Communication mode (*π*/4 DQPSK, 2441MHz)

Spectrum			
Ref Level 20.20 dBm Att 40 dB	Offset 0.20 dB	Mada Auto Duran	
1Pk Max	SWI IMS VBW 3 MH2	Mode Auto Sweep	
		M1[1]	0.24 dBm 2.48002710 GHz
10 dBm			
0 dBm		M1	
.∞±0°đBm			
-20 dBm			
- Marine			
~79 SR			
-180m	<u> </u>		
-180m	<u>                                  </u>		
		11 (B. 1)	2. * M

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Bluetooth Communication mode ( $\pi/4$  DQPSK, 2480MHz)

Spectrum			
Ref Level 20.20 dBm Att 40 dB	Offset 0.20 dB	Mada, Auto Curson	
1Pk Max		Mode Auto Sweep	
		M1[1]	0.28 dBm 2.44104640 GHz
10 dBm			
0 dBm		M1	
-10-d8m			
-20 dBm			
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#### 3.1.2 Radiated Spurious Emissions

Test Requirement:	FCC 47CFR 15.209
Test Method:	ANSI C63.10:2013
Test Date:	2020-10-22 to 2020-12-10
Mode of Operation:	Tx mode / Bluetooth play mode (GFSK)

Ambient Temperature: 26.8°C Relative Humidity: 43.9% Atmospheric Pressure: 100.8 kPa

#### **Test Method:**

For emission measurements at or below 1 GHz, the sample was placed 0.8m above the ground plane of semianechoic Chamber*. For emission measurements above 1 GHz, the sample was placed 1.5m above the ground plane of semi-anechoic Chamber*. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

* Semi-Anechoic chamber located on the G/F of The Hong Kong Standards and Testing Centre Ltd. with a metal ground plane filed with the FCC pursuant to section 2.948 of the FCC rules, with Registration Number: 607756.



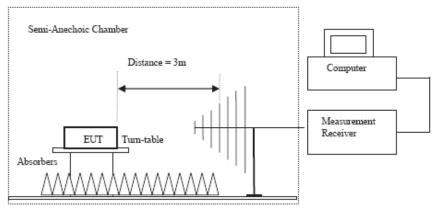
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#### **Spectrum Analyzer Setting:**

9KHz – 30MHz (Pk & Av)	RBW: VBW: Sweep: Span: Trace:	Auto Fully capture the emissions being measured
30MHz – 1GHz (QP)	RBW: VBW: Sweep: Span: Trace:	Fully capture the emissions being measured
Above 1GHz (Pk)	RBW: VBW: Sweep: Span: Trace:	Fully capture the emissions being measured
Above 1GHz (Av)	RBW: VBW: Sweep: Span: Trace:	
Test Seture		

### **Test Setup:**



Ground Plane

Absorbers placed on top of the ground plane are for measurements above 1000MHz only.
 Measurements between 30MHz to 1000MHz made with Bi-log antennas, above 1000MHz horn antennas are used, 9kHz to 30MHz loop antennas are used.

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#### Limits for Radiated Emissions FCC 47 CFR 15.247 Class B]:

Frequency Range	Quasi-Peak Limits
[MHz]	[µV/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

#### Result of Tx mode (2402.0 MHz) (GFSK) (9kHz - 30MHz): Pass

Field Strength of Spurious Emissions							
Peak Value							
Frequency Measured Correction Field Field Limit E-Field							
	Level Factor Strength Strength Polarity						
MHz dBuV dB/m dBuV/m uV/m uV/m							
Emissions detected are more than 20 dB below the FCC Limits							

#### Result of Tx mode (2402.0 MHz) (GFSK) (Above 1GHz): Pass

Field Strength of Spurious Emissions Peak Value							
Frequency	Measured	Correction	Field	Limit	Margin	E-Field	
	Level @3m	Factor	Strength	@3m		Polarity	
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dB		
4804.0	17.2	41.5	58.7	74.0	15.3	Vertical	
4804.0	14.4	42.4	56.8	74.0	17.2	Horizontal	
7206.0	12.1	45.1	57.2	74.0	16.8	Vertical	
7206.0	10.6	46.2	56.8	74.0	17.2	Horizontal	
9608.0	7.6	48.0	55.6	74.0	18.4	Vertical	
9608.0	6.0	48.8	54.8	74.0	19.2	Horizontal	
12010.0	4.5	51.8	56.3	74.0	17.7	Vertical	
12010.0	3.5	52.4	55.9	74.0	18.1	Horizontal	

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		Field Streng	th of Spuriou	is Emissions						
	Average Value									
Frequency	Measured	Correction	Field	Limit	Margin	E-Field				
	Level @3m	Factor	Strength	@3m		Polarity				
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dB					
4804.0	1.0	41.5	42.5	54.0	11.5	Vertical				
4804.0	0.0	42.4	42.4	54.0	11.6	Horizontal				
7206.0	-2.2	45.1	42.9	54.0	11.1	Vertical				
7206.0	-4.6	46.2	41.6	54.0	12.4	Horizontal				
9608.0	-7.6	48.0	40.4	54.0	13.6	Vertical				
9608.0	-8.4	48.8	40.4	54.0	13.6	Horizontal				
12010.0	-6.2	51.8	45.6	54.0	8.4	Vertical				
12010.0	-9.0	52.4	43.4	54.0	10.6	Horizontal				

# Result of Tx mode (2441.0 MHz) (GFSK) (9kHz - 30MHz): Pass

	Field Strength of Spurious Emissions								
Peak Value									
Frequency	Measured	Correction	Field	Field	Limit	E-Field			
	Level	Factor	Strength	Strength		Polarity			
MHz	dBuV	dB/m	dBuV/m	uV/m	uV/m	-			
	Emissions detected are more than 20 dB below the FCC Limits								

# Result of Tx mode (2441.0 MHz) (GFSK) (Above 1GHz): Pass

	Field Strength of Spurious Emissions Peak Value									
Frequency	Measured	Correction	Field	Limit	Margin	E-Field				
	Level @3m	Factor	Strength	@3m		Polarity				
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dB					
4882.0	16.1	41.6	57.7	74.0	16.3	Vertical				
4882.0	14.3	42.5	56.8	74.0	17.2	Horizontal				
7323.0	3.7	45.2	48.9	74.0	25.1	Vertical				
7323.0	10.9	46.3	57.2	74.0	16.8	Horizontal				
9764.0	7.8	48.1	55.9	74.0	18.1	Vertical				
9764.0	5.6	48.9	54.5	74.0	19.5	Horizontal				
12205.0	3.9	51.6	55.5	74.0	18.5	Vertical				
12205.0	3.8	52.5	56.3	74.0	17.7	Horizontal				

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	Field Strength of Spurious Emissions Average Value									
Frequency	Measured	Correction	Field	Limit	Margin	E-Field				
	Level @3m	Factor	Strength	@3m		Polarity				
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB					
4882.0	1.1	41.6	42.7	54.0	11.3	Vertical				
4882.0	-0.6	42.5	41.9	54.0	12.1	Horizontal				
7323.0	-2.7	45.2	42.5	54.0	11.5	Vertical				
7323.0	-3.4	46.3	42.9	54.0	11.1	Horizontal				
9764.0	-7.4	48.1	40.7	54.0	13.3	Vertical				
9764.0	-8.0	48.9	40.9	54.0	13.1	Horizontal				
12205.0	-11.5	51.6	40.1	54.0	13.9	Vertical				
12205.0	-10.1	52.5	42.4	54.0	11.6	Horizontal				

### Result of Tx mode (2480.0 MHz) (GFSK) (9kHz - 30MHz): Pass

	Field Strength of Spurious Emissions								
Peak Value									
Frequency	Measured	Correction	Field	Field	Limit	E-Field			
	Level	Factor	Strength	Strength		Polarity			
MHz	dBuV	dB/m	dBuV/m	uV/m	uV/m				
	Emissions	detected are r	nore than 20	dB below the	FCC Limits				

### Result of Tx mode (2480.0 MHz) (GFSK) (Above 1GHz): Pass

	Field Strength of Spurious Emissions Peak Value									
Frequency	Measured	Correction	Field	Limit	Margin	E-Field				
	Level @3m	Factor	Strength	@3m		Polarity				
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dB					
4960.0	16.1	41.4	57.5	74.0	16.5	Vertical				
4960.0	14.2	42.7	56.9	74.0	17.1	Horizontal				
7440.0	11.2	45.6	56.8	74.0	17.2	Vertical				
7440.0	9.2	46.5	55.7	74.0	18.3	Horizontal				
9920.0	6.7	48.6	55.3	74.0	18.7	Vertical				
9920.0	4.8	49.7	54.5	74.0	19.5	Horizontal				
12400.0	4.4	51.7	56.1	74.0	17.9	Vertical				
12400.0	3.2	52.7	55.9	74.0	18.1	Horizontal				

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		<b>Field Streng</b>	th of Spuriou	ıs Emissions					
	Average Value								
Frequency	Measured	Correction	Field	Limit	Margin	E-Field			
	Level @3m	Factor	Strength	@ 3m		Polarity			
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dB				
4960.0	1.3	41.4	42.7	54.0	11.3	Vertical			
4960.0	-0.7	42.7	42.0	54.0	12.0	Horizontal			
7440.0	-2.9	45.6	42.7	54.0	11.3	Vertical			
7440.0	-6.4	46.5	40.1	54.0	13.9	Horizontal			
9920.0	-8.1	48.6	40.5	54.0	13.5	Vertical			
9920.0	-8.8	49.7	40.9	54.0	13.1	Horizontal			
12400.0	-9.2	51.7	42.5	54.0	11.5	Vertical			
12400.0	-11.6	52.7	41.1	54.0	12.9	Horizontal			

#### Result of Tx mode (2402.0 MHz) (π/4-DQPSK) (9kHz – 30MHz): Pass

	Field Strength of Spurious Emissions							
Peak Value								
Frequency	Measured	Correction	Field	Field	Limit	E-Field		
	Level	Factor	Strength	Strength		Polarity		
MHz	MHz dBuV dB/m dBuV/m uV/m uV/m							
	Emissions detected are more than 20 dB below the FCC Limits							

### Result of Tx mode (2402.0 MHz) (π/4-DQPSK) (Above 1GHz): Pass

	Field Strength of Spurious Emissions Peak Value									
Frequency	Measured	Correction	Field	Limit	Margin	E-Field				
	Level @3m	Factor	Strength	@3m		Polarity				
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dB					
4804.0	16.4	41.5	57.9	74.0	16.1	Vertical				
4804.0	15.2	42.4	57.6	74.0	16.4	Horizontal				
7206.0	11.8	45.1	56.9	74.0	17.1	Vertical				
7206.0	10.5	46.2	56.7	74.0	17.3	Horizontal				
9608.0	8.9	48.0	56.9	74.0	17.1	Vertical				
9608.0	7.0	48.8	55.8	74.0	18.2	Horizontal				
12010.0	4.5	51.8	56.3	74.0	17.7	Vertical				
12010.0	4.1	52.4	56.5	74.0	17.5	Horizontal				

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	Field Strength of Spurious Emissions								
	Average Value								
Frequency	Measured	Correction	Field	Limit	Margin	E-Field			
	Level @3m	Factor	Strength	@3m		Polarity			
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dB				
4804.0	1.3	41.5	42.8	54.0	11.2	Vertical			
4804.0	0.7	42.4	43.1	54.0	10.9	Horizontal			
7206.0	-3.9	45.1	41.2	54.0	12.8	Vertical			
7206.0	-4.4	46.2	41.8	54.0	12.2	Horizontal			
9608.0	-7.4	48.0	40.6	54.0	13.4	Vertical			
9608.0	-7.4	48.8	41.4	54.0	12.6	Horizontal			
12010.0	-9.9	51.8	41.9	54.0	12.1	Vertical			
12010.0	-10.3	52.4	42.1	54.0	11.9	Horizontal			

# Result of Tx mode (2441.0 MHz) (π/4-DQPSK) (9kHz – 30MHz): Pass

Field Strength of Spurious Emissions							
Peak Value							
Frequency	Measured	Correction	Field	Field	Limit	E-Field	
	Level	Factor	Strength	Strength		Polarity	
MHz	dBuV	dB/m	dBuV/m	uV/m	uV/m		
	Emissions detected are more than 20 dB below the FCC Limits						

### Result of Tx mode (2441.0 MHz) (π/4-DQPSK) (Above 1GHz): Pass

	Field Strength of Spurious Emissions Peak Value									
Frequency	Measured	Correction	Field	Limit	Margin	E-Field				
	Level @3m	Factor	Strength	@3m	_	Polarity				
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dB					
4882.0	15.8	41.6	57.4	74.0	16.6	Vertical				
4882.0	15.2	42.5	57.7	74.0	16.3	Horizontal				
7323.0	4.8	45.2	50.0	74.0	24.0	Vertical				
7323.0	10.8	46.3	57.1	74.0	16.9	Horizontal				
9764.0	7.5	48.1	55.6	74.0	18.4	Vertical				
9764.0	6.4	48.9	55.3	74.0	18.7	Horizontal				
12205.0	5.9	51.6	57.5	74.0	16.5	Vertical				
12205.0	3.8	52.5	56.3	74.0	17.7	Horizontal				

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	Field Strength of Spurious Emissions Average Value									
Frequency	Measured	Correction	Field	Limit	Margin	E-Field				
	Level @3m	Factor	Strength	@3m	-	Polarity				
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB					
4882.0	1.2	41.6	42.8	54.0	11.2	Vertical				
4882.0	-0.2	42.5	42.3	54.0	11.7	Horizontal				
7323.0	-1.6	45.2	43.6	54.0	10.4	Vertical				
7323.0	-4.2	46.3	42.1	54.0	11.9	Horizontal				
9764.0	-8.1	48.1	40.0	54.0	14.0	Vertical				
9764.0	-7.2	48.9	41.7	54.0	12.3	Horizontal				
12205.0	-9.5	51.6	42.1	54.0	11.9	Vertical				
12205.0	-10.3	52.5	42.2	54.0	11.8	Horizontal				

### Result of Tx mode (2480.0 MHz) (π/4-DQPSK) (9kHz – 30MHz): Pass

Field Strength of Spurious Emissions							
Peak Value							
Frequency	Measured	Correction	Field	Field	Limit	E-Field	
	Level	Factor	Strength	Strength		Polarity	
MHz	dBuV	dB/m	dBuV/m	uV/m	uV/m		
	Emissions detected are more than 20 dB below the FCC Limits						

### Result of Tx mode (2480.0 MHz) (π/4-DQPSK) (Above 1GHz): Pass

	Field Strength of Spurious Emissions Peak Value									
Frequency	Measured	Correction	Field	Limit	Margin	E-Field				
	Level @3m	Factor	Strength	@3m	_	Polarity				
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dB	_				
4960.0	16.7	41.4	58.1	74.0	15.9	Vertical				
4960.0	15.7	42.7	58.4	74.0	15.6	Horizontal				
7440.0	11.3	45.6	56.9	74.0	17.1	Vertical				
7440.0	10.2	46.5	56.7	74.0	17.3	Horizontal				
9920.0	7.0	48.6	55.6	74.0	18.4	Vertical				
9920.0	6.3	49.7	56.0	74.0	18.0	Horizontal				
12400.0	4.7	51.7	56.4	74.0	17.6	Vertical				
12400.0	2.2	52.7	54.9	74.0	19.1	Horizontal				

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	Field Strength of Spurious Emissions									
	Average Value									
Frequency	Measured	Correction	Field	Limit	Margin	E-Field				
	Level @3m	Factor	Strength	@3m		Polarity				
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dB					
4960.0	2.0	41.4	43.4	54.0	10.6	Vertical				
4960.0	0.3	42.7	43.0	54.0	11.0	Horizontal				
7440.0	-3.5	45.6	42.1	54.0	11.9	Vertical				
7440.0	-3.6	46.5	42.9	54.0	11.1	Horizontal				
9920.0	-6.8	48.6	41.8	54.0	12.2	Vertical				
9920.0	-7.2	49.7	42.5	54.0	11.5	Horizontal				
12400.0	-8.9	51.7	42.8	54.0	11.2	Vertical				
12400.0	-10.8	52.7	41.9	54.0	12.1	Horizontal				

Remarks:

No additional spurious emissions found between lowest internal used/generated frequency and 30 MHz * Denotes restricted band of operation.

Measurements were made using a peak detector. Any emission less than 1000MHz and falling within the restricted bands of FCC Rules Part 15 Section 15.205 and the limits of FCC Rules Part 15 Section 15.209 were applied.

Correction Factor included Antenna Factor and Cable Attenuation.

Calculated measurement uncertainty (9kHz-30MHz): 2.0dB

(30MHz -1GHz): 4.9dB

(1GHz -6GHz): 4.02dB

(6GHz -26.5GHz): 4.03dB

Emissions in the vertical and horizontal polarizations have been investigated and the worst-case test results are recorded in this report.

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#### **Radiated Emissions Measurement:**

#### Limit :

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. 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 5.205(c)).

#### Result: RF Radiated Emissions (Lowest)-GFSK

	Field Strength of Band-edge Compliance								
Peak Value									
Frequency	Measured	Correction	Field	Limit	Margin	E-Field			
	Level @3m	Factor	Strength	@3m		Polarity			
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dB				
2390.0	10.4	36.8	47.2	74.0	26.8	Vertical			

Field Strength of Band-edge Compliance								
Average Value								
Frequency	Measured	Correction	Field	Limit	Margin	E-Field		
	Level @3m	Factor	Strength	@3m		Polarity		
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dB			
2390.0	1.7	36.8	38.5	54.0	15.5	Vertical		

#### Result: RF Radiated Emissions (Highest) -GFSK

	Field Strength of Band-edge Compliance								
Peak Value									
Frequency	Measured	Correction	Field	Limit	Margin	E-Field			
	Level @3m	Factor	Strength	@3m		Polarity			
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dB				
2483.5	24.2	36.8	61.0	74.0	13.0	Vertical			

Field Strength of Band-edge Compliance								
Average Value								
Frequency	Measured	Correction	Field	Limit	Margin	E-Field		
	Level @3m	Factor	Strength	@3m		Polarity		
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dB			
2483.5	4.5	36.8	41.3	54.0	12.7	Vertical		

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#### **Result: RF** Radiated Emissions (Lowest)- $\pi/4$ -DQPSK

	Field Strength of Band-edge Compliance								
Peak Value									
Frequency	Measured	Correction	Field	Limit	Margin	E-Field			
	Level @3m	Factor	Strength	@3m		Polarity			
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dB				
2390.0	11.3	36.8	48.1	74.0	25.9	Vertical			

Field Strength of Band-edge Compliance Average Value							
Frequency	Measured	Correction	Field	Limit	Margin	E-Field	
	Level @3m	Factor	Strength	@3m		Polarity	
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dB		
2390.0	1.3	36.8	38.1	54.0	15.9	Vertical	

### Result: RF Radiated Emissions (Highest) - $\pi/4$ -DQPSK

	Field Strength of Band-edge Compliance								
Peak Value									
Frequency	Measured	Correction	Field	Limit	Margin	E-Field			
	Level @3m	Factor	Strength	@3m		Polarity			
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dB				
2483.5	16.7	36.8	53.5	74.0	20.5	Vertical			

Field Strength of Band-edge Compliance Average Value								
Frequency	Measured	Correction	Field	e Limit	Margin	E-Field		
Trequency	Level @3m		Strength	@3m	wiargin	Polarity		
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dB	Tolarity		
2483.5	8.7	36.8	45.5	54.0	8.5	Vertical		

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#### Limits for Radiated Emissions FCC 47 CFR 15.247 Class B]:

Frequency Range	Quasi-Peak Limits		
[MHz]	[µV/m]		
0.009-0.490	2400/F (kHz)		
0.490-1.705	24000/F (kHz)		
1.705-30	30		
30-88	100		
88-216	150		
216-960	200		
Above960	500		

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

### Date: 12-10-2020 Level (dBuV/m) 70 60 FCC Part 15 Class B 50 40 30 20 10 C 200 Frequency (MHz) 30 50 100 500 1000

#### **Results of Bluetooth mode (GFSK 2402.0 MHz) (30MHz – 1GHz): Pass** Horizontal

Ambient Temperature: 25C Relative Humidity : 50%

	Freq	Level	Limit Line	Over Limit	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB		
1	66.733	37.42	40.00	-2.58	QP	Horizontal
2	68.151	37.49	40.00	-2.51	QP	Horizontal
3	75.182	36.35	40.00	-3.65	QP	Horizontal
4	180.649	33.35	43.50	-10.15	QP	Horizontal
5	240.830	37.47	46.00	-8.53	QP	Horizontal
6	422.058	37.92	46.00	-8.08	QP	Horizontal

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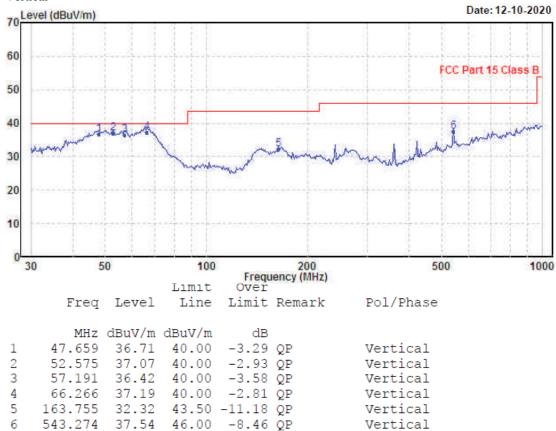
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#### Limits for Radiated Emissions FCC 47 CFR 15.247 Class B]:

Frequency Range	Quasi-Peak Limits		
[MHz]	[µV/m]		
0.009-0.490	2400/F (kHz)		
0.490-1.705	24000/F (kHz)		
1.705-30	30		
30-88	100		
88-216	150		
216-960	200		
Above960	500		

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.



#### Results of Bluetooth mode (GFSK 2402.0 MHz) (30MHz – 1GHz): Pass Vertical

Remarks: Calculated measurement uncertainty (30MHz – 1GHz): 4.9dB Emissions in the vertical and horizontal polarizations have been investigated and the worst-case test results are recorded in this report.

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#### 3.1.3 AC Mains Conducted Emissions (0.15MHz to 30MHz)

Test Requirement:	FCC 47CFR 15.207
Test Method:	ANSI C63.10:2013
Test Date:	2020-10-20
Mode of Operation:	Bluetooth mode
Test Voltage:	120Va.c. 60Hz
-	

Ambient Temperature: 25°C

Relative Humidity: 51%

Atmospheric Pressure: 101 kPa

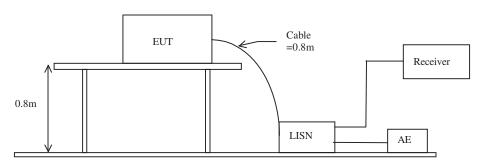
### **Test Method:**

The test was performed in accordance with ANSI ANSI C63.10:2013, with the following: an initial measurement was performed in peak and average detection mode on the live line, any emissions recorded within 30dB of the relevant limit line were re-measured using quasi-peak and average detection on the live and neutral lines with the worst case recorded in the table of results.

#### **Receiver Setting:**

Bandw. = 9 kHz, Meas. Time= 10.0 ms, Step Width = 5.0kHz Detector = MaxPeak and CISPR AV

### **Test Setup:**



#### Limits for Conducted Emissions (FCC 47 CFR 15.207):

Frequency Range	Quasi-Peak Limits	Average
[MHz]	[dBµV]	[dBµV]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

* Decreases with the logarithm of the frequency.

Remarks:

Calculated measurement uncertainty (0.15MHz - 30MHz): 3.25dB

-*- Emission(s) that is far below the corresponding limit line.

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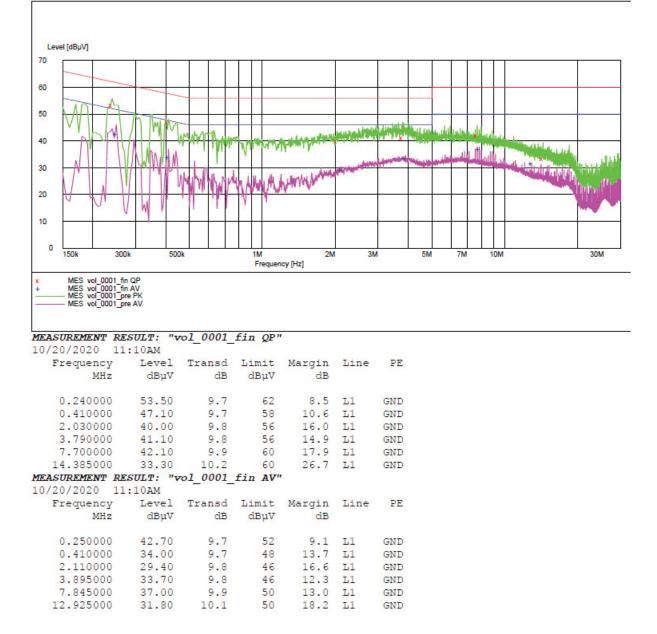


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**Results of Bluetooth mode (L): PASS** 

Please refer to the following diagram for individual results.



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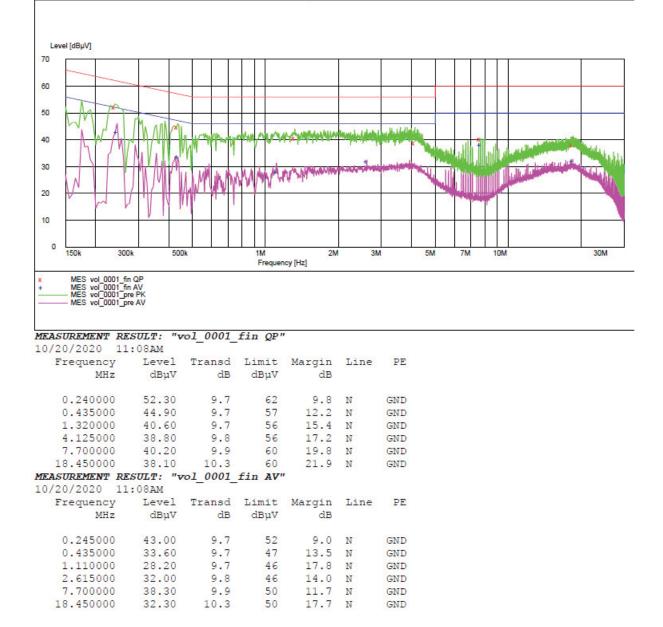


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**Results of Bluetooth mode (N): PASS** 

Please refer to the following diagram for individual results.



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#### 3.1.4 Number of Hopping Frequency

Ambient Temperature: 25°C Relative Humidity: 51% Atmospheric Pressure: 101 kPa

### Limit of Number of Hopping Frequency

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels

### **Test Method:**

The RF output of the EUT was connected to the spectrum analyzer by a low loss cable.

#### **Spectrum Analyzer Setting:**

RBW = 300 kHz,  $VBW \ge RBW$ , Sweep = Auto, Span = the frequency band of operation Detector = Peak, Trace = Max. hold

#### **Test Setup:**

As Test Setup of clause 3.1.1 in this test report.

#### Measurement Data: GFSK: 79 of 79 Channel

Ref Level         20.20         dBm         Offset         0.20         dB         RBW         300 kHz           Mat         40 dB         SWT         1 ms         VBW         300 kHz         Mode         Auto Sweep           IPk Max         10 dBm         0         dBm         dBm         0         dBm										'n	Spectrun
1Pk Max     10 dBm     0 dBm     -10	1-				uto Swoon						
					uto sweep	Mode A	500 KH2	1 113 • •	311	40 00	
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### π/4-DQPSK: 79 of 79 Channel

Spectrun	n								
	20.20 dBm			300 kHz					`
Att 1Pk Max	40 dB	SWT	1 ms 😑 V	<b>BW</b> 300 kHz	Mode A	uto Sweep			
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#### 3.1.5 20dB Bandwidth

Test Requirement:	FCC 47CFR 15.247(a)(1)
Test Method:	ANSI C63.10:2013
Test Date:	2020-10-23
Mode of Operation:	Tx mode

Ambient Temperature:  $25^{\circ}$  Relative Humidity:  $51^{\circ}$ 

Atmospheric Pressure: 101 kPa

#### **Remark:**

The result has been done on all the possible configurations for searching the worst cases.

#### **Test Method:**

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.

#### **Spectrum Analyzer Setting:**

RBW = 30kHz,  $VBW \ge RBW$ , Sweep = Auto, Span = two times and five times the OBW Detector = Peak, Trace = Max. hold

#### **Test Setup:**

As Test Setup of clause 3.1.1 in this test report.



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Fundamental Frequency	20dB Bandwidth	FCC Limits
[MHz]	[KHz]	[MHz]
2402	882.8	Within 2400-2483.5

#### (Lowest Operating Frequency) - (GFSK)

Spectrum					[
Ref Level 20.00 d	Bm 😑 RI	BW 30 kHz			
Att 40	dB SWT 63.2 µs 🖷 VI	BW 100 kHz	Mode Auto FFT		
●1Pk Max					
			M1[1]		-2.90 dB
10 dBm					2.40192040 G
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0 dBm		M1	Bw		882.80000000 k
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Fundamental Frequency	20dB Bandwidth	FCC Limits
[MHz]	[KHz]	[MHz]
2441	882.8	Within 2400-2483.5

(Middle Operating Frequency) - (GFSK)

Spectrum						
Ref Level 20.00 dBm	e RB	W 30 kHz				
Att 40 dB	SWT 63.2 µs 🖷 VB	W 100 kHz 🛛	Node Auto FFT			
1Pk Max						
			M1[1]			-3.21 dBn
10 dBm					2.440	92040 GH
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Fundamental Frequency	20dB Bandwidth	FCC Limits
[MHz]	[KHz]	[MHz]
2480	882.8	Within 2400-2483.5

(Highest Operating Frequency) - (GFSK)

Spectrum					
Ref Level 20.00 dBm	👄 RBV				,
Att 40 dB	SWT 63.2 µs 🖷 VBV	V 100 kHz	Mode Auto FFT		
●1Pk Max					
			M1[1]		-3.24 dBm
10 dBm					2.47992400 GHz
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Fundamental Frequency	20dB Bandwidth	FCC Limits
[MHz]	[MHz]	[MHz]
2402	1.2504	Within 2400-2483.5

(Lowest Operating Frequency) - ($\pi/4$ DQPSK)

Spectrum						
Ref Level 20.00 dBm	🖷 RB	W 30 kHz				
Att 40 dB	SWT 63.2 µs 🖷 VB	W 100 kHz	Mode Auto FFT			
●1Pk Max						
			M1[1]			-2.95 dBm
10 dBm					2.401	92190 GHz
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Fundamental Frequency	20dB Bandwidth	FCC Limits
[MHz]	[MHz]	[MHz]
2441	1.2816	Within 2400-2483.5

(Middle Operating Frequency) - ($\pi/4$ DQPSK)

Spectrum						
Ref Level 20.00 dBm	👄 RBV					
Att 40 dB	SWT 63.2 µs 🖷 VBV	₩ 100 kHz	Mode Auto FFT			
●1Pk Max						
			M1[1]			-3.20 dBm
10 dBm					2.440	92190 GHz
			ndB Bw		1 00160	20.00 dB 20000 MHz
0 dBm		M1	Q factor		1.28100	1904.6
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Fundamental Frequency	20dB Bandwidth	FCC Limits
[MHz]	[MHz]	[MHz]
2480	1.2504	Within 2400-2483.5

(Highest Operating Frequency) - ($\pi/4$ DQPSK)

Spectrun	n								
Ref Level	20.00 dBm		😑 RBV	V 30 kHz					
Att	40 dB	SWT 63.2	µs 🖷 VBN	₩ 100 kHz	Mode Au	to FFT			
●1Pk Max									
					IV	11[1]			-3.25 dBm
10 dBm								2.479	92190 GHz
TO UBIII						dB			20.00 dB
0 dBm				M1	-	w		1.2504	00000 MHz
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3.1.6 Hopping Channel Separation

Ambient Temperature: 25°CRelative Humidity: 51%Atmospheric Pressure: 101 kPa

Requirements:

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.

Spectrum Analyzer Setting:

RBW = 300 kHz, $VBW \ge RBW$, Sweep = Auto, Span = Wide enough to captur the peaks of two adjacent channels Detector = Peak, Trace = Max. hold

Limit:

The measured maximum bandwidth *2/3 = 1.2816MHz *2/3 = 854.4kHz

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Spectrun	n								
	20.20 dBm			3W 300 kHz					
Att	40 dB	SWT	5.3 µs 😑 VI	BW 300 kHz	Mode Aut	o FFT			
●1Pk Max						- 1			1 70 40
					M1[1]			-1.79 dBm 05790 GHz
10 dBm					D2[1]		2.402	0.04 dB
10 0.011						•		1.0	00580 MHz
0 dBm					M1		D2		
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Channel separation = 1MHz (>854.4kHz) (Lowest) (GFSK)

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Channel separation = 1MHz (>854.4kHz) (Mid) (GFSK) Spectrum Ref Level 20.20 dBm Offset 0.20 dB 👄 RBW 300 kHz Att 40 dB SWT 6.3 µs 🖷 VBW 300 kHz Mode Auto FFT ●1Pk Max M1[1] -2.38 dBm 2.44105070 GHz D2[1] 0.28 dB 10 dBm 1.00580 MHz 0 dBm 7 -10/dBm· -20 dBm an C Burr 04 25 AR BOTT a1 2. 190 BOOM (). (e.) T AN AND PAR

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Channel separation = 1MHz (>854.4kHz) (Highest) (GFSK) Spectrum Ref Level 20.20 dBm Offset 0.20 dB 👄 RBW 300 kHz Att 40 dB SWT 6.3 µs 👄 VBW 300 kHz Mode Auto FFT ●1Pk Max M1[1] -2.11 dBm 2.47905070 GHz D2[1] -0.05 dB 10 dBm-1.00580 MHz 0 dBm -Δ -10 dBm -20 dBm Real Contraction . A Car ST AL NOS DOS RAS CONTRACTOR OF

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Spectrun	n							
	20.20 dBm		0.20 dB 👄 RE					
Att	40 dB	SWT	6.3 µs 🖷 VI	3W 300 kHz	Mode Auto P	FT		
●1Pk Max								
					M1[1]			-2.07 dBm
							2.402	00000 GHz
10 dBm			-		D2[1]			-0.02 dB
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#### Channel separation = 1MHz (>854.4kHz) (Lowest) ( $\pi$ /4 DQPSK)

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Channel separation = 1MHz (>854.4kHz) (Mid) ( $\pi$ /4 DQPSK) Spectrum Ref Level 20.20 dBm Offset 0.20 dB 👄 RBW 300 kHz Att 40 dB SWT 6.3 µs 👄 VBW 300 kHz Mode Auto FFT ●1Pk Max D2[1] 0.01 dB 1.00580 MHz M1[1] -2.47 dBm 10 dBm-2.44100000 GHz 0 dBm--10 dBm--20 dBmant shirt 193 S. 1. 114 Sal Sant as Sine In Vin-A.P.S. Start 8. A. S. A. · · · · · · · · · · · · · · · ·

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Channel separation = 1MHz (>854.4kHz) (Highest) ( $\pi$ /4 DQPSK) Spectrum Ref Level 20.20 dBm Offset 0.20 dB 👄 RBW 300 kHz Att 40 dB SWT 6.3 µs 👄 VBW 300 kHz Mode Auto FFT ●1Pk Max M1[1] -2.34 dBm 2.47900000 GHz D2[1] 0.05 dB 10 dBm· 1.00720 MHz 0 dBm--10 dBm· -20 dBm· in the second second - 19 - Porto higher de la state de la state de la state de la state de la state de la state de la state de la state de la st <u> A</u> 1493 **(** 16 Line Literation

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#### 3.1.7 Band-edge Compliance of RF Conducted Emissions Measurement:

Ambient Temperature: 25°C

Relative Humidity: 51%

Atmospheric Pressure: 101 kPa

#### Limit:

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. Attenuation below the general limits specified in Section 15.209(a) is not required. According to the test method DA 00-705.

#### **Spectrum Analyzer Setting:**

RBW = 100kHz, VBW= 300kHz, Sweep = Coupled,

Span = Wide enough to captur 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. Detector = Peak, Trace = Max. hold

Remark: Emissions under the fixed frequency mode and hopping mode have been investigated, the worst-case measurement results were recorded in the test report



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#### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range	requency Range Reference level Lim		The highestLimitconducted bandedge emissionResult		
[MHz]	[dBm]	[dBm]	[dBm]		
2400 – Lowest Fundamental (2402)	-1.87	-21.87	-31.42	PASS	

#### Band-edge Compliance of RF Emissions – Lowest (GFSK) (Hopping on)

Spectrum				
Ref Level         20.20 dBm           Att         40 dB	Offset 0.20 dB		Auto FFT	<b>x</b>
●1Pk Max				
10 dBm			M1[1] M2[1]	-1.87 dBm 2.4019230 GHz -31.42 dBm
			mz[I]	2.4000420 GHz
0 dBm				M1
-10 dBm				
				/VV
-20 dBm				
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#### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range	quency Range Reference level Lim		Limit Conducted band edge emission Result	
[MHz]	[dBm]	[dBm]	[dBm]	
2400 – Lowest Fundamental (2402)	-1.75	-21.75	-31.10	PASS

#### Band-edge Compliance of RF Emissions – Lowest (GFSK) (Hopping off)

Spectrum				
Ref Level         20.20 dBm           Att         40 dB	Offset 0.20 dB ( SWT 76 us (	<ul> <li>RBW 100 kHz</li> <li>VBW 300 kHz</li> </ul>		•
●1Pk Max	SWI 70 µS	• • B • 300 KH2	Mode Auto FFT	
10 40-			M1[1]	-1.75 dBn 2.4019230 GH -31.10 dBn
10 dBm-			M2[1]	2.4000420 GH
0 dBm				M1
-10 dBm				
-20 dBm				
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#### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range	Frequency Range Reference level		The highest conducted band edge emission	Result
[MHz]	[dBm]	e		
2483.5 - Highest Fundamental (2480)	-2.79	-22.79	-51.37	PASS

#### Band-edge Compliance of RF Emissions - Highest (GFSK) (Hopping on)

Spectrum	Γ								
	15.20 dBm			RBW 100 kH					
Att	30 dB	SWT .	56.9 µs 👄	<b>/BW</b> 300 kH	z Mode	Auto FFT			
●1Pk Max									
10 dBm					M	1[1]		2 47	-2.79 dBm 99580 GHz
					м	2[1]			51.37 dBm
0 dBmM1									36270 GHz
MMK									
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#### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range	Frequency Range Reference level		The highest conducted band edge emission	Result
[MHz]	[dBm]	6		
2483.5 - Highest Fundamental (2480)	-2.04	-22.04	-49.72	PASS

#### Band-edge Compliance of RF Emissions - Highest (GFSK) (Hopping off)

Spectrum	Γ								
	15.20 dBm			BW 100 kH					
Att	30 dB	SWT S	56.9 µs 😑 V	<b>'BW</b> 300 kH	2 Mode	Auto FFT			
●1Pk Max 10 dBm						1[1] 2[1]			-2.04 dBm 99260 GHz 49.72 dBm
0 dBm	l								36270 GHz
-10 dBm									
-20 dBm								ļ	ļ
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Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range			The highest conducted band edge emission	Result
[MHz]	[dBm]	-		
2400 – Lowest Fundamental (2402)	-1.69	-21.69	-30.79	PASS

Band-edge Compliance of RF Emissions – Lowest ($\pi/4$ DQPSK) (Hopping on)

Spectrum			
Ref Level 19.00 dBm	Offset 0.20 dB RBW 10		
Att 30 dB	SWT 94.8 µs 👄 VBW 30	0 kHz Mode Auto FFT	
		M1[1]	-1.69 dBm 2.4019450 GHz
10 dBm-		M2[1]	-30.79 dBm 2.4000580 GHz
0 dBm			, Jun
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-20 dBm			
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Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range	Reference level	Limit	The highest conducted band edge emission	Result
[MHz]	[dBm]	[dBm]	[dBm]	
2400 – Lowest Fundamental (2402)	-1.69	-21.69	-30.70	PASS

Band-edge Compliance of RF Emissions – Lowest ($\pi/4$ DQPSK) (Hopping off)

Spectrum]					
Ref Level 19.		0.20 dB 😑 RB				-
Att 1Pk Max	30 dB SWT	94.8 µs 👄 VE	3W 300 kHz	Mode Auto	FFT	
				M1[1]		-1.69 dBm
10 dBm						2.4019450 GH
10 0000				M2[1]		-30.70 dBm 2.4000580 GHz
0 dBm						M1
						八
-10 dBm						
-20 dBm						
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Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range	Frequency Range Reference level		The highest conducted band edge emission	Result
[MHz]	[dBm]	[dBm] [dBm]		
2483.5 - Highest Fundamental (2480)	-2.06	-22.06	-50.25	PASS

Band-edge Compliance of RF Emissions – Highest ($\pi/4$ DQPSK) (Hopping on)

Spectrum	
Ref Level 15.20 dBm Offset 0.20 dB 👄 RBW 100 kHz	
e Att 30 dB SWT 56.9 μs e VBW 300 kHz Mode Auto FFT	
e 1Pk Max	
10 dBmM1[1]	-2.06 dBm 2.4799260 GHz
M2[1]	2.4799260 GHz -50.25 dBm
541	2.4836270 GHz
-10 dBm	<u> </u>
-20 dBm	
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Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range			The highest conducted band edge emission	Result
[MHz]	[dBm]	[dBm] [dBm]		
2483.5 - Highest Fundamental (2480)	-2.01	-22.01	-48.69	PASS

Band-edge Compliance of RF Emissions – Highest ($\pi/4$ DQPSK) (Hopping off)

Spectrum									
Ref Level 19 Att				BW 100 kH BW 300 kH					
● 1Pk Max	30 UB	3 WI 5	o.a ha 💻 🖌	BW 300 KH	2 Mode /	Auto FFT			
10 dBm						1[1] 2[1]		2.47	-2.01 dBn 99260 GHz 48.69 dBn
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Compliance of RF Conducted Emissions Measurement:

Limit :

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. Attenuation below the general limits specified in Section 15.209(a) is not required.

Remark: Emissions under the fixed frequency mode and hopping mode have been investigated, the worst-case measurement results were recorded in the test report.

Spectrum	- 1 -								
	19.00 dBm).20 dB 😑 R						
Att	30 de	SWT	250 ms 😑 V	/BW 300 kH	z Mode /	Auto Sweep			
●1Pk Max									
					M	1[1]			-1.84 dBm
10 dBm						0[1]			2.4020 GHz 42.07 dBm
10 0.0111					I¥I.	2[1]			42.07 aBm 1.8240 GHz
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-10 dBm									
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Compliance of RF Emissions – (GFSK 2402MHz) (the worst case)

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Compliance of RF Emissions – (π /4-DQPSK 2402MHz) (the worst case) Spectrum Ref Level 19.00 dBm Offset 0.20 dB 🖷 RBW 100 kHz 30 dB SWT 250 ms 👄 VBW 300 kHz Att Mode Auto Sweep ●1Pk Max M1[1] -2.07 dBm 2.4020 GHz 10 dBm-M2[1] -42.26 dBm 4.8240 GHz M 0 dBm--10 dBm--20 dBm <u>AR COMP</u> 130 a). Big ? any? Letterstale Strenges _______ kon kiato u. DATEN - Contraction KUK MES i jernen som de

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3.1.8 Time of Occupancy (Dwell Time)

Ambient Temperature: 25°C Relative Humidity: 51% Atmospheric Pressure: 101 kPa

Requirements:

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 channel employed. No requirements for Digital Transmission System.

Spectrum Analyzer Setting:

RBW = 300kHz, $VBW \ge RBW$, Sweep = A longer sweep time to show two successive hops on a channel, Span = Zero, Detector = Peak, Trace = Max. hold

Dwell Time = Pulse Duration * hop rate / number of channel * observation duration Observed duration: $0.4s \ge 79 = 31.6s$

Measurement Data:

Channel Occupied in π /4-DQPSK: 79 of 79 Channel

Ref Level	20.20 dBm	Offset 0.	20 dB 🔵 RE	3W 300 kHz					
Att	40 dB	SWT	1 ms 😑 ۷	3W 300 kHz	Mode A	uto Sweep			
1Pk Max									
10 dBm									
0 dBm	ስብልሰስብኑስ	0.0.0.0.0.0.0	1000000	አስደበኮታበል	04460604	00000000	/በሌክ . አዳል	000000000	ከአለሰብ በ
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-20 dBm									
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DH5 Packet:

DH5 Packet permit maximum 1600/79/6 = 3.37 hops per second in each channel (5 time slots RX, 1 time slot TX). The Dwell time is the time duration of the pulse times $3.37 \times 31.6 = 106.6$ within 31.6 seconds

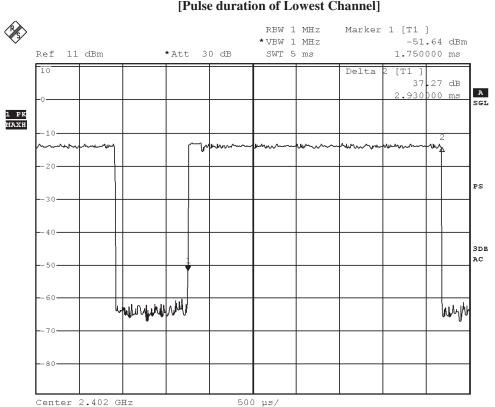


Fig. A [Pulse duration of Lowest Channel]

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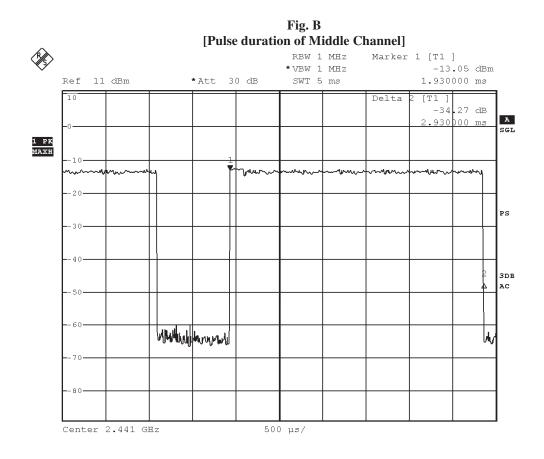
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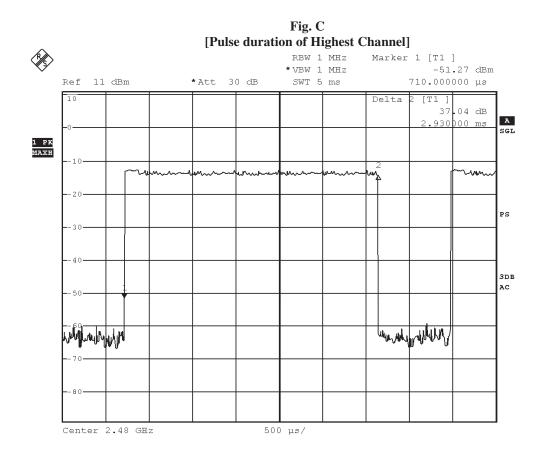
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DH3 Packet:

DH3 Packet permit maximum 1600/79/4 = 5.06 hops per second in each channel (3 time slots RX, 1 time slot TX). The Dwell time is the time duration of the pulse times $5.06 \times 31.6 = 160$ within 31.6 seconds

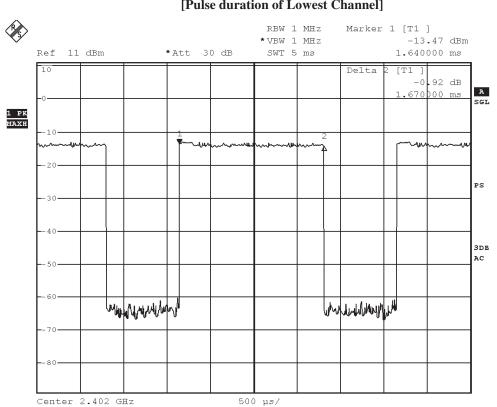


Fig. D [Pulse duration of Lowest Channel]

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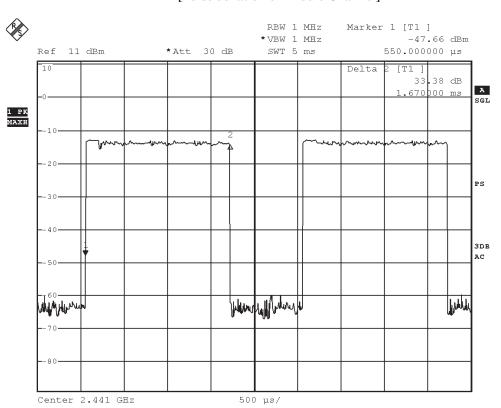


Fig. E [Pulse duration of Middle Channel]

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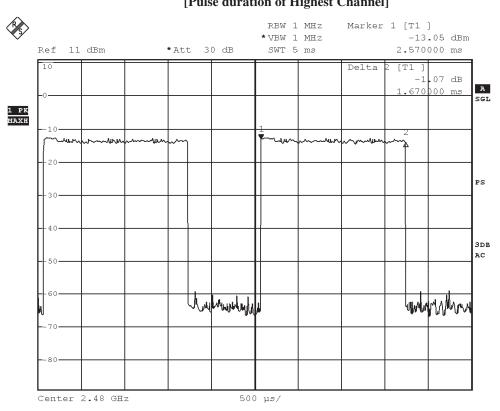


Fig. F [Pulse duration of Highest Channel]

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DH1 Packet:

DH1 Packet permit maximum 1600/79/2 = 10.12 hops per second in each channel (3 time slots RX, 1 time slot TX). The Dwell time is the time duration of the pulse times $10.12 \times 31.6 = 320$ within 31.6 seconds

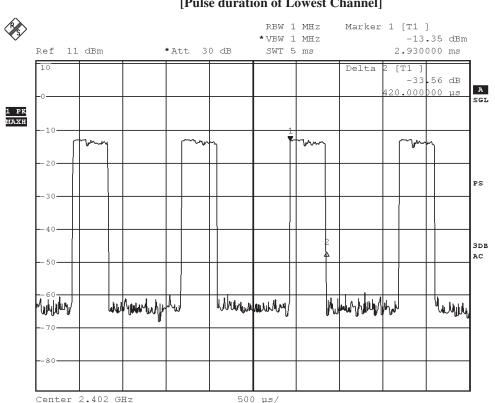


Fig. G [Pulse duration of Lowest Channel]

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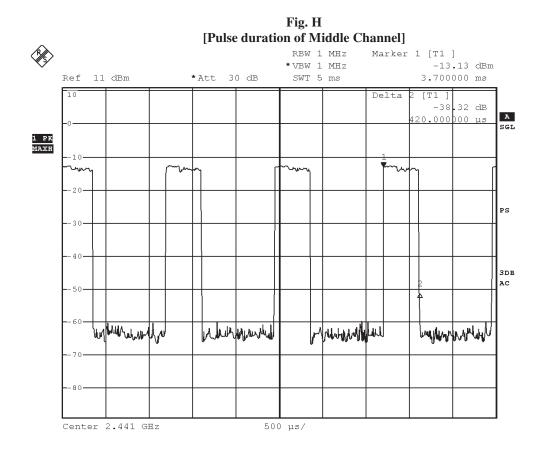
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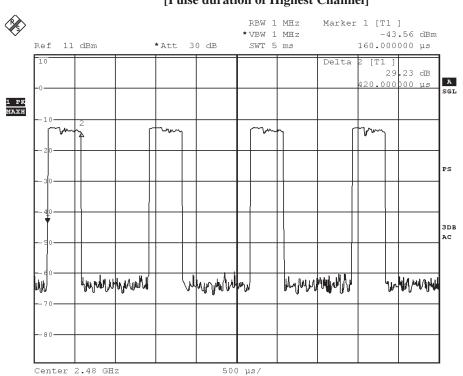


Fig. I [Pulse duration of Highest Channel]

Time of occupancy (I	Dwell Time):
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Data Packet	Frequency	Pulse Duration	Dwell Time	Limits	Test Results
	(MHz)	(ms)	(s)	(s)	
DH5	2402	2.930	0.313	0.400	Complies
DH5	2441	2.930	0.313	0.400	Complies
DH5	2480	2.930	0.313	0.400	Complies
DH3	2402	1.680	0.269	0.400	Complies
DH3	2441	1.680	0.269	0.400	Complies
DH3	2480	1.680	0.269	0.400	Complies
DH1	2402	0.420	0.134	0.400	Complies
DH1	2441	0.420	0.134	0.400	Complies
DH1	2480	0.420	0.134	0.400	Complies

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3.1.9 Channel Centre Frequency

Ambient Temperature: 25°C Relative Humidity: 51% Atmospheric Pressure: 101 kPa

Requirements:

Frequency hopping system in the 2400-2483.5MHz band shall use at least 79 (Channel 1 to 79) non-overlapping channels.

The EUT operates in according with the Bluetooth system specification within the 2400 - 2483.5 MHz frequency band.

RF channels for Bluetooth systems are spaced 1 MHz and are ordered in channel number k. In order to comply with out-of-band regulations, a lower frequency guard band of 2.0 MHz and a higher frequency guard band of 3.5MHz is used.

The operating frequencies of each channel are as follows:

First RF channel start from 2400MHz + 2MHz guard band = 2402MHz Frequency of RF Channel = 2402+k MHz, k = 0,...,78 (Channel separation = 1MHz)



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3.1.10 Pseudorandom Hopping Algorithm

Ambient Temperature: 25°C Relative Humidity: 51% Atmospheric Pressure: 101 kPa

Requirements:

The channel frequencies shall be selected from a pseudorandom ordered list of hopping frequencies. Each frequency must be used equally by the transmitter.

EUT Pseudorandom Hopping Algorithm

The EUT is a Bluetooth device, the Pseudo-random hopping pattern; hopping characteristics and algorithm are based on the Bluetooth specification.



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3.1.11 Antenna Requirement

Ambient Temperature: 25°C

Relative Humidity: 51%

Atmospheric Pressure: 101 kPa

Test Requirements: § 15.203

Test Specification:

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.

Test Results:

This is PCB antenna. There is no external antenna, the antenna gain = 0dBi. User is unable to remove or changed the Antenna.



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Appendix A

List of Measurement Equipment

Radiated Emission									
EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL			
EM215	MULTIDEVICE CONTROLLER	EMCO	2090	00024676	N/A	N/A			
EM217	ELECTRIC POWERED TURNTABLE	EMCO	2088	00029144	N/A	N/A			
EM218	ANECHOIC CHAMBER	ETS-LINDGREN	FACT-3		2020/04/20	2021/04/20			
EM356	ANTENNA POSITIONING TOWER	ETS-LINDGREN	2171B	00150346	N/A	N/A			
EM336	PRECISION CONICAL DIPOLE	SEIBERSDORF LABORATORIES	PCD 3100	6236/M	2020/05/30	2022/05/30			
EM229	EMI TEST RECEIVER	R&S	ESIB40	100248	2020/05/13	2021/05/13			
EM276	BROADBAND HORN ANTENNA	A-INFOMW	JXTXLB- 10180-SF	J203109090300 7	2019/03/20	2021/03/29			
EM300	PYRAMIDAL STANDARD GAIN HORN ANTENNA	ETS-LINDGREN	3160-09	00130130	2020/04/28	2022/04/28			
EM301	PYRAMIDAL STANDARD GAIN HORN ANTENNA	ETS-LINDGREN	3160-10	00130988	2020/04/28	2022/04/28			
EM022	LOOP ANTENNA	ETS_LINDGREN	6502	00206533	2019/11/30	2021/11/30			
EM200	DUAL CHANNEL POWER METER	R & S	NRVD	100592	2019/10/11	2021/10/11			
EM012	PRE-AMPLIFIER	HP	HP8448B	3008A00262	2019/11/08	2021/11/08			

Line Conducted

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL			
EM119	LISN	R & S	ESH3-Z5	0831.5518.52	2020/06/30	2021/06/30			
EM145	EMI TEST RECEIVER	R & S	ESIB7	100072	2020/05/13	2021/05/13			
EM179	IMPULSE LIMITER	ROHDE & SCHWARZ	ESH3-Z2	357-8810.52/54	2020/01/13	2021/01/11			
EM154	SHIELDING ROOM	SIEMENS MATSUSHITA COMPONENTS	N/A	803-740-057- 99A	2017/02/02	2022/02/02			
N/A	MEASUREMENT AND EVALUATION SOFTWARE	ROHDE & SCHWARZ	BSIB-K1	V1.20	N/A	N/A			

Remarks:-

CM Corrective Maintenance

N/A Not Applicable

TBD To Be Determined

The Hong Kong Standards and Testing Centre Limited

10 Dai Wang Street, Taipo Industrial Estate, Tai Po, N.T., Hong Kong

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Appendix B

Photographs of EUT



Inside view of the product

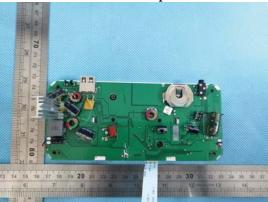


Inner circuit bottom view





Inner circuit top view



Inner circuit top view



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Photographs of EUT

Inner circuit bottom view

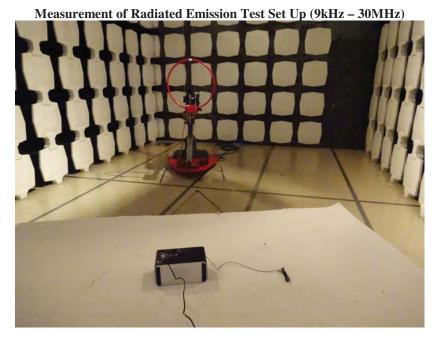


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Photographs of EUT



Measurement of Radiated Emission Test Set Up (30MHz to 1000MHz)



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Photographs of EUT



***** End of Test Report *****

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