Tonal

TEST REPORT FOR

Apollo Board, Model: 500-0806 Trainer, Model: T2

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Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

15.207 & 15.247 (DTS 2400-2483.5 MHz)

Report No.: 110285-54

Date of issue: November 27, 2024



Test Certificate # 803.01

This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

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Administrative Information

Test Report Information

REPORT PREPARED FOR:

REPORT PREPARED BY:

Tonal 69 Converse, Suite 200 San Francisco, CA 94103 Stacey Noriega CKC Laboratories, Inc. 5046 Sierra Pines Drive Mariposa, CA 95338

Project Number: 110285

Customer Reference Number: PO3196

DATE OF EQUIPMENT RECEIPT: DATE(S) OF TESTING:

Representative: Lars Gilstrom

October 2, 2024 October 10 & October 22, 2024 and November 4, 2024

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the equipment provided by the client, tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.

Steve -7 Bel

Steve Behm Director of Quality Assurance & Engineering Services CKC Laboratories, Inc.



Test Facility Information



Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S): CKC Laboratories, Inc. 1120 Fulton Place Fremont, CA 94539

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.20

Site Registration & Accreditation Information

Location	*NIST CB #	FCC	Canada	Japan
Canyon Park, Bothell, WA	US0103	US1024	3082C	A-0136
Brea, CA	US0103	US1024	3082D	A-0136
Fremont, CA	US0103	US1024	3082B	A-0136
Mariposa, CA	US0103	US1024	3082A	A-0136

*CKC's list of NIST designated countries can be found at: <u>https://standards.gov/cabs/designations.html</u>



Summary of Results

Standard / Specification: FCC Part 15 Subpart C - 15.247 (DTS 2400-2483.5 MHz)

Test Procedure	Description	Modifications	Results
15.247(a)(2)	6dB Bandwidth	NA	PASS
15.247(b)(3)	Output Power	NA	PASS
15.247(e)	Power Spectral Density	NA	PASS
15.247(d)	RF Conducted Emissions & Band Edge	NA	PASS
15.247(d)	Radiated Emissions & Band Edge Mod#1		PASS
15.207	AC Conducted Emissions	Mod#1	PASS

NA = Not Applicable

ISO/IEC 17025 Decision Rule

The equipment sample utilized for testing is selected by the manufacturer. The declaration of pass or fail herein is a binary statement for simple acceptance rule (ILAC G8) based upon assessment to the specification(s) listed above, without consideration of measurement uncertainties. For performance related tests, equipment was monitored for specified criteria identified in that section of testing.

Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

Summary of Conditions

```
Modification #1 (Mod#1) = Added a ferrite (Wurth: 742 712 21) on lower resistor wire Green Resistor
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Modifications listed above must be incorporated into all production units.

Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

Summary of Conditions
None



Equipment Under Test (EUT)

During testing, numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

Configuration A

Equipment Under To	<i>est</i> (* = EUT):		
Device Name	Manufacturer	Model #	S/N
Apollo Board	Tonal	500-0806	080600030001263

Support Devices:

Device Name	Manufacturer	Model #	S/N
MCB Board	Tonal	500-0131	500-0131_rev003_00001286_20240909_17
Laptop	Dell	XPS	22E00911
AC/DC Adapter for	Dell	DA130PM130	CN-06TTY6-48661-4CO-27M7-A00
Laptop			

Configuration 1

Equipment Under Test (* = EUT):

Device Name	Manufacturer	Model #	S/N
Trainer	Tonal	T2	4000055

Support Devices:

Device Name	Manufacturer	Model #	S/N
Laptop	Dell	XPS	22E00911
AC/DC Adapter for Laptop	Dell	DA130PM130	CN-06TTY6-48661-4CO- 27M7-A00



General Product Information:

Description of EUT
Exercise Trainer

Product Information	Manufacturer-Provided Details	
Operating Frequencies Tested:	2402-2480MHz	
Equipment Type:	Stand-Alone Equipment	
Type of Wideband System:	Bluetooth Low Energy	
Maximum Duty Cycle:	100%	
Modulation Type(s):	GFSK	
Number of TX Chains:	1	
Beamforming Type:	NA	
Antenna Type(s) and Gain:	External/4.83dBi	
Antenna Connection Type:	External Connector	
Nominal Input Voltage:	12VDC	
Firmware / Software Version(s): Putty		
Eirmwara / Softwara Description	Using Putty through USB port to control all modulation types and	
Filliware / Software Description.	frequencies to continuously transmit or receive as intended	
Firmware / Software Setting(s):	NA	
Tune-up or Adjustment(s):	NA	
The validity c	f results is dependent on the stated product details,	
the accuracy of which the manufacturer assumes full responsibility.		



EUT and Accessory Photo(s)



EUT

Support Equipment Photo(s)



Support Equipment - Laptop



Block Diagram of Test Setup(s)

Configuration#	Setup Description of Block Diagram
	Radiated Measurement: the Antenna is set up at 3meter distance from the EUT according to
1	ANSI C63.10 2020. The EUT is set up and operated as intended.
	Conducted Measurement: The EUT is placed non-conducted table. It is operated as intended. It is connected straight to a Spectrum Analyzer.

Radiated Method Setup





FCC Part 15 Subpart C

15.247(a)(2) 6dB Bandwidth

Test Setup/Conditions					
Test Location:	Fremont Lab Bench	Test Engineer:	Hieu Song Nguyenpham		
Test Method:	ANSI C63.10 (2020), KDB 558074	Test Date(s):	10/10/2024		
Configuration:	А				
Test Setup:	The EUT is placed non-conducted table. It is operated as intended. It is connected				
straight to a Spectrum Analyzer					

Environmental Conditions					
Temperature (^o C)	21.8	Relative Humidity (%):	48		

Test Equipment							
Asset# Description Manufacturer Model Cal Date Cal Due							
03013	Cable	Astrolab	32022-2-2909K-36TC	1/9/2024	1/9/2026		
P07365	Attenuator	Weinschel	54A-10	5/26/2023	5/26/2025		
03471	Spectrum Analyzer	Agilent	E4440A	2/23/2024	2/23/2026		

Test Data Summary						
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results	
2402	1	GFSK	711.294	≥500	Pass	
2442	1	GFSK	711.701	≥500	Pass	
2480	1	GFSK	718.170	≥500	Pass	



Plot(s)



Occupied Bandwidth, 6dB, Low Channel









Occupied Bandwidth, 6dB, High Channel



Test Setup Photo(s)



Test Setup



Test Setup, Close View



15.247(b)(3) Output Power

Test Setup/Conditions					
Test Location:	Fremont Lab Bench	Test Engineer:	Hieu Song Nguyenpham		
Test Method:	ANSI C63.10 (2020), KDB 558074	Test Date(s):	10/10/2024		
Configuration:	A				
Test Setup:	The EUT is placed non-conducted table. It is operated as intended. It is connected straight				
	to a Spectrum Analyzer				

Environmental Conditions					
Temperature (ºC) 21.8 Relative Humidity (%): 48					

Test Equipment							
Asset# Description Manufacturer Model Cal Date Cal Due							
03013	Cable	Astrolab	32022-2-2909K-36TC	1/9/2024	1/9/2026		
P07365	Attenuator	Weinschel	54A-10	5/26/2023	5/26/2025		
03471	Spectrum Analyzer	Agilent	E4440A	2/23/2024	2/23/2026		

Test Data Summary - Voltage Variations						
Frequency Modulation / Ant V _{Minimum} V _{Nominal} V _{Maximum} Max Deviation						
(MHz)	Port	(dBm)	(dBm)	(dBm)	from V _{Nominal} (dB)	
2402	GFSK	-1.18	-1.16	-1.19	0.03	
2442	GFSK	-1.32	-1.32	-1.33	0.01	
2480	GFSK	-1.45	-1.44	-1.44	0.01	

Test performed using operational mode with the highest output power, representing worst case.

Parameter Definitions:

Measurements performed at input voltage Vnominal ± 15%.

Parameter	Value
V _{Nominal} :	12VDC
V _{Minimum} :	10.2VDC
V _{Maximum} :	13.8VDC



Test Data Summary - RF Conducted Measurement							
Measureme	nt Option: RBW > D	rS Bandwidth					
Frequency	Frequency Modulation Ant. Type / RF Conducted EIRP (dBm) (dBm)					Results	
(IVIHZ)		Gain (dBi)	Measured	Limit	Calculated	Limit	
2402	GFSK	External/4.83	-1.16	≤30	3.67	≤36	Pass
2442	GFSK	External/4.83	-1.32	≤30	3.51	≤36	Pass
2480	GFSK	External/4.83	-1.44	≤30	3.39	≤36	Pass

EIRP is calculated as RF conducted power (dBm) + antenna gain (dBi)

For fixed point-to-point antennas, the limit is calculated in accordance with 15.247(c)(1):

For all other antennas, the RF conducted power limit is calculated according to a maximum of 1W (30 dBm) conducted power with a maximum of 6dBi gain antenna in accordance with 15.247(b)

For directional beamforming antennas, the limit is calculated in accordance with 15.247(c)(2) and KDB 662911.



Plots



RF Output Power, Low Channel



RF Output Power, Middle Channel





RF Output Power, High Channel



Test Setup Photo(s)



Test Setup



Test Setup, Close View



15.247(e) Power Spectral Density

Test Setup/Conditions					
Test Location:	Fremont Lab Bench	Test Engineer:	Hieu Song Nguyenpham		
Test Method:	ANSI C63.10 (2020), KDB 558074	Test Date(s):	10/10/2024		
Configuration:	A				
Test Setup:	The EUT is placed non-conducted table. It is operated as intended. It is connected				
straight to a Spectrum Analyzer					

Environmental Conditions						
Temperature (^o C)	21.7	Relative Humidity (%):	48			

Test Equipment											
Asset# Description Manufacturer Model Cal Date Ca											
03013	Cable	Astrolab	32022-2-2909K-36TC	1/9/2024	1/9/2026						
P07365	Attenuator	Weinschel	54A-10	5/26/2023	5/26/2025						
03471	Spectrum Analyzer	Agilent	E4440A	2/23/2024	2/23/2026						

Test Data Summary - RF Conducted Measurement										
Measurement	Measurement Method: PKPSD									
Frequency (MHz)	Frequency (MHz) Modulation Measured (dBm/3kHz) Limit (dBm/3kHz) Results									
2402	GFSK	-14.91	≤8	Pass						
2442	GFSK	-13.98	≤8	Pass						
2480	2480 GFSK -15.36 ≤8 Pass									



Plot(s)



Power Spectral Density, Low Channel









Power Spectral Density, High Channel



Test Setup Photo(s)



Test Setup



Test Setup, Close View



15.247(d) RF Conducted Emissions & Band Edge

Test Data

Test Location: Customer: Specification: Work Order #:	CKC Laboratories, Inc. • 1120 Fulton Pl • Fremont CA 94539 • (510) 249-1170 Tonal 15.247(d) Conducted Spurious Emissions 110285 Date: 10/10/2024								
Test Type:	Conducted Scan	Tim	ie: 1:50:57 PM						
Tested By:	Hieu Song Nguyenpham	Sequence	:#: 54						
Software:	EMITESt 5.05.20								
Fauinment Teste	d•								
Device	Manufacturer	Model #	S/N						
Configuration A									
Support Equipme	ent:								
Device	Manufacturer	Model #	S/N						
Configuration A									
Test Conditions /	'Notes:								
Conducted Spurio	ous Emission								
Frequency Range	: 9kHz to 25GHz								
Test Environment	Conditiona								
Temperature: 21.8	R°C								
Humidity: 47%	,								
Atmospheric Pres	sure: 101.5kPa								
Highest Generated	d Frequency: 5.825GHz								
Test Method: AN	SI C63.10 2020								
RF Output Set at	0dBm								
The EUT is place	d non-conducted table. It is opera	ted as intended. It is con	inected straight to a Spectrum	m Analyzer.					
A laptop is used to	b send the command to the EUT.								
Note:									
Low Channel BI	LE (BOBBLE)								



Tonal WO#: 110285 Sequence#: 54 Date: 10/10/2024 15.247(d) Conducted Spurious Emissions Test Distance: None None



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN03471	Spectrum Analyzer	E4440A	2/23/2024	2/23/2026
T1	ANP07365	Attenuator	54A-10	5/26/2023	5/26/2025
T2	AN03013	Cable	32022-2-2909K- 36TC	1/9/2024	1/9/2026



Measu	rement Data:	R	eading lis	ted by ma	argin.		Te	st Distance	e: None		
#	Freq	Rdng	T1	T2			Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV	dBµV	dB	Ant
1	10.979k	62.2	+9.8	+0.1			+0.0	72.1	85.4	-13.3	None
2	31.065k	60.6	+9.8	+0.0			+0.0	70.4	85.4	-15.0	None
3	108.532k	48.2	+9.8	+0.0			+0.0	58.0	85.4	-27.4	None
4	22348.802 M	43.3	+10.1	+2.6			+0.0	56.0	85.4	-29.4	None
5	22139.221 M	42.9	+10.1	+2.6			+0.0	55.6	85.4	-29.8	None
6	23690.120 M	42.2	+10.0	+2.6			+0.0	54.8	85.4	-30.6	None
7	23103.293 M	41.5	+10.1	+2.6			+0.0	54.2	85.4	-31.2	None
8	23553.892 M	41.5	+10.0	+2.6			+0.0	54.1	85.4	-31.3	None
9	24696.108 M	41.2	+10.0	+2.8			+0.0	54.0	85.4	-31.4	None



Test Location:	CKC Laboratories, Inc. • 1120 Fulton Pl • Free	mont CA 94539	• (510) 249-1170
Customer:	Tonal		
Specification:	15.247(d) Conducted Spurious Emissions		
Work Order #:	110285	Date:	10/10/2024
Test Type:	Conducted Scan	Time:	1:31:51 PM
Tested By:	Hieu Song Nguyenpham	Sequence#:	53
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration A			
Support Equipment	t:		
Device	Manufacturer	Model #	S/N
Configuration A			
Test Conditions / N	otes:		
Conducted Spurious	Emission		
Frequency Range: 9	kHz to 25GHz		
Test Environment C	onditions:		
Temperature: 21.8°C	2		
Humidity: 47%			
Atmospheric Pressu	re: 101.5kPa		
Hignest Generated F	requency: 5.825GHz		
DE Outrat Sat at 04	C03.10 2020		
KF Output Set at 0d	Bm		
The EUT is placed a	on-conducted table. It is operation	ted as intended. It is co	nnected straight to a Spectrum Analyzer
A lanton is used to s	end the command to the EUT		
Note:			
Middle Channel Bl	LE (BOBBLE)		



Tonal WO#: 110285 Sequence#: 53 Date: 10/10/2024 15.247(d) Conducted Spurious Emissions Test Distance: None None



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN03471	Spectrum Analyzer	E4440A	2/23/2024	2/23/2026
T1	ANP07365	Attenuator	54A-10	5/26/2023	5/26/2025
T2	AN03013	Cable	32022-2-2909K- 36TC	1/9/2024	1/9/2026



Measu	rement Data:	: Re	eading lis	ted by ma	argin.		Te	st Distance	e: None		
#	Freq	Rdng	T1	T2			Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV	dBµV	dB	Ant
1	9.000k	65.3	+9.9	+0.1			+0.0	75.3	85.4	-10.1	None
2	31.065k	63.5	+9.8	+0.0			+0.0	73.3	85.4	-12.1	None
3	106.707k	49.9	+9.8	+0.0			+0.0	59.7	85.4	-25.7	None
4	22327.844 M	43.9	+10.1	+2.6			+0.0	56.6	85.4	-28.8	None
5	22149.700 M	43.0	+10.1	+2.6			+0.0	55.7	85.4	-29.7	None
6	22254.491 M	42.9	+10.0	+2.6			+0.0	55.5	85.4	-29.9	None
7	24769.461 M	42.3	+10.0	+2.8			+0.0	55.1	85.4	-30.3	None
8	22705.089 M	42.0	+10.1	+2.6			+0.0	54.7	85.4	-30.7	None
9	24968.563 M	41.8	+10.1	+2.8			+0.0	54.7	85.4	-30.7	None



Test Location:	CKC Laboratories, Inc. • 1120 Fulton Pl • Free	mont CA 94539	• (510) 249-1170
Customer:	Tonal		
Specification:	15.247(d) Conducted Spurious Emissions		
Work Order #:	110285	Date:	10/10/2024
Test Type:	Conducted Scan	Time:	1:24:21 PM
Tested By:	Hieu Song Nguyenpham	Sequence#:	52
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration A			
Support Equipme	nt:		
Device	Manufacturer	Model #	S/N
Configuration A			
Test Conditions /	Notes:		
Conducted Spuriou	us Emission		
Frequency Range:	9kHz to 25GHz		
Test Environment	Conditions:		
Temperature: 21.8	°C		
Humidity: 47%			
Atmospheric Press	ure: 101.5kPa		
Highest Generated	Frequency: 5.825GHz		
Test Method: ANS	SI C63.10 2020		
RF Output Set at 0	dBm		
The EUT is placed	non-conducted table. It is operat	ted as intended. It is con	nected straight to a Spectrum Analyzer.
A laptop is used to	send the command to the EUT.		
Note:			
High Channel BL	TE (BOBBLE)		

High Channel _BLE (BOBBLE)



Tonal WO#: 110285 Sequence#: 52 Date: 10/10/2024 15.247(d) Conducted Spurious Emissions Test Distance: None None



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN03471	Spectrum Analyzer	E4440A	2/23/2024	2/23/2026
T1	ANP07365	Attenuator	54A-10	5/26/2023	5/26/2025
T2	AN03013	Cable	32022-2-2909K- 36TC	1/9/2024	1/9/2026



Measu	<i>leasurement Data:</i> Reading listed by margin.			argin.	Test Distance: None						
#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	9.000k	66.2	+9.9	+0.1			+0.0	76.2	85.4	-9.2	None
2	30.990k	64.2	+9.8	+0.0			+0.0	74.0	85.4	-11.4	None
3	108.271k	50.6	+9.8	+0.0			+0.0	60.4	85.4	-25.0	None
4	22327.844 M	43.5	+10.1	+2.6			+0.0	56.2	85.4	-29.2	None
5	24884.731 M	42.6	+10.0	+2.8			+0.0	55.4	85.4	-30.0	None
6	22788.922 M	42.6	+10.1	+2.6			+0.0	55.3	85.4	-30.1	None
7	22747.006 M	42.3	+10.1	+2.6			+0.0	55.0	85.4	-30.4	None
8	24968.563 M	41.8	+10.1	+2.8			+0.0	54.7	85.4	-30.7	None
9	24800.898 M	41.6	+10.0	+2.8			+0.0	54.4	85.4	-31.0	None



Band Edge

Band Edge Summary								
Limit applied: N	Limit applied: Max Power/100kHz - 20dB.							
Frequency (MHz)	Frequency (MHz) OBW (MHz) Modulation Measured (dBuV) Limit (dBuV) Results							
2400	1	GFSK	49.7	<85.4	Pass			
2483.5	1	GFSK	57.8	<85.4	Pass			

Band Edge Plots



Low Channel





High Channel



Test Setup / Conditions / Data

Test Location: Customer: Specification: Work Order #: Test Type: Tested By: Software:	CKC Laboratories, Inc. • 1120 Fulton I Tonal Band Edge 110285 Conducted Emission on Antenna Po Hieu Song Nguyenpham EMITest 5.03.20	Pl • Fremont CA 9453 Date: rt Time: Sequence#:	9 • (510) 249-1170 10/10/2024 13:48:29 51				
Equipment Tested	1:						
Device	Manufacturer	Model #	S/N				
Configuration A							
Support Equipme	ent:						
Device	Manufacturer	Model #	S/N				
Configuration A							
Test Conditions /	Notes:						
Band Edge							
Test Environment Temperature: 21.8 Humidity: 47% Atmospheric Press	Conditions: °C sure: 101.5kPa						
Highest Generated Frequency: 5.825GHz Test Method: ANSI C63.10 2020 RF Output Set at 0dBm							

The EUT is placed non-conducted table. It is operated as intended. It is connected straight to a Spectrum Analyzer. A laptop is used to send the command to the EUT.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN03471 Spectrum Analyzer		E4440A	2/23/2024	2/23/2026
	ANP07365	Attenuator	54A-10	5/26/2023	5/26/2025
	AN03013	Cable	32022-2-	1/9/2024	1/9/2026
			2909K-36TC		

Measurement Data:		Reading listed by order taken.			Test Distance: None						
#	Freq	Rdng					Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV	dBµV	dB	Ant
1	2483.500M	49.7					+0.0	49.7	85.4	-35.7	None
2	2400.000M	57.8					+0.0	57.8	85.4	-27.6	None



Test Setup Photo(s)



Test Setup



Test Setup, Close View



15.247(d) Radiated Emissions & Band Edge

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 1120 Fult	on Pl • Fremont CA 94539	9 • (510) 249-1170
Customer:	Tonal		
Specification:	15.247(d) / 15.209 Radiated Spuri	ous Emissions	
Work Order #:	110285	Date:	11/6/2024
Test Type:	Radiated Scan	Time:	18:54:30
Tested By:	Hieu Song Nguyenpham	Sequence#:	167
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:								
Device	Manufacturer	Model #	S/N					
Configuration 1								

Test Conditions / Notes:

Radiated Emission Frequency Range: 9kHz to 1GHz

Test Environment Conditions: Temperature: 22.7°C Humidity: 36% Atmospheric Pressure: 101.8kPa Highest Generated Frequency: 5.825GHz Method: ANSI C63.10 2020

The unit is mounted to a floor standing rack as to simulate typical wall mounted setup. One weight line is extended to the floor. Camera is on.

BT transmitting continuously with GFSK modulation type, LE1Mbps with pattern of 0s and 1s at power level 0 dBm

2442MHz-Middle Channel

Modification #1 in use during testing: Added a ferrite (Wurth: 742 712 21) on lower resistor wire. Green Resistor

No emissions from EUT has been found in 20dB tolerance in the frequency range 9kHz to 30MHz.



Tonal WO#: 110285 Sequence#: 167 Date: 11/6/2024 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP07508	Preamp	310N	4/5/2024	4/5/2026
	AN00432	Loop Antenna	6502	7/10/2023	7/10/2025
T2	AN01995	Biconilog Antenna	CBL6111C	5/16/2024	5/16/2026
Т3	ANP00880	Cable	RG214U	3/26/2024	3/26/2026
T4	ANP01187	Cable	CNT-195	7/3/2024	7/3/2026
T5	ANP06691	Cable	PE3062-180	3/20/2024	3/20/2026
	AN02660	Spectrum Analyzer	E4446A	12/6/2022	12/6/2024



Measu	rement Data:	Re	Reading listed by margin.			Test Distance: 3 Meters					
#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5								
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	$dB\mu V/m$	dB	Ant
1	311.943M	52.8	-31.9	+19.4	+1.8	+0.5	+0.0	43.2	46.0	-2.8	Horiz
			+0.6								
2	360.010M	51.3	-31.9	+20.5	+1.9	+0.6	+0.0	43.1	46.0	-2.9	Horiz
	QP		+0.7								
^	360.010M	52.5	-31.9	+20.5	+1.9	+0.6	+0.0	44.3	46.0	-1.7	Horiz
			+0.7								
4	297.365M	51.6	-31.9	+19.4	+1.8	+0.5	+0.0	42.0	46.0	-4.0	Horiz
			+0.6								
5	503.752M	41.4	-32.0	+24.5	+2.3	+0.7	+0.0	37.7	46.0	-8.3	Vert
			+0.8								
6	448.289M	40.8	-32.0	+23.2	+2.1	+0.7	+0.0	35.5	46.0	-10.5	Vert
			+0.7								
7	945.121M	29.7	-31.0	+30.6	+3.5	+1.0	+0.0	35.1	46.0	-10.9	Vert
			+1.3								



Test Location:	CKC Laboratories, Inc. • 1120 Fulton Pl •	Fremont CA 94539	• (510) 249-1170
Customer:	Tonal		
Specification:	15.247(d) / 15.209 Radiated Spurious En	missions	
Work Order #:	110285	Date:	11/4/2024
Test Type:	Radiated Scan	Time:	16:09:06
Tested By:	Hieu Song Nguyenpham	Sequence#:	124
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			
Support Equipmen	ıt:		
Device	Manufacturer	Model #	S/N
Configuration 1			
Test Conditions / I	Notes:		
Radiated Emission			
Frequency Range:	1GHz to 26GHz		
Test Environment (Temperature: 22.0° Humidity: 37% Atmospheric Press	Conditions: C ure: 101.5kPa		
Highest Generated	Frequency: 5.825GHz		
Test Method: ANS	I C63.10 2020		
The unit is mounter to the floor. Camer BT transmitting con	d to a floor standing rack as to si a is on. ntinuously with GFSK modulatio	mulate typical wall mount on type, LE1Mbps with pa	nted setup. One weight line is extended attern of 0s and 1s at power level 0 dBm
Modification #1 in	use during testing: Added a fe	rrite (Wurth: 742 712 21)	on lower resistor wire. Green Resistor

Low Channel



Tonal WO#: 110285 Sequence#: 124 Date: 11/4/2024 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02157	Horn Antenna-	3115	1/11/2023	1/11/2025
		ANSI C63.5			
T2	AN03302	Cable	32026-29094K-	1/9/2024	1/9/2026
			29094K-72TC		
Т3	ANP01210	Cable	FSJ1P-50A-4A	1/9/2024	1/9/2026
	AN02660	Spectrum Analyzer	E4446A	12/6/2022	12/6/2024
T4	AN02810	Preamp	83051A	4/6/2023	4/6/2025
T5	AN03013	Cable	32022-2-2909К-	1/9/2024	1/9/2026
			36TC		
	ANP07701	Cable	32022-29094K-	8/16/2024	8/16/2026
			29094K-120TC		
	AN02693	Active Horn	AMFW-5F-	1/9/2024	1/9/2026
		Antenna	12001800-20-		
			10P		
	AN02694	Horn Antenna	AMFW-5F-	1/9/2024	1/9/2026
			18002650-20-		
			10P		
	ANP00928	Cable	various	1/26/2024	1/26/2026

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ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	ANP00929	Cable	various	1/26/2024	1/26/2026
	ANP07698	Cable	32022-29094K-	8/16/2024	8/16/2026
			29094K-72TC		
T6	ANP07938	Preamp	83017A	6/14/2023	6/14/2025
T7	AN03386	High Pass Filter	11SH10-	3/22/2024	3/22/2026
			3000/T10000-		
			0/0		
Т8	AN03011	Cable	32022-2-2909K-	3/23/2023	3/23/2025
			24TC		

Measu	rement Data:	Re	eading lis	ted by ma	argin.		Те	est Distance	e: 3 Meters		
#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5	T6	T7	T8					
	MHz	dBµV	dB	dB	dB	dB	Table	$dB\mu V/m$	$dB\mu V/m$	dB	Ant
1	1198.800M	50.7	+24.8	+0.9	+1.7	-28.5	+0.0	50.2	54.0	-3.8	Vert
			+0.6	+0.0	+0.0	+0.0					
2	2198.400M	43.8	+28.2	+1.3	+2.4	-27.2	+0.0	49.3	54.0	-4.7	Horiz
			+0.8	+0.0	+0.0	+0.0					
3	1596.400M	46.7	+26.1	+1.1	+2.0	-28.0	+0.0	48.5	54.0	-5.5	Horiz
			+0.6	+0.0	+0.0	+0.0					
4	1336.000M	41.0	+25.1	+1.0	+1.9	-28.3	+0.0	41.3	54.0	-12.7	Horiz
			+0.6	+0.0	+0.0	+0.0					
5	1022.400M	38.3	+24.3	+1.0	+1.6	-28.7	+0.0	37.1	54.0	-16.9	Vert
	Ave		+0.6	+0.0	+0.0	+0.0					
^	1022.400M	58.1	+24.3	+1.0	+1.6	-28.7	+0.0	56.9	54.0	+2.9	Vert
			+0.6	+0.0	+0.0	+0.0					
7	9606.040M	45.3	+39.3	+3.0	+5.9	-28.2	+0.0	34.8	54.0	-19.2	Vert
			+1.6	-33.6	+0.2	+1.3					
8	9606.560M	44.6	+39.3	+3.0	+5.9	-28.2	+0.0	34.1	54.0	-19.9	Horiz
			+1.6	-33.6	+0.2	+1.3					
9	4797.560M	52.1	+33.4	+2.0	+3.6	-26.4	+0.0	32.8	54.0	-21.2	Vert
			+1.1	-34.1	+0.3	+0.8					
10	7206.000M	44.7	+36.0	+2.5	+4.5	-25.6	+0.0	30.8	54.0	-23.2	Vert
			+1.5	-34.4	+0.2	+1.4					
11	4805.680M	47.5	+33.4	+2.0	+3.6	-26.4	+0.0	28.2	54.0	-25.8	Horiz
			+1.1	-34.1	+0.3	+0.8					



Test Location:	CKC Laboratories, Inc. • 1120 Fultor	n Pl • Fremont CA 94539	• (510) 249-1170
Customer:	Tonal		
Specification:	15.247(d) / 15.209 Radiated Spurio	us Emissions	
Work Order #:	110285	Date:	11/4/2024
Test Type:	Radiated Scan	Time:	15:55:24
Tested By:	Hieu Song Nguyenpham	Sequence#:	125
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			
Support Equipment:			
Device	Manufacturer	Model #	S/N
Configuration 1			
Test Conditions / No	otes:		
Radiated Emission			
Frequency Range: 10	GHz to 26GHz		
Test Environment Co Temperature: 22.0°C Humidity: 37% Atmospheric Pressure Highest Generated Fi	onditions: e: 101.5kPa requency: 5.825GHz		
Test Method: ANSI (C63.10 2020		
The unit is mounted to the floor. Camera i BT transmitting conti	to a floor standing rack as to s is on. nuously with GFSK modulati	simulate typical wall mo on type, LE1Mbps with	unted setup. One weight line is extended pattern of 0s and 1s at power level 0 dBm
Modification #1 in u	ise during testing: Added a f	errite (Wurth: 742 712 2	1) on lower resistor wire. Green Resistor
Middle Channel			



Tonal WO#: 110285 Sequence#: 125 Date: 11/4/2024 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02157	Horn Antenna- ANSI C63.5	3115	1/11/2023	1/11/2025
T2	AN03302	Cable	32026-29094K- 29094K-72TC	1/9/2024	1/9/2026
Т3	ANP01210	Cable	FSJ1P-50A-4A	1/9/2024	1/9/2026
	AN02660	Spectrum Analyzer	E4446A	12/6/2022	12/6/2024
T4	AN02810	Preamp	83051A	4/6/2023	4/6/2025
T5	AN03013	Cable	32022-2-2909K-	1/9/2024	1/9/2026
			36TC		
	ANP07701	Cable	32022-29094K-	8/16/2024	8/16/2026
			29094K-120TC		
	AN02693	Active Horn	AMFW-5F-	1/9/2024	1/9/2026
		Antenna	12001800-20-		
			10P		
	AN02694	Horn Antenna	AMFW-5F-	1/9/2024	1/9/2026
			18002650-20-		
			10P		



ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	ANP00928	Cable	various	1/26/2024	1/26/2026
	ANP00929	Cable	various	1/26/2024	1/26/2026
	ANP07698	Cable	32022-29094K-	8/16/2024	8/16/2026
			29094K-72TC		
Т6	ANP07938	Preamp	83017A	6/14/2023	6/14/2025
T7	AN03386	High Pass Filter	11SH10-	3/22/2024	3/22/2026
			3000/T10000-		
			0/0		
Т8	AN03011	Cable	32022-2-2909К-	3/23/2023	3/23/2025
			24TC		

Measu	rement Data:	Re	eading lis	ted by ma	argin.		Те	est Distance	e: 3 Meters		
#	Freq	Rdng	T1	T2	Т3	T4	Dist	Corr	Spec	Margin	Polar
			T5	T6	T7	T8					
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	$dB\mu V/m$	dB	Ant
1	2192.200M	43.1	+28.2	+1.3	+2.4	-27.2	+0.0	48.6	54.0	-5.4	Vert
			+0.8	+0.0	+0.0	+0.0					
2	1397.900M	45.4	+25.3	+1.0	+1.9	-28.2	+0.0	46.0	54.0	-8.0	Horiz
			+0.6	+0.0	+0.0	+0.0					
3	1673.400M	42.3	+26.5	+1.1	+2.1	-27.9	+0.0	44.7	54.0	-9.3	Vert
			+0.6	+0.0	+0.0	+0.0					
4	1199.000M	44.6	+24.8	+0.9	+1.7	-28.5	+0.0	44.1	54.0	-9.9	Horiz
			+0.6	+0.0	+0.0	+0.0					
5	1595.700M	42.1	+26.1	+1.1	+2.0	-28.0	+0.0	43.9	54.0	-10.1	Horiz
			+0.6	+0.0	+0.0	+0.0					
6	1018.200M	38.9	+24.3	+1.0	+1.6	-28.7	+0.0	37.7	54.0	-16.3	Vert
	Ave		+0.6	+0.0	+0.0	+0.0					
^	1018.200M	58.5	+24.3	+1.0	+1.6	-28.7	+0.0	57.3	54.0	+3.3	Vert
			+0.6	+0.0	+0.0	+0.0					
8	9768.680M	43.2	+39.5	+3.0	+5.9	-28.4	+0.0	32.8	54.0	-21.2	Horiz
			+1.6	-33.5	+0.2	+1.3					
9	9768.680M	42.4	+39.5	+3.0	+5.9	-28.4	+0.0	32.0	54.0	-22.0	Vert
			+1.6	-33.5	+0.2	+1.3					
10	12210.680	41.8	+40.0	+3.3	+6.5	-29.6	+0.0	31.7	54.0	-22.3	Vert
	М		+1.8	-34.1	+0.6	+1.4					
11	7326.680M	44.9	+36.3	+2.6	+4.6	-25.6	+0.0	31.5	54.0	-22.5	Vert
			+1.5	-34.5	+0.2	+1.5					
12	4884.480M	47.5	+33.6	+2.0	+3.6	-26.4	+0.0	28.5	54.0	-25.5	Horiz
			+1.1	-34.0	+0.2	+0.9					
13	4884.320M	46.4	+33.6	+2.0	+3.6	-26.4	+0.0	27.4	54.0	-26.6	Vert
			+1.1	-34.0	+0.2	+0.9					



Test Location:	CKC Laboratories, Inc. • 1120 Fulton Pl • Fr	emont CA 94539	• (510) 249-1170
Customer:	Tonal		
Specification:	15.247(d) / 15.209 Radiated Spurious Emis	sions	
Work Order #:	110285	Date:	11/4/2024
Test Type:	Radiated Scan	Time:	15:41:28
Tested By:	Hieu Song Nguyenpham	Sequence#:	126
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			
Support Equipment:			
Device	Manufacturer	Model #	S/N
Configuration 1			
Test Conditions / No	tes:		
Radiated Emission			
Frequency Range: 1G	Hz to 26GHz		
Test Environment Co Temperature: 22.0°C Humidity: 37% Atmospheric Pressure Highest Generated Fr	nditions: :: 101.5kPa equency: 5.825GHz		
Test Method: ANSI C	263.10 2020		
The unit is mounted t to the floor. Camera i BT transmitting conti	o a floor standing rack as to s s on. nuously with GFSK modulation	simulate typical wall more on type, LE1Mbps with p	unted setup. One weight line is extended pattern of 0s and 1s at power level 0 dBm
Modification #1 in u	se during testing: Added a fe	errite (Wurth: 742 712 21	l) on lower resistor wire. Green Resistor
High Channel		·	



Tonal WO#: 110285 Sequence#: 126 Date: 11/4/2024 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02157	Horn Antenna- ANSI C63.5	3115	1/11/2023	1/11/2025
T2	AN03302	Cable	32026-29094K- 29094K-72TC	1/9/2024	1/9/2026
Т3	ANP01210	Cable	FSJ1P-50A-4A	1/9/2024	1/9/2026
	AN02660	Spectrum Analyzer	E4446A	12/6/2022	12/6/2024
T4	AN02810	Preamp	83051A	4/6/2023	4/6/2025
T5	AN03013	Cable	32022-2-2909К- 36TC	1/9/2024	1/9/2026
	ANP07701	Cable	32022-29094K- 29094K-120TC	8/16/2024	8/16/2026
	AN02693	Active Horn Antenna	AMFW-5F- 12001800-20- 10P	1/9/2024	1/9/2026
	AN02694	Horn Antenna	AMFW-5F- 18002650-20- 10P	1/9/2024	1/9/2026
	ANP00928	Cable	various	1/26/2024	1/26/2026

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ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	ANP00929	Cable	various	1/26/2024	1/26/2026
	ANP07698	Cable	32022-29094K-	8/16/2024	8/16/2026
			29094K-72TC		
T6	ANP07938	Preamp	83017A	6/14/2023	6/14/2025
T7	AN03386	High Pass Filter	11SH10-	3/22/2024	3/22/2026
			3000/T10000-		
			0/0		
Т8	AN03011	Cable	32022-2-2909K-	3/23/2023	3/23/2025
			24TC		

Measu	rement Data:	Re	eading lis	ted by ma	argin.	Test Distance: 3 Meters					
#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5	T6	T7	T8					
	MHz	dBµV	dB	dB	dB	dB	Table	$dB\mu V/m$	$dB\mu V/m$	dB	Ant
1	2194.200M	43.2	+28.2	+1.3	+2.4	-27.2	+0.0	48.7	54.0	-5.3	Horiz
			+0.8	+0.0	+0.0	+0.0					
2	1796.600M	44.9	+27.2	+1.2	+2.2	-27.7	+0.0	48.5	54.0	-5.5	Vert
			+0.7	+0.0	+0.0	+0.0					
3	1599.200M	46.7	+26.1	+1.1	+2.0	-28.0	+0.0	48.5	54.0	-5.5	Horiz
			+0.6	+0.0	+0.0	+0.0					
4	1198.800M	48.2	+24.8	+0.9	+1.7	-28.5	+0.0	47.7	54.0	-6.3	Vert
			+0.6	+0.0	+0.0	+0.0					
5	1023.800M	38.1	+24.3	+1.0	+1.6	-28.7	+0.0	36.9	54.0	-17.1	Vert
	Ave		+0.6	+0.0	+0.0	+0.0					
^	1023.800M	58.1	+24.3	+1.0	+1.6	-28.7	+0.0	56.9	54.0	+2.9	Vert
			+0.6	+0.0	+0.0	+0.0					
7	7442.200M	46.7	+36.6	+2.6	+4.6	-25.7	+0.0	33.4	54.0	-20.6	Horiz
			+1.5	-34.6	+0.2	+1.5					
8	7440.860M	46.0	+36.6	+2.6	+4.6	-25.7	+0.0	32.7	54.0	-21.3	Vert
			+1.5	-34.6	+0.2	+1.5					
9	9920.860M	42.1	+39.6	+3.0	+5.8	-28.6	+0.0	31.6	54.0	-22.4	Vert
			+1.7	-33.5	+0.2	+1.3					
10	4960.140M	48.5	+33.8	+2.0	+3.6	-26.4	+0.0	29.8	54.0	-24.2	Horiz
			+1.2	-34.0	+0.2	+0.9					
11	4962.200M	47.6	+33.8	+2.0	+3.6	-26.4	+0.0	28.9	54.0	-25.1	Vert
			+1.2	-34.0	+0.2	+0.9					



Band Edge

	Band Edge Summary										
Limit applied at restricted bands: 15.209											
Limit applie	Limit applied for other than restricted bands: Max Power/100kHz - 20dB.										
Frequency	Modulation	Ant. Type /	Ave (dBuV/i	rage m @3m)	Peak (dBuV/m (Results					
(IVIHZ)		Gain (dBl)	Measured	Limit	Measured	Limit					
2390.0	GFSK	External/4.83	45.4	≤54	59.2	≤74	Pass				
2400.0	GFSK	External/4.83	NA2	NA2	53.3	≤78.2	Pass				
2483.5	GFSK	External/4.83	45.2	≤54	62.8	≤74	Pass				

NA2 = Average limit not applicable when applying 20dBc limit.

Band Edge Plots



Average Value, Low Channel





Peak Value, Low Channel



Peak Value, Low Channel, RBW=100kHz





Average Value, High Channel



Peak Value, High Channel



Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. •	1120 Fulton Pl • Fremont CA 94539	• (510) 249-1170
Customer:	Tonal		
Specification:	Band Edge		
Work Order #:	110285	Date:	10/22/2024
Test Type:	Radiated Scan	Time:	16:46:42
Tested By:	Hieu Song Nguyenpham	Sequence#:	12
Software:	EMITest 5.03.20	-	

Equipment Tested:

Device	Manufacturer	Model #	S/N									
Configuration 1												
Support Equipment:	Support Equipment:											
Device	Manufacturer	Model #	S/N									
Configuration 1												
Test Conditions / Not	tes:											
Band Edge												
Test Environment Con	nditions:											
Temperature: 21.8°C												
Humidity: 47%												
Atmospheric Pressure	: 101.5kPa											
Highest Generated Fre	equency: 2.48GHz											
0												
Test Method: ANSI C	63.10 2020											
RF output set at 0dBn	1											
1												
The unit is mounted to	o a floor standing rack as to s	imulate typical wall mou	nted setup. One weight line is extended									
to the floor. Camera is	s on.	J 1	1 8									



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02157	Horn Antenna- ANSI C63.5	3115	1/11/2023	1/11/2025
T2	AN03302	Cable	32026-29094К-	1/9/2024	1/9/2026
			29094K-72TC		
T3	ANP01210	Cable	FSJ1P-50A-4A	1/9/2024	1/9/2026
	AN02660	Spectrum Analyzer	E4446A	12/6/2022	12/6/2024

Measi	urement Data:	Read	Reading listed by order taken.				Test Distance: 3 Meters				
#	Freq	Rdng	T1	T2	T3		Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	$dB\mu V/m$	$dB\mu V/m$	dB	Ant
1	2390.000M	27.1	+28.3	+1.3	+2.5		+0.0	59.2	54.0	+5.2	Vert
2	2390.000M	13.3	+28.3	+1.3	+2.5		+0.0	45.4	54.0	-8.6	Vert
	Ave										
3	2400.000M	21.1	+28.3	+1.4	+2.5		+0.0	53.3	78.2	-24.9	Vert
4	2483.500M	30.5	+28.3	+1.4	+2.6		+0.0	62.8	54.0	+8.8	Vert
5	2483.500M	12.9	+28.3	+1.4	+2.6		+0.0	45.2	54.0	-8.8	Vert
	Ave										



Test Setup Photo(s)



9kHz – 1GHz, Front View



9kHz – 1GHz, Back View





30MHz – 1GHz, Front View



30MHz – 1GHz, Back View





1GHz – 12GHz, Front View



1GHz – 12GHz, Back View





12GHz – 40GHz, Front View



12GHz – 40GHz, Back View



15.207 AC Conducted Emissions

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 1120 Fulton	Pl • Fremont CA 94539	9 • (510) 249-1170
Customer:	Tonal		
Specification:	15.207 AC Mains - Average		
Work Order #:	110285	Date:	10/17/2024
Test Type:	Conducted Emissions	Time:	13:46:52
Tested By:	Hieu Song Nguyenpham	Sequence#:	170
Software:	EMITest 5.03.20		120V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:				
Device	Manufacturer	Model #	S/N	
Configuration 1				

Test Conditions / Notes:

Conducted Emission Frequency Range: 150kHz to 30MHz

Test Environment Conditions: Temperature: 21.6°C Humidity: 49% Atmospheric Pressure: 101.4kPa

Highest Generation Frequency: 5.825GHz Test Method: ANSI C63.4 2014

The unit is mounted to a floor standing rack as to simulate typical wall mounted setup. It is set in a testing mode, lifting a weight on a loop. Video and Camera are On All WIFI and Bluetooth modules are on

Modification #1 in use during testing: Added a ferrite (Wurth: 742 712 21) on lower resistor wire. Green Resistor



Tonal WO#: 110285 Sequence#: 170 Date: 11/06/2024 15.207 AC Mains - Average Test Lead: 120V 60Hz Line



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP01211	Attenuator	23-10-34	12/2/2022	12/2/2024
T2	ANP00880	Cable	RG214U	3/26/2024	3/26/2026
Т3	ANP06691	Cable	PE3062-180	3/20/2024	3/20/2026
T4	AN03814	50uH LISN-1PH-	NSLK 8126	1/4/2023	1/4/2025
		Line (dB)			
	AN03814	50uH LISN-1PH-	NSLK 8126	1/4/2023	1/4/2025
		Neutral (dB)			
	AN02660	Spectrum Analyzer	E4446A	12/6/2022	12/6/2024
T5	ANP05258	High Pass Filter	HE9615-150K-	5/6/2024	5/6/2026
			50-720B		



Measurement Data:Reading listed by margin.Test Lead: Line				1: Line						
# Freq	Rdng	T1	T2	Т3	T4	Dist	Corr	Spec	Margin	Polar
		T5								
MHz	dBµV	dB	dB	dB	dB	Table	dBµV	dBµV	dB	Ant
1 254.718k	46.8	+9.9	+0.1	+0.0	+0.0	+0.0	56.9	61.6	-4.7	Line
QP		+0.1								
2 254.718k	36.2	+9.9	+0.1	+0.0	+0.0	+0.0	46.3	51.6	-5.3	Line
Ave		+0.1								
^ 254.718k	48.1	+9.9	+0.1	+0.0	+0.0	+0.0	58.2	51.6	+6.6	Line
	-	+0.1								
4 758.671k	39.7	+9.9	+0.1	+0.0	+0.1	+0.0	50.0	56.0	-6.0	Line
OP	0,11	+0.2	011	0.0	0.11	0.0	0010	0010	0.0	2
5 4 237M	29.0	+9.9	+0.2	+0.1	+0.1	+0.0	39.4	46.0	-6.6	Line
Ave	29.0	+0.1	. 0.2	. 0.1	. 0.11	0.0	57.1	10.0	0.0	Line
6 2 485M	39.0	+9.9	+0.1	+0.0	+0.1	+0.0	49.2	56.0	-6.8	Line
OP	57.0	+0.1	. 0.11	0.0	. 0.11	. 0.0	19.2	20.0	0.0	Line
7 1 494M	38.2	+9.9	+0.1	+0.0	+0.1	+0.0	48.4	56.0	-7.6	Line
OP	50.2	+0.1	. 0.11	0.0	. 0.11	0.0	10.1	20.0	7.0	Line
8 3 501M	36.2	+9.9	+0.2	+0.1	+0.1	+0.0	46.6	56.0	-94	Line
OP	50.2	+0.1	. 0.2	. 0.1	. 0.11	0.0	10.0	20.0	<i></i>	Line
9 758 671k	26.2	+9.9	+0.1	+0.0	+0.1	+0.0	36.5	46.0	-95	Line
Ave	20.2	+0.2	. 0.11	0.0	. 0.11	0.0	50.5	10.0	5.5	Line
^ 758 671k	41 9	+9.9	+0.1	+0.0	+0.1	+0.0	52.2	46.0	+6.2	Line
700107 III	11.9	+0.2	. 0.11	0.0	. 011	0.0	02.2	10.0	0.2	Line
11 1.494M	25.7	+9.9	+0.1	+0.0	+0.1	+0.0	35.9	46.0	-10.1	Line
Ave	2017	+0.1	011	0.0	011	0.0	000		1011	2
^ 1.494M	41.0	+9.9	+0.1	+0.0	+0.1	+0.0	51.2	46.0	+5.2	Line
	11.0	+0.1	. 0.11	0.0	. 011	0.0	01.2	10.0		Line
13 2.744M	25.6	+9.9	+0.1	+0.0	+0.1	+0.0	35.8	46.0	-10.2	Line
Ave	2010	+0.1	011	0.0	011	0.0	2010		10.2	2
14 3.739M	34.7	+9.9	+0.2	+0.1	+0.1	+0.0	45.1	56.0	-10.9	Line
OP	• • • •	+0.1						• • • •		
15 4.041M	34.1	+9.9	+0.2	+0.1	+0.1	+0.0	44.5	56.0	-11.5	Line
OP	-	+0.1					-		-	
16 4.237M	33.9	+9.9	+0.2	+0.1	+0.1	+0.0	44.3	56.0	-11.7	Line
OP		+0.1					-			
^ 4.237M	41.2	+9.9	+0.2	+0.1	+0.1	+0.0	51.6	46.0	+5.6	Line
		+0.1								
18 6.463M	37.8	+9.9	+0.2	+0.1	+0.1	+0.0	48.2	60.0	-11.8	Line
QP		+0.1								
19 2.485M	22.7	+9.9	+0.1	+0.0	+0.1	+0.0	32.9	46.0	-13.1	Line
Ave		+0.1								
^ 2.485M	41.1	+9.9	+0.1	+0.0	+0.1	+0.0	51.3	46.0	+5.3	Line
		+0.1								
21 3.739M	22.2	+9.9	+0.2	+0.1	+0.1	+0.0	32.6	46.0	-13.4	Line
Ave		+0.1								
^ 3.739M	42.0	+9.9	+0.2	+0.1	+0.1	+0.0	52.4	46.0	+6.4	Line
		+0.1								



23	2.744M	31.3	+9.9	+0.1	+0.0	+0.1	+0.0	41.5	56.0	-14.5	Line
Ç)P		+0.1								
^	2.744M	36.6	+9.9	+0.1	+0.0	+0.1	+0.0	46.8	46.0	+0.8	Line
			+0.1								
25	3.501M	20.9	+9.9	+0.2	+0.1	+0.1	+0.0	31.3	46.0	-14.7	Line
А	ve		+0.1								
^	3.501M	39.8	+9.9	+0.2	+0.1	+0.1	+0.0	50.2	46.0	+4.2	Line
			+0.1								
27	6.463M	24.3	+9.9	+0.2	+0.1	+0.1	+0.0	34.7	50.0	-15.3	Line
A	ve		+0.1								
^	6.463M	41.7	+9.9	+0.2	+0.1	+0.1	+0.0	52.1	50.0	+2.1	Line
			+0.1								
29	4.041M	20.2	+9.9	+0.2	+0.1	+0.1	+0.0	30.6	46.0	-15.4	Line
А	ve		+0.1								
^	4.041M	39.1	+9.9	+0.2	+0.1	+0.1	+0.0	49.5	46.0	+3.5	Line
			+0.1								



Test Location:	CKC Laboratories, Inc. • 1120 Fulton Pl • Fr	remont CA 94539	• (510) 249-1170
Customer:	Tonal		
Specification:	15.207 AC Mains - Average		
Work Order #:	110285	Date:	10/17/2024
Test Type:	Conducted Emissions	Time:	14:16:33
Tested By:	Hieu Song Nguyenpham	Sequence#:	171
Software:	EMITest 5.03.20		120V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			
Support Equipment:			
Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Conducted Emission Frequency Range: 150kHz to 30MHz

Test Environment Conditions: Temperature: 21.6°C Humidity: 49% Atmospheric Pressure: 101.4kPa

Highest Generation Frequency: 5.825GHz Test Method: ANSI C63.4 2014

The unit is mounted to a floor standing rack as to simulate typical wall mounted setup. It is set in a testing mode, lifting a weight on a loop. Video and Camera are On All WIFI and Bluetooth modules are on

Modification #1 in use during testing: Added a ferrite (Wurth: 742 712 21) on lower resistor wire Green Resistor



Tonal WO#: 110285 Sequence#: 171 Date: 11/06/2024 15.207 AC Mains - Average Test Lead: 120V 60Hz Neutral



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP01211	Attenuator	23-10-34	12/2/2022	12/2/2024
T2	ANP00880	Cable	RG214U	3/26/2024	3/26/2026
Т3	ANP06691	Cable	PE3062-180	3/20/2024	3/20/2026
	AN03814	50uH LISN-1PH-	NSLK 8126	1/4/2023	1/4/2025
		Line (dB)			
T4	AN03814	50uH LISN-1PH-	NSLK 8126	1/4/2023	1/4/2025
		Neutral (dB)			
	AN02660	Spectrum Analyzer	E4446A	12/6/2022	12/6/2024
T5	ANP05258	High Pass Filter	HE9615-150K-	5/6/2024	5/6/2026
			50-720B		



Measurement Data:	Re	eading list	ted by ma	argin.			Test Lead	l: Neutral		
# Freq	Rdng	T1 T5	T2	Т3	T4	Dist	Corr	Spec	Margin	Polar
MHz	dBµV	dB	dB	dB	dB	Table	dBµV	dBµV	dB	Ant
1 3.722M OP	38.8	+9.9 +0.1	+0.2	+0.1	+0.1	+0.0	49.2	56.0	-6.8	Neutr
2 255.445k	44.0	+9.8	+0.1	+0.0	+0.0	+0.0	54.0	61.6	-7.6	Neutr
3 255.445k	33.3	+9.8	+0.1	+0.0	+0.0	+0.0	43.3	51.6	-8.3	Neutr
^ 255.445k	44.9	+9.8	+0.1	+0.0	+0.0	+0.0	54.9	51.6	+3.3	Neutr
5 1.485M	37.4	+9.9	+0.1	+0.0	+0.1	+0.0	47.6	56.0	-8.4	Neutr
6 2.489M	37.3	+9.9	+0.1	+0.0	+0.1	+0.0	47.5	56.0	-8.5	Neutr
7 761.580k	36.7	+9.9 +0.2	+0.1	+0.0	+0.0	+0.0	46.9	56.0	-9.1	Neutr
8 2.961M OP	36.2	+9.9	+0.1	+0.0	+0.1	+0.0	46.4	56.0	-9.6	Neutr
9 6.449M OP	38.5	+9.9	+0.2	+0.1	+0.1	+0.0	48.9	60.0	-11.1	Neutr
10 506.032k	34.5	+9.9 +0.2	+0.1	+0.0	+0.0	+0.0	44.7	56.0	-11.3	Neutr
11 3.722M Ave	23.3	+9.9	+0.2	+0.1	+0.1	+0.0	33.7	46.0	-12.3	Neutr
^ 3.722M	42.2	+9.9	+0.2	+0.1	+0.1	+0.0	52.6	46.0	+6.6	Neutr
13 506.032k Ave	22.6	+9.9 +0.2	+0.1	+0.0	+0.0	+0.0	32.8	46.0	-13.2	Neutr
^ 506.032k	38.9	+9.9 +0.2	+0.1	+0.0	+0.0	+0.0	49.1	46.0	+3.1	Neutr
15 761.580k Ave	22.4	+9.9 +0.2	+0.1	+0.0	+0.0	+0.0	32.6	46.0	-13.4	Neutr
^ 761.580k	39.4	+9.9 +0.2	+0.1	+0.0	+0.0	+0.0	49.6	46.0	+3.6	Neutr
17 2.489M Ave	21.8	+9.9 +0.1	+0.1	+0.0	+0.1	+0.0	32.0	46.0	-14.0	Neutr
^ 2.489M	41.5	+9.9 +0.1	+0.1	+0.0	+0.1	+0.0	51.7	46.0	+5.7	Neutr
19 6.449M Ave	25.0	+9.9	+0.2	+0.1	+0.1	+0.0	35.4	50.0	-14.6	Neutr
^ 6.449M	42.2	+9.9	+0.2	+0.1	+0.1	+0.0	52.6	50.0	+2.6	Neutr
21 1.485M Ave	21.0	+9.9	+0.1	+0.0	+0.1	+0.0	31.2	46.0	-14.8	Neutr
^ 1.485M	41.5	+9.9 +0.1	+0.1	+0.0	+0.1	+0.0	51.7	46.0	+5.7	Neutr



23	2.961M	20.6	+9.9	+0.1	+0.0	+0.1	+0.0	30.8	46.0	-15.2	Neutr
A	lve		+0.1								
^	2.961M	38.9	+9.9	+0.1	+0.0	+0.1	+0.0	49.1	46.0	+3.1	Neutr
			+0.1								
25	3.705M	29.2	+9.9	+0.2	+0.1	+0.1	+0.0	39.6	56.0	-16.4	Neutr
Q)P		+0.1								
26	3.705M	17.9	+9.9	+0.2	+0.1	+0.1	+0.0	28.3	46.0	-17.7	Neutr
A	lve		+0.1								
^	3.705M	39.7	+9.9	+0.2	+0.1	+0.1	+0.0	50.1	46.0	+4.1	Neutr
			+0.1								



Test Setup Photo(s)



Front View



Side View



APPENDIX A: MODIFICATIONS MADE DURING TESTING

This list is a summary of the conditions noted for or modifications made to the equipment during testing.

Summary of Conditions

Modification #1 (Mod#1) = Added a ferrite (Wurth: 742 712 21) on lower resistor wire Green Resistor

Modifications listed above must be incorporated into all production units.



Modification #1



Supplemental Information

Measurement Uncertainty

Uncertainty Value	Parameter
5.77 dB	Radiated Emissions
0.673 dB	RF Conducted Measurements
5.77 x 10 ⁻¹⁰	Frequency Deviation
0.00005 s	Time Deviation
3.18 dB	Mains Conducted Emissions

Uncertainties reported are worst case for all CKC Laboratories' sites and represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2. Compliance is deemed to occur provided measurements are below the specified limits.

Emissions Test Details

TESTING PARAMETERS

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in dB μ V/m, the spectrum analyzer reading in dB μ V was corrected by using the following formula. This reading was then compared to the applicable specification limit. Individual measurements were compared with the displayed limit value in the margin column. The margin was calculated based on subtracting the limit value from the corrected measurement value; a positive margin represents a measurement exceeding the limit, while a negative margin represents a measurement less than the limit.

SAMPLE CALCULATIONS					
	Meter reading	(dBµV)			
+	Antenna Factor	(dB/m)			
+	Cable Loss	(dB)			
-	Distance Correction	(dB)			
-	Preamplifier Gain	(dB)			
=	Corrected Reading	(dBµV/m)			



TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE						
TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING			
CONDUCTED EMISSIONS	150 kHz	30 MHz	9 kHz			
RADIATED EMISSIONS	9 kHz	150 kHz	200 Hz			
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz			
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz			
RADIATED EMISSIONS	1000 MHz	>1 GHz	1 MHz			

SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or caret ("^") was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

Peak

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

Average

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point, the measuring device is set into the linear mode and the scan time is reduced.

End of Report