

		1031	Report	
Date : 2024-04-16 No. : HMD24020004				Page 1 of 69
Applicant	:	SHENZHEN JUI	NLAN ELECTRONIC LTD.	
		-	Road, Shijing Community, Pings istrict, Shenzhen, China	shan Office,
Supplier / Manufacturer	:	SHENZHEN JUN	NLAN ELECTRONIC LTD.	
		-	Road, Shijing Community, Pings istrict, Shenzhen, China	shan Office,
Description of Sample(s)	:	Submitted sampl	e(s) said to be	
		Product:	3 in 1 Bluetooth Turntable with Aux	AM/FM Radio and
		Brand Name:	Hearth & Hand with Magnolia	
		Model No.:	NASA	
		FCC ID:	OKUJC1620	
Date Samples Received	:	2024-02-22		
Date Tested	:	2024-02-22 to 20	24-03-27	
Investigation Requested	:	with FCC 47CFR	Magnetic Interference measureme [Codes of Federal Regulations]] FCC Certification.	
Conclusions	:	Communications Subpart C. The t	oduct <u>COMPLIED</u> with the requi Commission [FCC] Rules and Ro ests were performed in accordanc and on Section 2.2 in this Test Re	egulations Part 15, we with the standards
Remarks	:	Bluetooth FHSS	(GFSK / π/4-DQPSK)	
Test by		Susu	RONG KONG STA	OARD

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Knort

Dr.CHAN Kwok Hung, Brian Authorized Signatory



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<u>1.0</u> <u>General Details</u>

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:	3 in 1 Bluetooth Turntable with AM/FM Radio and Aux
Manufacturer:	SHENZHEN JUNLAN ELECTRONIC LTD
	No. 277, Pingkui Road, Shijing Community, Pingshan Office,
	Pingshan New District, Shenzhen, China
Brand Name:	Hearth & Hand with Magnolia
Model Number:	NASA
Additional Model Number:	324-06-0009, JC-1620
Rating:	9.0Vd.c. by adapter
The AC/DC adaptor was provide	ed by the applicant with following details:
Brand name: N/A; Model no.:G	KYPS0080090UL1;
Input: 100-240Va.c. 50/60Hz 0.	5A; Output: 9.0Vd.c. 0.8A 7.2W

1.2.1 Description of EUT Operation

The Equipment Under Test (EUT) is a 3 in I Bluetooth Turntable with AM/FM Radio and Aux . 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

2024-02-21

- **1.4** Submitted Sample(s): 1 Sample
- **1.5 Test Duration** 2024-02-22 to 2024-03-27
- **1.6 Country of Origin** China

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1.7 **RF Module Details**

Module Model Number:	AC6951C
Module FCC ID:	N/A
Module Transmission Type:	Bluetooth V5.3 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

Module Specification (specification provided by manufacturer)

1.8 Antenna Details

Antenna Type:	PCB antenna
Antenna Gain:	-0.58dBi

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.

The device was realized by test software.

FCC Assist 1.0.2.2		_	×
帮助(H)			
申口设置 申口 COM5 (USB-SERIAL CH340) 波特率 115200 数据位 8 校验位 None 停止位 1 流 控 NoFlow 美闭 BR/EDR BLE MODE TX Channel 78 Transmit_Power 7 Packet_Type 2-DH1 Hopping ON Data_Types Pn9	设备[COM5]打开成功 reply data: 04 0E 04 01 01 FC 00 return code: 0x0 配置数据发送成功! reply data: 04 0E 04 01 01 FC 00 return code: 0x0 配置数据发送成功!		
Send configuration	清除日志		

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2.2 Test Standards and Results Summary Tables

EMISSION Results Summary							
Test Condition	Test Requirement	Test Method	Class / Severity	T Pass	Test Result Pass Failed N/A		
Maximum Peak Conducted Output Power	FCC 47CFR 15.247(b)(1)	ANSI C63.10: 2013	N/A				
Radiated Spurious Emissions	FCC 47CFR 15.209, FCC 47CFR 15.205	ANSI C63.10: 2013	N/A				
AC Mains Conducted Emissions	FCC 47CFR 15.207	ANSI C63.10: 2013	N/A				
Conducted Spurious Emissions	FCC 47CFR 15.247(d)	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 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(2DH1/2DH3/2DH5)	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: 2013	
Test Date:	2024-02-23	
Mode of Operation:	Tx mode	
Ambient Temperature: 25° C	Relative Humidity: 51%	Atmospheric Pre

Ambient Temperature: 25°C

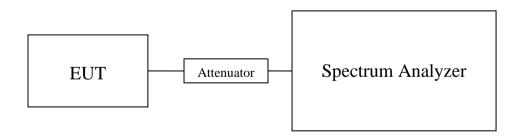
Test Method:

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= 50MHz, 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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Atmospheric Pressure: 101 kPa



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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						
ChannelFrequency(MHz)Conducted power(dBm)Antenna Gain(dBi)E.I.R.P(dBm)E.I.R.P (Watt)						
0	2402	-2.209	-0.58	-2.789	0.000526	
39	2441	-1.231	-0.58	-1.811	0.000659	
78	2480	-1.255	-0.58	-1.835	0.000655	

Results of Bluetooth Communication mode (π /4-DQPSK) (Fundamental Power): Pass						
Channel	Frequency(MHz)	Conducted Antenna E.I.R.P(dBm) E.I.R				
		power(dBm)	Gain(dBi)		(Watt)	
0	2402	-1.465	-0.58	-2.045	0.000624	
39	2441	-0.549	-0.58	-1.129	0.000771	
78	2480	0.008	-0.58	-0.572	0.000877	
Calculated measurement uncertainty : 30MHz to 1GHz 1.7dB						
1GHz to 18GHz 1.7dB						

Remark:

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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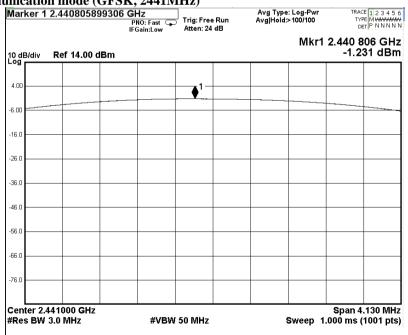
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Test plot of Maximum Peak Conducted Output Power:

Bluetooth Communication mode (GFSK, 2402MHz)

Ref Level 14.00 dBm		PNO: Fast 😱 IFGain:Low	Trig: Free Run Atten: 24 dB	Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 123456 TYPE MWWWWW DET PINNNN	
0 dB/div	Ref 14.00 dBm			Mkr1	2.401 822 GHz -2.209 dBm	
4.00			1			
6.00				<u> </u>		
16.0						
26.0						
36.0						
46.0						
56.0						
66.0						
76.0						
	402000 GHz 3.0 MHz	#VBW	50 MHz	Sweep 1	Span 4.122 MHz .000 ms (1001 pts	

Bluetooth Communication mode (GFSK, 2441MHz)



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Bluetooth Communication mode (GFSK, 2480MHz)

TRACE 123456 TYPE MWWWWWW DET PNNNNN Avg Type: Log-Pwr Avg|Hold:>100/100 PNO: Fast Trig: Free Run Mkr1 2.479 727 GHz -1.255 dBm Ref 14.00 dBm 10 dB/div Log **●**¹ 4.00 -6.00 -16.0 -26.0 -36.0 -46.0 -56.0 -66.0 -76.0 Span 4.133 MHz Sweep 1.000 ms (1001 pts) Center 2.480000 GHz #Res BW 3.0 MHz #VBW 50 MHz Bluetooth Communication mode (π/4 DQPSK, 2402MHz) TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P N N N N N Avg Type: Log-Pwr Avg|Hold:>100/100 Mkr1 2.401 723 GHz -1.465 dBm 10 dB/div Log Ref 14.00 dBm 4.00 ١ -6.00 16.0 -26.0 -36.0 46.0 -56.1 -66.0 76. Center 2.402000 GHz Span 6.145 MHz #Res BW 3.0 MHz #VBW 50 MHz Sweep 1.000 ms (1001 pts)

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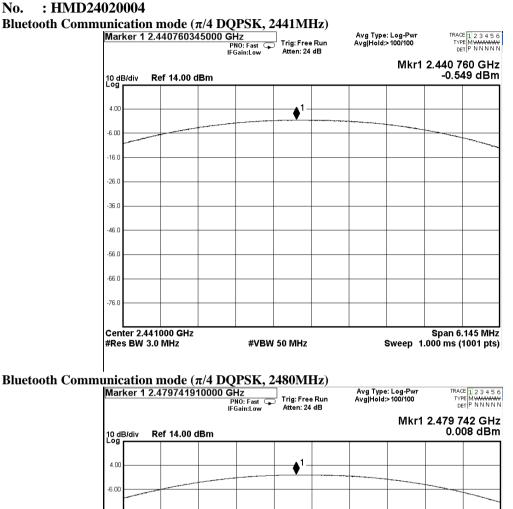
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-16. -26.0 -36.0 -46.0 -56.) -66.0 76. Center 2.480000 GHz Span 6.145 MHz #Res BW 3.0 MHz #VBW 50 MHz Sweep 1.000 ms (1001 pts)

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3.1.2 Radiated Spurious Emissions

Test Requirement:	FCC 47CFR 15.209	
Test Method:	ANSI C63.10:2013	
Test Date:	2024-02-23 to 2024-02-26	
Mode of Operation:	Tx mode / Bluetooth play m	ode (GFSK)
Ambient Temperature: 26.8°C	Relative Humidity: 43.9%	Atmospheri

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 Registration Number: HK0001 Test Firm Registration Number: 367672



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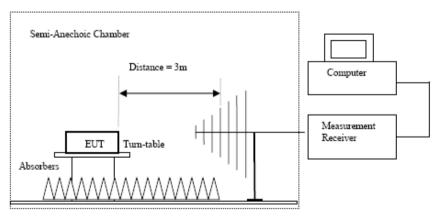
Spectrum Analyzer Setting:

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

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]	$[\mu V/m]$
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										
1	Level @3m	Factor	Strength	@3m		Polarity				
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dB	-				
4804.0	56.4	0.82	57.2	74.0	16.8	Vertical				
4804.0	57.0	0.52	57.5	74.0	16.5	Horizontal				
7206.0	49.8	7.00	56.8	74.0	17.2	Vertical				
7206.0	50.2	6.50	56.7	74.0	17.3	Horizontal				
9608.0	46.7	8.50	55.2	74.0	18.8	Vertical				
9608.0	47.7	8.30	56.0	74.0	18.0	Horizontal				
12010.0	45.1	10.90	56.0	74.0	18.0	Vertical				
12010.0	45.4	10.80	56.2	74.0	17.8	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	41.1	0.8	41.9	54.0	12.1	Vertical				
4804.0	41.2	0.5	41.7	54.0	12.3	Horizontal				
7206.0	35.0	7.0	42.0	54.0	12.0	Vertical				
7206.0	35.3	6.5	41.8	54.0	12.2	Horizontal				
9608.0	31.9	8.5	40.4	54.0	13.6	Vertical				
9608.0	32.0	8.3	40.3	54.0	13.7	Horizontal				
12010.0	29.8	10.9	40.7	54.0	13.3	Vertical				
12010.0	29.3	10.8	40.1	54.0	13.9	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	56.7	0.8	57.5	74.0	16.5	Vertical				
4882.0	57.1	0.5	57.6	74.0	16.4	Horizontal				
7223.0	49.9	7.0	56.9	74.0	17.1	Vertical				
7223.0	50.4	6.5	56.9	74.0	17.1	Horizontal				
9764.0	48.5	8.5	57.0	74.0	17.0	Vertical				
9764.0	48.6	8.3	56.9	74.0	17.1	Horizontal				
12205.0	45.3	10.9	56.2	74.0	17.8	Vertical				
12205.0	45.4	10.8	56.2	74.0	17.8	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	41.2	0.8	42.0	54.0	12.0	Vertical				
4882.0	40.9	0.5	41.4	54.0	12.6	Horizontal				
7323.0	34.7	7.0	41.7	54.0	12.3	Vertical				
7323.0	35.1	6.5	41.6	54.0	12.4	Horizontal				
9764.0	32.8	8.5	41.3	54.0	12.7	Vertical				
9764.0	33.9	8.3	42.2	54.0	11.8	Horizontal				
12205.0	30.7	10.9	41.6	54.0	12.4	Vertical				
12205.0	30.4	10.8	41.2	54.0	12.8	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 more 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	C	Polarity				
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dB	-				
4960.0	55.7	0.8	56.5	74.0	17.5	Vertical				
4960.0	56.9	0.5	57.4	74.0	16.6	Horizontal				
7440.0	49.6	7.0	56.6	74.0	17.4	Vertical				
7440.0	49.5	6.5	56.0	74.0	18.0	Horizontal				
9920.0	46.7	8.5	55.2	74.0	18.8	Vertical				
9920.0	47.2	8.3	55.5	74.0	18.5	Horizontal				
12400.0	45.2	10.9	56.1	74.0	17.9	Vertical				
12400.0	45.2	10.8	56.0	74.0	18.0	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	40.3	0.8	41.1	54.0	12.9	Vertical	
4960.0	41.4	0.5	41.9	54.0	12.1	Horizontal	
7440.0	34.7	7.0	41.7	54.0	12.3	Vertical	
7440.0	34.8	6.5	41.3	54.0	12.7	Horizontal	
9920.0	33.7	8.5	42.2	54.0	11.8	Vertical	
9920.0	33.2	8.3	41.5	54.0	12.5	Horizontal	
12400.0	29.6	10.9	40.5	54.0	13.5	Vertical	
12400.0	30.4	10.8	41.2	54.0	12.8	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			
1 2	Level @3m	Factor	Strength	@3m	U	Polarity			
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dB	-			
4804.0	57.0	0.8	57.8	74.0	16.2	Vertical			
4804.0	56.4	0.5	56.9	74.0	17.1	Horizontal			
7206.0	49.8	7.0	56.8	74.0	17.2	Vertical			
7206.0	50.0	6.5	56.5	74.0	17.5	Horizontal			
9608.0	47.2	8.5	55.7	74.0	18.3	Vertical			
9608.0	47.9	8.3	56.2	74.0	17.8	Horizontal			
12010.0	45.2	10.9	56.1	74.0	17.9	Vertical			
12010.0	45.3	10.8	56.1	74.0	18.0	Horizontal			

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		Α	verage Valu	e		
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	40.9	0.8	41.7	54.0	12.3	Vertical
4804.0	39.8	0.5	40.3	54.0	13.7	Horizontal
7206.0	34.4	7.0	41.4	54.0	12.6	Vertical
7206.0	33.7	6.5	40.2	54.0	13.8	Horizontal
9608.0	32.2	8.5	40.7	54.0	13.3	Vertical
9608.0	32.9	8.3	41.2	54.0	12.8	Horizontal
12010.0	30.4	10.9	41.3	54.0	12.7	Vertical
12010.0	30.2	10.8	41.01	54.0	13.0	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	56.5	0.8	57.3	74.0	16.7	Vertical			
4882.0	56.4	0.5	56.9	74.0	17.1	Horizontal			
7223.0	49.7	7.0	56.7	74.0	17.3	Vertical			
7223.0	50.0	6.5	56.5	74.0	17.5	Horizontal			
9764.0	47.4	8.5	55.9	74.0	18.1	Vertical			
9764.0	47.1	8.3	55.4	74.0	18.6	Horizontal			
12205.0	45.2	10.9	56.1	74.0	17.9	Vertical			
12205.0	45.1	10.8	55.9	74.0	18.1	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	dBuV	dB/m	dBuV/m	dBuV/m	dB			
4882.0	41.2	0.8	42.0	54.0	12.0	Vertical		
4882.0	40.4	0.5	40.9	54.0	13.1	Horizontal		
7323.0	34.7	7.0	41.7	54.0	12.3	Vertical		
7323.0	34.2	6.5	40.7	54.0	13.3	Horizontal		
9764.0	32.5	8.5	41.0	54.0	13.0	Vertical		
9764.0	33.4	8.3	41.7	54.0	12.3	Horizontal		
12205.0	31.4	10.9	42.3	54.0	11.7	Vertical		
12205.0	30.6	10.8	41.4	54.0	12.6	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	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	56.4	0.8	57.2	74.0	16.8	Vertical			
4960.0	55.9	0.5	56.4	74.0	17.6	Horizontal			
7440.0	49.6	7.0	56.6	74.0	17.4	Vertical			
7440.0	50.0	6.5	56.5	74.0	17.5	Horizontal			
9920.0	47.5	8.5	56.0	74.0	18.0	Vertical			
9920.0	46.9	8.3	55.2	74.0	18.8	Horizontal			
12400.0	45.3	10.9	56.2	74.0	17.8	Vertical			
12400.0	45.3	10.8	56.1	74.0	17.9	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	U	Polarity		
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dB	-		
4960.0	40.7	0.8	41.5	54.0	12.5	Vertical		
4960.0	40.8	0.5	41.3	54.0	12.7	Horizontal		
7440.0	34.5	7.0	41.5	54.0	12.5	Vertical		
7440.0	35.1	6.5	41.6	54.0	12.4	Horizontal		
9920.0	32.7	8.5	41.2	54.0	12.8	Vertical		
9920.0	32.2	8.3	40.5	54.0	13.5	Horizontal		
12400.0	29.9	10.9	40.8	54.0	13.2	Vertical		
12400.0	30.9	10.8	41.7	54.0	12.3	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	(9kHz-30MHz): 2.0dB
uncertainty	(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 15.205(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	48.1	-4.8	43.3	74.0	30.7	Vertical	
2390.0	49.4	-4.7	44.7	74.0	29.3	Horizontal	

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	43.1	-4.8	38.3	54.0	15.7	Vertical	
2390.0	42.7	-4.7	38.0	54.0	16.0	Horizontal	

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	52.6	-4.8	47.8	74.0	26.2	Vertical	
2483.5	53.5	-4.7	48.8	74.0	25.2	Horizontal	

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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	43.7	-4.8	38.9	54.0	14.9	Vertical	
2483.5	42.8	-4.7	38.1	54.0	15.9	Horizontal	

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

r								
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	49.4	-4.8	44.6	74.0	29.4	Vertical		
2390.0	48.6	-4.7	43.9	74.0	30.1	Horizontal		

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	42.9	-4.8	38.1	54.0	15.9	Vertical	
2390.0	42.5	-4.7	37.8	54.0	16.5	Horizontal	

Result: RF Radiated Emissions (Highest) -π/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	52.9	-4.8	48.1	74.0	25.9	Vertical	
2483.5	52.3	-4.7	47.6	74.0	26.4	Horizontal	

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	43.3	-4.8	38.5	54.0	15.5	Vertical
2483.5	42.9	-4.7	38.2	54.0	15.9	Horizontal

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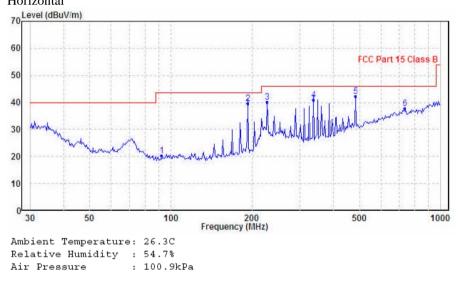
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Limits for Radiated Emissions FCC 47 CFR 15.247 Class B]:

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 Horizontal



	Freq	Level	Limit Line	Over Limit	Remark	Pol/Phase
	MHz	$\overline{dBuV/m}$	$\overline{dBuV/m}$	dB		
1	92.419	20.40	43.50	-23.10	QP	Horizontal
2	192.419	39.52	43.50	-3.98	QP	Horizontal
3	227.691	40.20	46.00	-5.80	QP	Horizontal
4	337.216	40.88	46.00	-5.12	QP	Horizontal
5	482.216	42.17	46.00	-3.83	QP	Horizontal
6	734.491	37.70	46.00	-8.30	QP	Horizontal

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5

6

361.714

30.92

482.216 40.89 46.00 -5.11 QP

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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.

70 Level (dBuV/m) 60 FCC Part 15 Class B 50 40 H 30 20 10 0 30 200 Frequency (MHz) 500 50 100 1000 Ambient Temperature: 26.3C Relative Humidity : 54.7% Air Pressure : 100.9kPa Limit Over Freq Level Line Limit Remark Pol/Phase MHz dBuV/m dBuV/m dB 33.799 36.40 40.00 -3.60 QP Vertical 1 2 46.016 35.16 40.00 -4.84 QP Vertical З 71.080 25.74 40.00 -14.26 QP Vertical 216.783 46.00 -21.51 QP Vertical 4 24.49

46.00 -15.08 QP

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.

Vertical

Vertical

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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:	2024-02-22
Mode of Operation:	Bluetooth mode
Test Voltage:	120Va.c. 60Hz
-	

Ambient Temperature: 25°C Relative Humidity: 51%

Atmospheric Pressure: 101 kPa

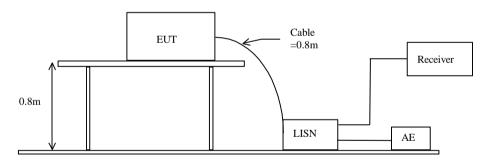
Test Method:

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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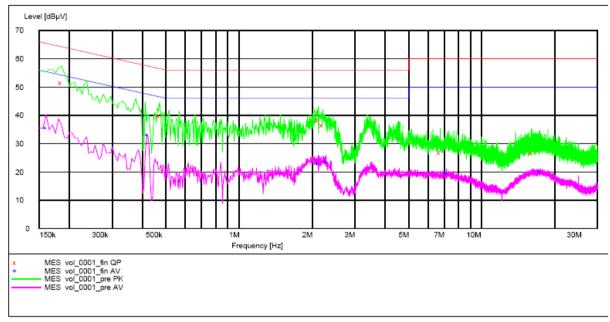
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Results of Bluetooth mode (L): PASS

Please refer to the following diagram for individual results.



MEASUREMENT R			-			
Frequency	Level	Transd	Limit	Margin	Line	PE
MHz	dBµV	dB	dBµV	dB		
0.185000	51.60	9.7	64.30	12.70	L1	GND
0.470000	39.90	9.7	56.50	16.60	L1	GND
2.120000	38.50	9.8	56.00	17.50	L1	GND
2.210000	36.70	9.8	56.00	19.30	L1	GND
6.750000	27.00	9.9	60.00	33.00	L1	GND
16.190000	26.80	10.3	60.00	33.20	L1	GND
MEASUREMENT R	ESULT: "v	01_0001_1	fin AV"			
MEASUREMENT R. Frequency	<i>ESULT:</i> "v Level	01_0001_1 Transd		Margin	Line	PE
				Margin dB	Line	PE
Frequency	Level	Transd	Limit		Line	PE
Frequency	Level	Transd	Limit		Line L1	PE GND
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	dB		
Frequency MHz 0.160000	Level dBµV 35.30	Transd dB 9.7	Limit dBµV 55.50 47.40	dB 20.20	L1	GND
Frequency MHz 0.160000 0.420000	Level dBµV 35.30 33.10	Transd dB 9.7 9.7	Limit dBµV 55.50 47.40	dB 20.20 14.30	L1 L1	GND GND
Frequency MHz 0.160000 0.420000 2.120000	Level dBµV 35.30 33.10 23.00	Transd dB 9.7 9.7 9.8	Limit dBµV 55.50 47.40 46.00	dB 20.20 14.30 23.00	L1 L1 L1	GND GND GND
Frequency MHz 0.160000 0.420000 2.120000 2.285000	Level dBµV 35.30 33.10 23.00 23.40	Transd dB 9.7 9.7 9.8 9.8	Limit dBµV 55.50 47.40 46.00 46.00	dB 20.20 14.30 23.00 22.60	L1 L1 L1 L1	GND GND GND GND

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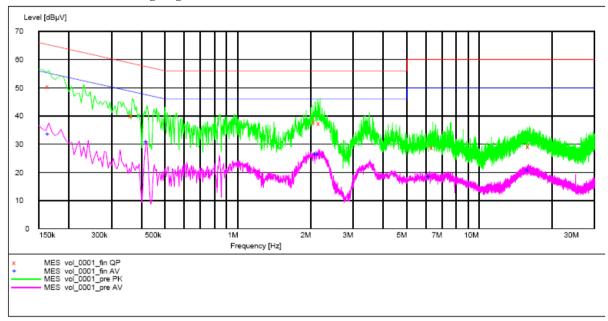


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Results of Bluetooth mode (N): PASS

Please refer to the following diagram for individual results.



MEASUREMENT RE	SULT: "V	01_0001_1	fin QP"			
Frequency	Level	Transd	Limit	Margin	Line	PE
MHz	dBµV	dB	dBµV	dB		
0.165000	50.50	9.7	65.20	14.70	N	GND
0.365000	40.20	9.7	58.60	18.40	N	GND
2.090000	38.00	9.8	56.00	18.00	N	GND
2.190000	37.50	9.8	56.00	18.50	N	GND
6.425000	28.80	9.9	60.00	31.20	Ν	GND
16.140000	29.10	10.3	60.00	30.90	N	GND
MEASUREMENT RE	SULT: "V	01_0001_1	in AV"			
Frequency	Lovol	Trangel	Limit	Margin	Line	DF

Frequency MHz	dBµV	dB	dBµV	Margin dB	Line	РВ
0.165000	33.60	9.7	55.20	21.60	N	GND
0.420000	30.80	9.7	47.40	16.60	N	GND
2.105000	26.60	9.8	46.00	19.40	N	GND
2.160000	26.40	9.8	46.00	19.60	N	GND
6.230000	18.50	9.9	50.00	31.50	N	GND
15.970000	20.80	10.3	50.00	29.20	N	GND

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3.1.4 Number of Hopping Frequency

Ambient Temperature: 25°C Relative Humidity: 51%

Atmospheric Pressure: 101 kPa

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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.

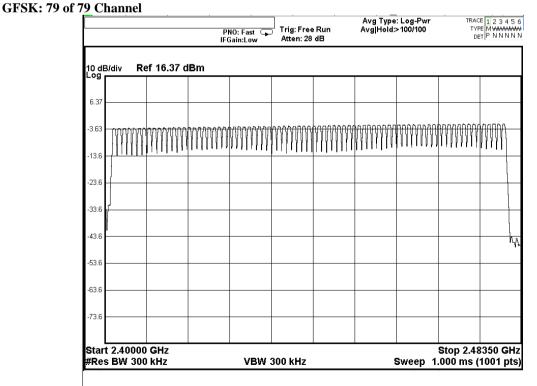
Spectrum Analyzer Setting:

RBW = 300kHz, $VBW \ge RBW$, 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:



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	79 Ch Freq 2	annei .4000000	PI	NO: Fast 🕞 Gain:Low	Trig: Free Atten: 28		Avg Type Avg Hold:	:: Log-Pwr >100/100	TY	CE 12345 PE MWWWWW ET P N N N N
10 dB ^{Log} [ldiv R	ef 16.37 d	Bm						1	
6.37 -										
-3.63 -	<u>אא</u> אאא אא	hadaabhad	AAAAAAA	lhaldaan	www	wwwww	<u>AAAAAAA</u>	wwww	wwww	www
-13.6	[
-23.6										
-33.6										
-43.6										
-53.6										
-63.6										
-73.6 -										
	2.40000 BW 300			VBW	300 kHz			Sweep 1	Stop 2.44 .000 ms (

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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:	2024-02-23
Mode of Operation:	Tx mode

Ambient Temperature: 25°C Relative Humidity: 51% 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	875.9	Within 2400-2483.5

(Lowest Operating Frequency) - (GFSK)

Marker 1 -	Hz	Center Freq: 2.402000000 GHz Trig: Free Run Avg Hold:>10/10				× 10/10	Radio Std: None				
		#11	Gain:Lo	ow 🗭	#Atten: 3		A	vg noia:	>10/10	Radio Dev	/ice: BTS
10 dB/div Log	Ref 10.0	0 dBm		·							
0.00	_										
-10.0					\sim	~~~					
-20.0					لم	· \					
-30.0			تمسر				\sim	hay and			
-40.0		~	1					- ~	h		
-50.0										~~	
-60.0	معمرمهم								~	walk w	
-70.0											
-80.0											
Center 2.4 #Res BW					#VE	3W 100 k	Hz				an 3 MHz 4.133 ms
Occup	ied Banc	lwidth				Total P	ow	er	2.50) dBm	
		828	3.78	3 kH	Z						
Transm	nit Freq Er	ror	-33.2	229 kl	Hz OBW Power			99	99.00 %		
x dB Ba	andwidth		87	5.9 kl	Ηz	x dB			-20.	00 dB	

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Fundamental Frequency	20dB Bandwidth	FCC Limits
[MHz]	[KHz]	[MHz]
2441	874.9	Within 2400-2483.5

(Middle Operating Frequency) - (GFSK)

larker 1 ·	Hz	#IF	Gain:Lo	- -	Center Fi Trig: Free Atten: 30			0 GHz vg Hold:	> 10/10	Radio Sto Radio De	l: None vice: BTS
0 d <u>B/div</u>	Ref 19.0	0 dBm									
.og 9.00											
1.00											
11.0					$\sim\sim$	m					
21.0				\sim			\searrow	<u> </u>			
31.0		-						- Jone	n in the second s		
1.0	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~								J		
i1.0	we want the second second	\sim								V	man
1.0											
enter 2.4 Res BW					#VE	3W 100 k	Hz				oan 3 MH 4.133 m
Occup	ied Band	lwidth				Total P	ow	er	3.6	0 dBm	
		825	5.96	6 kHz	2						
Transm	nit Freq Eri	ror	-33.6	670 kH	z	OBW P	ow	er	9	9.00 %	
x dB Ba	andwidth 874.9 kHz			z	x dB -20			.00 dB			

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Fundamental Frequency	20dB Bandwidth	FCC Limits
[MHz]	[kHz]	[MHz]
2480	875.7	Within 2400-2483.5

(Highest Operating Frequency) - (GFSK)

enter Fre	q 2.48000		GHZ IFGain:Lu		Center Fi Trig: Free ¥Atten: 3			0 GHz vg Hold	:> 10/10	Radio Std Radio Dev	
0 dB/div	Ref 10.0	0 dBm									1
.og 0.00											
0.0					\sim	~~~					
0.0			کم سر				\searrow	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			
0.0		~	/~r					۰. ۱	home		
0.0										m.	
0.0 ********	m m								~~	Mr. March	hand the second
0.0											
0.0											
enter 2.4 Res BW 3					#VE	3W 100 k	Hz				an 3 MH 4.133 m
Occupi	ed Band	lwidth				Total P	ow	er	4.34	1 dBm	
		82	6.59) kH	z						
Transmi	it Freq Er	ror	-34.2	259 kH	z	OBW P	ow	er	99	9.00 %	
x dB Ba	ndwidth		87	5.7 kH	z	x dB			-20	00 dB	

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Fundamental Frequency	20dB Bandwidth	FCC Limits
[MHz]	[MHz]	[MHz]
2402	1.229	Within 2400-2483.5

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

Center Fr	eq 2.4020000	10 GHz	Center Freq: 2.402000000 GHz			Radio Std: None				
		#IFGain:Low	#Atten: 30 dB				Radio De	evice: BTS		
10 dB/div	Ref 19.00 dE	sm								
og										
9.00										
1.00			<u> </u>				-			
11.0			$ \longrightarrow $	mm	ma					
1.0						<u></u>				
31.0						γ				
1.0						+ -				
i1.0	\sim					~~~	-			
1.0										
/1.0										
Center 2.402 GHz #Res BW 30 kHz				#VBW 100 kHz			Span 3 MH Sweep 4.133 m			
Occupied Bandwidth				Total Power			2.38 dBm			
	1	.1663 M⊢	IZ							
Transmit Freq Error -35.151 I			Hz	OBW Power			99.00 %			
x dB Bandwidth		1.229 M	Hz	x dB		-20.00 dB				

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Fundamental Frequency	20dB Bandwidth	FCC Limits
[MHz]	[MHz]	[MHz]
2441	1.228	Within 2400-2483.5

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

enter Fre	eq 2.441000000 GHz #IFGain:Low			Center Freq: 2.441000000 GHz Trig: Free Run Avg Hold:> #Atten: 30 dB				Radio Std: None •10/10 Radio Device: BTS			
0 dB/div	Ref 19.00 di	Bm								I	
og .00											
.00											
1.0			~~~~~	$\wedge \checkmark$	\sim						
1.0		~					Mr.				
1.0							1	\			
1.0	m	f						Jawar	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~	
1.0											
1.0											
enter 2.441 GHz Res BW 30 kHz				#VBW 100 kHz					Span 3 MH Sweep 4.133 m		
Occupied Bandwidth					Total Power			3.49 dBm			
		1.16	76 MH2	Z							
Transmit Freq Error -35.368 kH			z	OBW Power			99.00 %				
x dB Bandwidth 1.22			1.228 MH	-	x dB			-20.00 dB			

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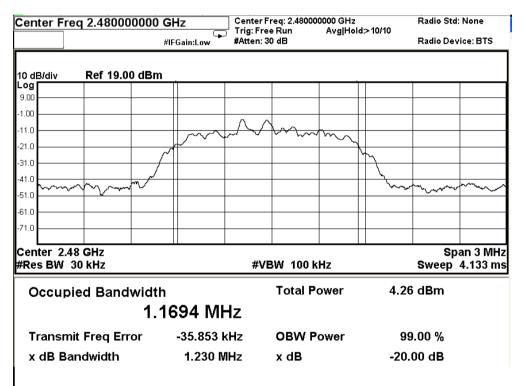


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Fundamental Frequency	20dB Bandwidth	FCC Limits
[MHz]	[MHz]	[MHz]
2480	1.230	Within 2400-2483.5

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



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3.1.6 Hopping Channel Separation

Ambient Temperature: 25°C	Relative Humidity: 51%	A
---------------------------	------------------------	---

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= 1230kHz (π /4 DQPSK)

The measured maximum bandwidth * 2/3 = 1.230 MHz * 2/3 = 820.0 kHz ($\pi/4$ DQPSK)



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Channel separation = 1MHz (>820kHz) (Lowest) (GFSK)

larker	1 \ 1	.00000	0000 MH	IZ PNO: Fast ⊆ FGain:Low	Trig: Free Ru Atten: 24 dB	Av: In Avg	g Type: Log-P Hold:>100/10	wr 10	TRACE 1 2 3 4 TYPE MWWW DET P N N N
10 dB/div	/ Re	f 14.00	dBm					∆Mkr1	1.000 MH 0.002 d
4.00							Δ2		
6.00			- /	X				<u> </u>	
16.0				-	\vdash		$- \rightarrow$, 	
26.0			1						
36.0	~			-					
46.0									
			_						
					1 1				
66.0									
66.0									
66.0		500 GH2	2						
66.0 76.0 Center #Res B	W 300	kHz	2	#VBV	V 300 kHz			o 1.000 r	ns (1001 p
66.0 76.0 Center Res B	W 300	kHz	X		Y	FUNCTION	Sweep FUNCTION WI	o 1.000 r	
66.0 76.0 Center #Res Β 4 Δ2 2 F	W 300	kHz	× 1.0	#VBV 000 MHz (Δ) 000 GHz	V 300 kHz V 300 kHz -2.663 dBm	FUNCTION		o 1.000 r	ns (1001 p
66.0 76.0 Center #Res Β 4 Δ2 F 3 4	W 300	kHz	× 1.0	000 MHz (Δ)	Y 0.002 dB	FUNCTION		o 1.000 r	ns (1001 p
66.0 76.0 2enter #Res B #XXF NODE 1 A2 2 F 3 4 5 6	W 300	kHz	× 1.0	000 MHz (Δ)	Y 0.002 dB	FUNCTION		o 1.000 r	ns (1001 p
66.0 76.0 Center fRes B 1 A2 2 F 3 4 5 6 7	W 300	kHz	× 1.0	000 MHz (Δ)	Y 0.002 dB	FUNCTION		o 1.000 r	ns (1001 p
#Res B 1 Δ2 2 F 3 4 5 6 7 8 9	W 300	kHz	× 1.0	000 MHz (Δ)	Y 0.002 dB	FUNCTION		o 1.000 r	an 4.000 Mi ns (1001 pi Jinction Value
66.0 76.0 Center #Res Bi 1 02 2 F 3 4 5 6 7 8	W 300	kHz	× 1.0	000 MHz (Δ)	Y 0.002 dB	FUNCTION		o 1.000 r	ns (1001 p

	1.00000	0000 MHz PNO: IFGain	ast ⊆ Low	Trig: Free R Atten: 24 dE	un Avg H	ype: Log-Pwr old:>100/100	TRACE 1 2 TYPE MV DET P N
3/div F	Ref 14.00	dBm				ΔM	//kr1 1.000 0.22
					_ 1∆:	2	
	+					\rightarrow	
<u> </u>							
	_						
	_						
	1500 GHz						0
s BW 30		<u>.</u>	#VBW	300 kHz		Sweep 1	Span 4.000 1.000 ms (100
Mode TRC	f (Δ)	× 1.000 M		Y 0.222 dB		FUNCTION WIDTH	FUNCTION VAL
F 1	f	2.441 000 G		-1.677 dBm			
			_				

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	DOOOOO MHz PNO: Fast IEGain:Low	Trig: Free Run Atten: 24 dB	Avg Type: L Avg Hold>10	00/100	TRACE 1 2 3 TYPE MWWW DET P N N
dB/div Ref 14.0		Atten: 24 4B		ΔMkr	1 1.000 M 0.077
			▲1∆2		
10					
.0					
.0					
.0					m.
.0					"The second
.0					
0			_		
.0			_		
nter 2.479500 G es BW 300 kHz		300 kHz	Sw		pan 4.000 M) ms (1001
$\begin{array}{c c} \text{MODE TRC SCL} \\ \hline \Delta 2 & 1 & f & (\Delta) \end{array}$	× 1.000 MHz (/		UNCTION FUNCTION	ON WIDTH	FUNCTION VALUE
F 1 f	2.479 000 GHz	-1.176 dBm			
3 1 3					
i i					
3					

Channel separation = 1MHz (>820kHz) (Lowest) ($\pi/4$ DQPSK)

			IFGain:Low	Atter	n: 24 dB		ΔN	1kr1 1.0	000 MH
-og	Ref 1	4.00 dBm				440).240 u
4.00				×2					
6.00				×2					
16.0									
26.0									
36.0									
46.0									
56.0									
66.0									
76.0									
70.0									
Center 2. #Res BW			#V	BW 300 k	Hz	·	Sweep 1		4.000 Mi (1001 pi
4KR MODE T		×		Ÿ		UNCTION FU	NCTION WIDTH	FUNCT	ION VALUE
1 Δ2 2 F	1 f (∆ 1 f		1.000 MHz 1 102 000 GHz		246 dB 1 dBm				
3		۷.	02 000 0112	-0.91	T GDIII				
5									
6									
6									
6 7 8 9									
6 7 8									

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		1.00	00000	000 MHz	2 PNO: Fas IFGain:Lo		Trig: Free I Atten: 24 d			e: Log-Pwr i:>100/100	I	ACE 1 2 3 4 YPE MWWW DET P N N N
dB/di	v	Ref	r 14.00	dBm						ΔΙ	//Wkr1 1.	000 MH 0.026 d
									▲ 1Δ2 -			
.00					_	×,			.			
5.0						// \\\2	Ĩ	-				
5.0												
5.0				-	-							
5.0				-	-							
5.0		-										-
6.0				-	_						-	
5.0				_	_						_	_
enter Res B			00 GH: kHz	Z	#\	/BW	300 kHz			Sweep		4.000 M (1001 p
R MODI	TRC			×			Y		CTION FL	INCTION WIDTH	FUNC	FION VALUE
1 <u>Δ2</u> 2 F	1	f	<u>(</u> Δ)		000 MHz	(<u></u>)	-0.026 d					
3		Ľ.		2.441	000 0112		0.100 021					
5								-				
6												
7 B								-				
9												
9 0 1	-											

Channel separation = 1MHz (>820kHz) (Highest) ($\pi/4$ DQPSK) [Marker 1 Δ 1.000000000 MHz Avg Type: Log-Pwr Avg Type:

IB/div Ref 14.	.00 dBm			440		-0	.048
	~ ~			1∆2 -			
		2 ~~					
					, ``		
)							
,							
nter 2.479500 C		≠VBW 300 k	Hz		Sweep 1.	Span 4 .000 ms (
nter 2.479500 C es BW 300 kHz MODE THE SCL	#	Y	FUN		Sweep 1.	.000 ms (1001
hter 2.479500 C es BW 300 kHz Δ2 1 f (Δ) F 1 f	# × 1.000 MH	Y Iz (Δ) -0.0	FUN			.000 ms (
hter 2.479500 C es BW 300 kHz Δ2 1 f (Δ)	#	Y Iz (Δ) -0.0	FUN			.000 ms (1001
hter 2.479500 C es BW 300 kHz Δ2 1 f (Δ)	# × 1.000 MH	Y Iz (Δ) -0.0	FUN			.000 ms (1001
hter 2.479500 C es BW 300 kHz Δ2 1 f (Δ)	# × 1.000 MH	Y Iz (Δ) -0.0	FUN			.000 ms (1001

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3.1.7 Band-edge Compliance of RF Conducted Emissions Measurement:

Ambient Temperature: $25^{\circ}C$

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.

According to the test method DA 00-70

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	Reference level	Limit	The highest conducted band edge emission	Result
[MHz]	[dBm]	[dBm]	[dBm]	
2400 – Lowest Fundamental (2402)	-2.706	-22.706	-55.111	PASS

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

larker	1 2.4	01854	000000 GH PN IFG	Z O: Fast G ain:Low	Trig: Free #Atten: 24		Avg Type Avg Hold	e: Log-Pwr :>100/100	TY	CE 1 2 3 4 5 PE MWWW ET P N N N
0 dB/div	/ R	ef 14.00	dBm					Mkr1	2.401 8 -2.7	354 GH 06 dBi
.og 4.00										▲ 1
5.00										
6.0										f
6.0										
6.0										\downarrow
6.0									2,	
6.0		<u>.</u>							- mannah	1
6.0 M	and the second s	- Wardton Mark	and the second second	*ጉ~ጉጉጉ	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	ᠮᡃᢑᢛᡘᡟᡀᡗᢦᡒᢥ	^โ รงว ีฟราจาก ให้สูงหนึ่ง	work worksen	New Martin	
6.0										
tart 2. Res B				#VB\	N 300 kHz		:	Sweep 2	Stop 2.4(2.800 ms (
KR MODE			Х	,	Y		TION FUI	NCTION WIDTH	FUNCTI	ON VALUE
1 N 2 N	1 f		2.401 854 2.400 000		-2.706 dB -55.111 dB					
3			2.400 000		-00.111 00					
4 5										
6						_				
7 8										
9										
						-				

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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)	-2.731	-22.731	-55.219	PASS

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

Mar	ker	22	.40	0000	0000	Р	Hz 'NO: Fas Gain:Lo		Trig: Free #Atten: 24				lold:>10	og-Pwr)0/100		TYF	E 1 2 3 4 5 1 E MWWWW T P N N N N
10 di	3/div	I	Ref	14.00	dBm	1								Mkr			00 GHz 19 dBm
Log																	~ 1
4.00																	
-6.00			+														-11/11
-16.0			+														/ V V
-26.0			+												_		1
-36.0			_												_		
-46.0																_ 2{	ł
-56.0																9 7	
-66.0	, nor	www	wh	بلواندر) معنو	www.	and the second	-www.rw	~~~~	ᡧᡵ᠋ᠺᢦᡊ᠇ᡇ᠆᠃ᢦᠰᢪᡃᢈ	~~ntr-vvi	m	*~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~	AL ANNAL AN		
-76.0																	
Star	t 2.3	3750)0 C	Hz													400 GHz
#Re	s BV	V 10	00 k	Hz			#\	/BW	300 kHz				Sw	eep :	2.800	ms (1001 pts)
MKR		TRC				×			Y		FUNCT	ION	FUNCTI	DN WIDTH	ł	FUNCTIO	IN VALUE
1	N N	1	f				4 GHz		-2.731 dE								
3		•	-		2.	400 00			-00.213 UL	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,							
4			_							_							
6																	
7			-							_							
9																	
10 11			-+							_							
			-							_					-		V

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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]	
2483.5 - Highest Fundamental (2480)	-4.053	-24.053	-63.164	PASS

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

larker 2 2.4	8350000	PN	Z 0: Fast (ain:Low	➡ Trig: Free #Atten: 24			Type: Log-Pwr told:>100/100	т	ACE 12345 YPE MWWWM DET PNNNN
0 dB/div R e	ef 14.00 c	IBm					Mkr2		500 GH I64 dBr
4.00	1								
5.00 ×	l								
6.0	\backslash								
16.0									
16.0	h								
i6.0		2							
6.0	**	Min More work	ᠾᢂᢧᠰᡨ	maria	n Man	Mu	New Marine		at water and the store
6.0									
tart 2.47800									50000 GH
Res BW 100	kHz		#VB	W 300 kHz			Sweep 2	.133 ms	(1001 pt
KR MODE TRC SO		× 2.479 980	GHz	Y -4.053 dB	FUN	TION	FUNCTION WIDTH	FUNCT	ION VALUE
2 N 1 f		2.483 500		-63.164 dB					
4									
5 6									
8									
7									

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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]	
2483.5 - Highest Fundamental (2480)	-4.068	-24.068	-62.941	PASS

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

arker	2 2.4	4835000		Hz NO: Fast Gain:Low				Type: Log-Pwr Hold:>100/100		RACE 1 2 3 4 5 TYPE MWWWW DET PINNNN
) dB/div	v R	ef 14.00	dBm					Mkr		500 GH 941 dBr
.00	(, i								
.00	mř	1								
6.0	\vee	<u>\</u>								_
6.0		1								
6.0 6.0		4								
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5.0		۴Ÿ	Morrison	******	or announder	www.ww	mahrym	www.www.	www.	man
6.0										
tart 2.	4780	0 GHz							Stop 2.	50000 GH
Res B	W 10	0 kHz		#VI	300 kH	z		Sweep 2		; (1001 pt
KR MODE		CL	× 2.479 980	이 더니지	Y -4.068 d		UNCTION	FUNCTION WIDTH	FUNC	TION VALUE
2 N 3		f	2.483 50		-62.941 (
4		_								
5										
7										
9										
1										

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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)	-2.743	-22.743	-54.939	PASS

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

/lar	ker	12	.40	18540	000	J	GHz PNO: Fas FGain:Lo		Trig: Free #Atten: 24		n			:: Log-Pw >100/100	r	TY	CE 1 2 3 4 PE M WWW DET P N N N	••••
0 dE	3/div	,	Rei	14.00	dBn	<u>n</u>								Mkr	12		354 G 43 dE	
.og 4.00																	 1_	
6.00																	pro-	
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6.0	prne	rumin)	, ¹⁰ , 10				100 100 100 100		H. C. M. C.		ry fure-re	Վ Աթվեն	^л \н.үү	www.	• • •••••	- ¹		_
6.0					_		_			-								_
				GHz					, 200 kili-								0400 G	
				kHz			#	VBW	/ 300 kHz	_				Sweep			<u> </u>	π
	ADDE N	TRC 1	f			× .401 8	54 GHz	:	-2.743 dE	3m	FUNC	TION	FUN	ICTION WIDT	Ή	FUNCT	ON VALUE	-
2 3	Ν	1	f		2	.400 0	00 GHz	-	-54.939 dE	۶m								_
4	_									_					_			_
5 6										\pm								_
7 8																		_
9 0	_									-			-		-			_
1																		_
																		2

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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)	-2.870	-22.870	-55.825	PASS

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

	ter 1	2.40	J10230	000000	FRZ PNO: Fast IFGain:Lov	· •	Trig: Free #Atten: 24		Avg Ty Avg Ho	/pe: Log-Pwr ld:>100/100	TY	ĈĒ 1 2 3 4 9 PE MWWW ET P N N N I
0 dB	3/div	Rei	f 14.00	dBm						Mkr1	2.401 8 -2.8	325 GH 70 dBi
og												a 1
4.00 -												
6.00 -												
6.0		-										
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6.0			0									
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6.0 -												
tart	: 2.37 s BW				#V	/BW 3	00 kHz			Sweep 2	Stop 2.4	
tart Res	BW	100	kHz	×	#V	/BW 3	00 kHz	FUN	CTION	Sweep 2	2.800 ms (
tart Res Re M	BW	100 E SEI	kHz	2.401 8	325 GHz		Y -2.870 dB	m	CTION	· ·	2.800 ms ((1001 pt
tart Res	; BW	100 C SCI	kHz	2.401 8			Y	m	CTION	· ·	2.800 ms ((1001 pt
tart Res 1 2 3 4	BW	100 E SEI	kHz	2.401 8	325 GHz		Y -2.870 dB	m		· ·	2.800 ms ((1001 pt
tart Res 1 2 3 4 5	BW	100 E SEI	kHz	2.401 8	325 GHz		Y -2.870 dB	m		· ·	2.800 ms ((1001 pt
Res 1 2 3 4 5 6 7	BW	100 E SEI	kHz	2.401 8	325 GHz		Y -2.870 dB	m		· ·	2.800 ms ((1001 pt
tart Res 1 2 3 4 5 6 7 8	BW	100 E SEI	kHz	2.401 8	325 GHz		Y -2.870 dB	m		· ·	2.800 ms ((1001 pt
tart Res 1 2 3 4 5 6	BW	100 E SEI	kHz	2.401 8	325 GHz		Y -2.870 dB	m		· ·	2.800 ms ((1001 pt

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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]	
2483.5 - Highest Fundamental (2480)	-4.043	-24.043	-65.720	PASS

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

		IFGain:Low			Mkr2	2.483 5	
dB/div Re	f 14.00 dBm					-65.72	20 dB
9 00							
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.0 7	<u> </u>						
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0	W Long		Annow washing	www.when	mom	www.	
0							
art 2.47800	<u></u>					Stop 2.50	
es BW 100		#VB	N 300 kHz		Sweep 2		
R MODE TRC SCL	×		Y	FUNCTION	FUNCTION WIDTH		IN VALUE
N 1 f		'9 980 GHz	-4.043 dBm	rononon		- Onone	
	2.48	3 500 GHz	-65.720 dBm				
N 1 f							
<u>N 1 f</u>							
N 1 f							
N 1 f							
<u>N</u> 1 f							
N 1 f							

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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]	
2483.5 - Highest Fundamental (2480)	-4.035	-24.035	-64.367	PASS

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

		_					Mkr2	2.483 5	
dB/div Re	f 14.00 d	Bm						-04.3	
0 0									
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0			http://willy.com/arcade		n				
0									
								<u> </u>	
art 2.47800 es BW 100			#VB	W 300 kHz		9	Sweep 2	Stop 2.50 .133 ms (
R MODE TRC SC		×		Y	ELING		ICTION WIDTH		N VALUE
N 1 f		2.479 98		-4.035 dE	3m				
N 1 f		2.483 50	0 GHz	-64.367 dE	3m				
					_				
	-				-				

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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

Spect	rum		-									
Ref L	evel	6.00 de	3m	e F	RBW	100 kHz						
e Att		25	dB SWT 250	ms 🕳 🖣	/BW	300 kHz	Mode Au	to Swee	q			
●1Pk M	ах											
0 dBm-	MI							41[1]				-3.59 dBm 2.4020 GHz
-10 dBn	n- -						٩	42[1]				-41.39 dBm 4.8180 GHz
-20 dBn	n- -											
-30 dBn	∩_∦_							+				
-40 dBn	₀		м2 Т мз		-					i		
-50 dBn	- N		T		_M4			-		<u> </u>		1
-60 dBn	n fr	مر ساسترین	Mannang	, i		Mr. Mark	mander	werter	m	Munu	www.www.whe	munumum
-70 dBn	n		74% 					-				
-80 dBn	n				-			-				
-90 dBn	~				-	P		_		*		
Start 3	10.0 M	Hz				691	pts				Stop	25.0 GHz
Marker		1 5352 4								0.00		
Туре	Ref	Trc	X-value		3	Y-value		ction		Fund	tion Result	t
M1		1		2 GHz		-3.59 dB			-			
M2 M3		1		.8 GHz I3 GHz		-41.39 dB			-			
M3 M4		1		13 GHZ		-53.53 dB			-			
			9.00			55,55 UL	~~~					

Compliance of RF Emissions – (GFSK 2402MHz) (the worst case)

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Spectrum			× ×	•			
Ref Level	6.00 dBm	n 🖷 RE	SW 100 kHz				(
Att	25 dB	8 SWT 250 ms 🕳 VE	3W 300 kHz	Mode Auto :	Sweep		
●1Pk Max							
0 damM1				M1	[1]		-3.60 dBr
0 dBm MI				-			2.4020 GH
-10 dBm				M2	[1]		-42.88 dBr
-10 UBIII				1			4.8180 GH
-20 dBm							
-30 dBm							
-40 dBm	M						
-50 dBm		M3 M	14				
-60 dBm-	Winner	thursday		1 1	Mary	manum	Ban k
-	W	hoursen	to the work working	www.wat			marine have and
-70 dBm-							
-80 dBm							
-90 dBm							
Start 30.0	MHz	he di	691	pts			Stop 25.0 GHz
Marker							
Type Ref	Trc	X-value	Y-value	Functi	on	Function	n Result
M1	1	2.402 GHz	-3.60 dB	69785			
M2	1	4.818 GHz	-42.88 dB				
MЗ	1	7.203 GHz	-49.42 dB				
M4	1	9.588 GHz	-51.27 dB	m			

Compliance of RF Emissions – (π /4-DQPSK 2402MHz) (the worst case)

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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 GFSK: 79 of 79 Channel

10 dE - ^{og}	3/div	Re	f 16.37 d	IBm								
6.37												
3.63	\ \ \ \ \ \ \	γŋ	ላሳሳሳሳሳሳ	AAAAAAA	ለሉላሳላላሳ	www	ᡐ᠋ᡟᢧᡀᡀᡐᡐ	ላሳሳላሳሳላሳሳ	ᡐᡐᡐᡐᡐᡍ	WWWWW	www	
13.6 23.6												
33.6	}											Į
43.6												-
53.6												
63.6												
73.6												
	t 2.400 5 BW (VBM	300 kHz				Stop 2.48 .000 ms (

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2DH5 Packet:

2DH5 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

Aarker 1 2.89500 ms	PNO: Fast 🔸 IFGain:Low	Trig: Free Run Atten: 28 dB	Avg Type: Log-Pwr	TRACE 1 2 3 4 5 TYPE WWWWWW DET P N N N N
0 dB/div Ref 16.37 dB	\$m		ΔΜ	lkr1 2.895 m -22.26 di
6.37				
3.63		andress and	dapan no a san na dara dan da	
13.6				
23.6				
33.6	%2			
43.6				
53.6 63.6 63.6	locly apply and the			1Δ2 WWW
73.6				
Center 2.402000000 GH Res BW 1.0 MHz		1.0 MHz	Sweep 5.00	Span 0 H 00 ms (1001 pts

Fig. A [Pulse duration of Lowest Channel] Page 54 of 69



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/lar	ker 1 2.89500 ms	PNO: Fast ↔→ IFGain:Low	Trig: Free Run Atten: 28 dB	Avg Type: Log-Pwr	TRACE 1234 TYPE WWWWW DET PNNN
I0 dl	B/div Ref 16.37 dBn	1			10 12.895 Mkr1 2.895 m 10 53.20 d
6.37					
3.63		المراجع معامير مطح بعد المراجع	171500-500-201-0000000-00-00	<u>1∆</u>	2
13.6					
23.6					
33.6					
43.6					
53.6					
63.6	Vhyphwiphun un han 19702			Li Li Mu	handren and the physical states of the second states of the second states of the second states of the second st
73.6					
. 5.0					
	ter 2.441000000 GHz BW 1.0 MHz	#\/D\\/	1.0 MHz	Owener 1	Span 0 H 5.000 ms (1001 pt

Marker 1 2.89500 m	PNC): Fast ↔ in:Low	Trig: Free R Atten: 28 dB	un	ype: Log-Pwr	TRACE 12345 TYPE WWWWW DET P NNNN
10 dB/div Ref 16.37 d	1Bm					-51.31 dl
6.37						
3.63		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	44.~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		******	4
13.6						
23.6						
33.6						
43.6						
63.6 63.6 WIMPHING AND	malwayawa	h				1 <u>0</u> 2 —
-73.6						

Fig C



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2DH3 Packet:

2DH3 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

Mar	ker 1 Δ	1.64500 ı	PN	10: Fast Jain:Low	Trig: Fi Atten:	ree Run 28 dB	Avg 1	[ype	: Log-Pwr	TYP	E 1 2 3 4 5 E WWWWWW T P N N N N
10 di _og	B/div R	ef 16.37 d	Bm						Δ	Mkr1 1. -5	645 m 6.43 dl
6.37											
3.63					unathered	magning	nandrundang/				
-13.6					_						
23.6											
-33.6							_				
43.6											
53.6 63.6	Anthilun _{pe} nne	alalalalala	platytytypenet	γW				ι2 Μ		Marphfyrmyfind	MMMr.uly
73.6				·							
	ter 2.402 BW 1.0 F	000000 G VIHz	Hz	#VE	SW 1.0 MH	łz			Sweep 5	S .000 ms (pan 0 H 1001 pt

Fig. D [Pulse duration of Lowest Channel]

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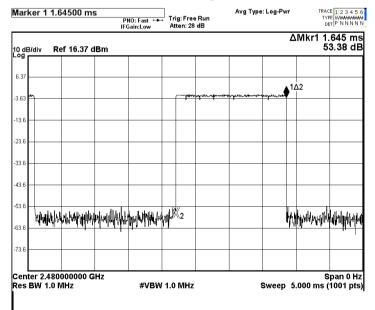


Date : 2024-04-16 No. : HMD24020004

Ava Type: Loa-Pw Marker 1 1.64500 ms TYPE WWWWWWW DET P NNNNN PNO: Fast ↔ Trig: Free Run IEGain: I ow Atten: 28 dB ∆Mkr1 1.645 ms -59.17 dB Ref 16.37 dBm 10 dB/div 63 -3.63 Kσ -13.8 -23.6 -331 -43.0 -53 upper the production of the -63. Center 2.441000000 GHz Res BW 1.0 MHz Span 0 Hz Sweep 5.000 ms (1001 pts) #VBW 1.0 MHz

Fig. E [Pulse duration of Middle Channel]

Fig. F [Pulse duration of Highest Channel]



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2DH1 Packet:

2DH1 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

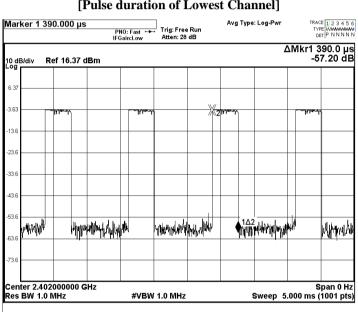


Fig. G [Pulse duration of Lowest Channel]

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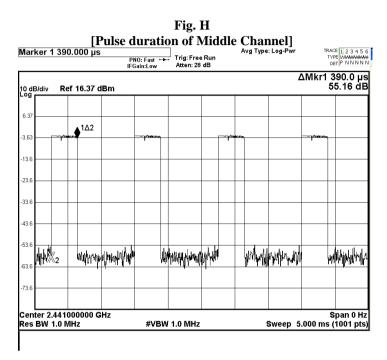
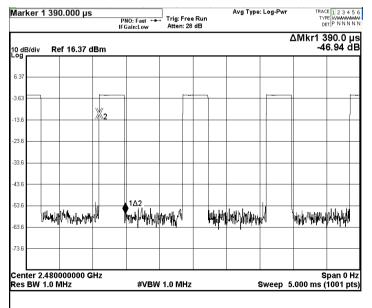


Fig. I [Pulse duration of Highest Channel]





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Time of occupancy (Dwell Time).

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Data Packet	Frequency	Pulse Duration	Dwell Time	Limits	Test Results
	(MHz)	(ms)	(s)	(s)	
2DH5	2402	2.895	0.3083	0.400	Complies
2DH5	2441	2.895	0.3083	0.400	Complies
2DH5	2480	2.895	0.3083	0.400	Complies
2DH3	2402	1.645	0.2630	0.400	Complies
2DH3	2441	1.645	0.2630	0.400	Complies
2DH3	2480	1.645	0.2630	0.400	Complies
2DH1	2402	0.390	0.1247	0.400	Complies
2DH1	2441	0.390	0.1247	0.400	Complies
2DH1	2480	0.390	0.1247	0.400	Complies



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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 = -0.58dBi. User is unable to remove or changed the Antenna.



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Appendix A

List of Measurement Equipment

		Radiated I	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		2019-04-16	2024-04-16
EM356	ANTENNA POSITIONING TOWER	ETS-LINDGREN	2171B	00150346	N/A	N/A
EM293	SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	N9020A	MY50510152	2023-03-21	2025-03-21
EM299	BROADBAND HORN ANTENNA	ETS-LINDGREN	3115	00114120	2023-01-25	2025-01-25
EM300	PYRAMIDAL STANDARD GAIN HORN ANTENNA	ETS-LINDGREN	3160-09	00130130	2023-01-16	2025-01-16
EM301	PYRAMIDAL STANDARD GAIN HORN ANTENNA	ETS-LINDGREN	3160-10	00130988	2023-02-15	2025-02-15
EM353	LOOP ANTENNA	ETS_LINDGREN	6502	00206533	2022-09-26	2024-09-26
EM355	BICONILOG ANTENNA	ETS-LINDGREN	3143B	00094856	2022-08-26	2024-08-26
EM200	DUAL CHANNEL POWER METER	R & S	NRVD	100592	2023-08-02	2025-08-02
EM012	PRE-AMPLIFIER	HP	HP8448B	3008A00262	2022-11-08	2025-11-08
EM215	MULTIDEVICE CONTROLLER	EMCO	2090	00024676	N/A	N/A

Line Conducted

			aactea			
EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EM232	LISN	SCHAFFNER	NNB41	04/100082	2023-05-30	2024-05-30
EM181	EMI TEST RECEIVER	R & S	ESIB7	100072	2023-05-22	2024-05-22
EM179	IMPULSE LIMITER	R & S	ESH3-Z2	357.8810.52/54	2023-03-17	2025-03-17
EM154	SHIELDING ROOM	SIEMENS MATSUSHITA COMPONENTS	N/A	803-740-057- 99A	2022-02-06	2027-02-06
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

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Appendix B

Photographs of EUT



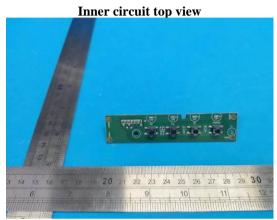




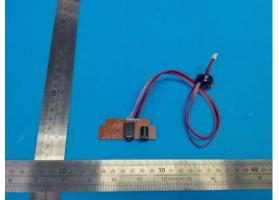
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Photographs of EUT



Inner circuit top view



Inner circuit top view



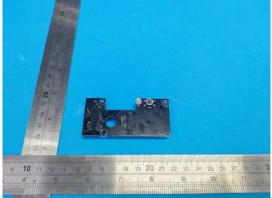


Inner circuit top view

Inner circuit top view



Inner circuit top view





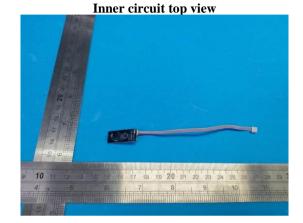
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Photographs of EUT

Inner <u>circuit top view</u>

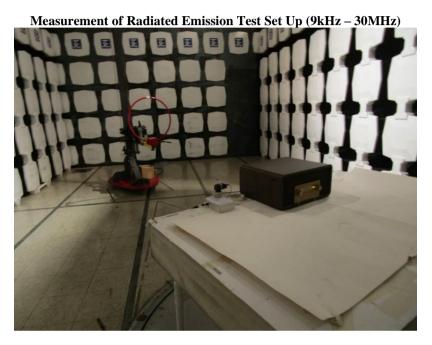






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Photographs of EUT



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



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Date : 2024-04-16 No. : HMD24020004 Photographs of EUT



Measurement of Conducted Emission Test Set Up



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

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- 3. The Company shall be at liberty to disclose the testing-related documents and/or files anytime to any third-party accreditation and/or recognition bodies for audit or other related purposes. No liabilities whatsoever shall attach to the Company's act of disclosure.
- 4. The Company shall not be called or be liable to be called to give evidence or testimony on the Report in a court of law without its prior written consent, unless required by the relevant governmental authorities, laws or court orders.
- 5. The results in Report apply only to the sample as received and do not apply to the bulk, unless the sampling has been carried out by the Company and is stated as such in the Report.
- 6. When a statement of conformity to a specification or standard is provided, the ILAC-G8 Guidance document (and/or IEC Guide 115 in the electrotechnical sector) will be adopted as a decision rule for the determination of conformity unless it is inherent in the requested specification or standard, or otherwise specified in the Report.
- 7. In the event of the improper use the report as determined by the Company, the Company reserves the right to withdraw it, and to adopt any other additional remedies which may be appropriate.
- 8. Sample submitted for testing are accepted on the understanding that the Report issued cannot form the basis of, or be the instrument for, any legal action against the Company.
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- 11. Subject to the variable length of retention time for test data and report stored hereinto as to otherwise specifically required by individual accreditation authorities, the Company will only keep the supporting test data and information of this test report for a period of three years. The data and information will be disposed of after the aforementioned retention period has elapsed. Under no circumstances shall we provide any data and information which has been disposed of after the retention period. Under no circumstances shall we be liable for damages of any kind, including (but not limited to) compensatory damages, lost profits, lost data, or any form of special, incidental, indirect, consequential or punitive damages of any kind, whether based on breach of contract of warranty, tort (including negligence), product liability or otherwise, even if we are informed in advance of the possibility of such damages.
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