

FCC Test Report (BT-LE)

- Standards:FCC 47 CFR Part 15 Subpart CISED RSS-247 Issue 2ISED RSS-GEN Issue 5
- **Report Number:** Report 813-FCC15C Rev. 1
- **Product Name:** USB Dongle with accessory cable
 - Model Name: B00046
 - FCC ID: JNZB00046
 - **IC:** 4418A-B00046
 - Issued Date: December 16, 2020
 - **Applicant:** Logitech Far East Ltd.
 - Address: 7700 Gateway Blvd., Newark, CA 94560
 - Applicant Contact: Jesse Chen, jchen29@logitech.com
 - **Issued By:** Avidity Test Labs
 - Lab Address: 4700 NW Camas Meadows Dr., Camas WA 98697



Certificate # 4080.01

Product compliance is the responsibility of the client. This Report may only be duplicated in its entirety.

Report Format Version 1.0

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Revision History

Issue Number	Description	Date Issued
Report 813-FCC15C	Original Release	December 4, 2020
Revision 1	Added information per TCB feedback	December 16, 2020



Facility

Avidity Test Lab	4700 NW Camas Meadows Dr.,
	Camas WA, 98607
	(360)-817-1214
A2LA Accreditation	Certificate # 4080.01
FCC Designation Number	US1159
Innovation, Science and Economic	ISED: US0209
Development Canada	IC: 24630
VCCI	A-0324
Recognized Phase I CAB for KCC	US0209



1 Certificate of Test

Product:	USB Dongle with Accessory Cable
Brand:	Ultimate Ears
Model:	B00046
Serial Number:	Engineering Sample
Test Date:	11/11/2020-12/15/2020
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247)
	ISED RSS-247 Issue 2
	ISED RSS-GEN Issue 5
	ANSI C63.10:2013

Remark: The manufacturer declares that the EUT hardware and firmware is representative of a mass production sample.

The above equipment has been tested by **Avidity Test Labs** and found to be in compliance with the requirements of the above standards. The test record, data evaluation and Equipment Under test (EUT) configurations represented herein are true and accurate accounts of the measurement of the sample's EMC characteristics under the conditions specified in this report.

Prepared by:	Jacob Borg	,	Date:	12/15/2020
	Jacob Borg			Date
	Test Engineer			
Approved by:	David W. Crawford	,	Date	12/16/2020
	Dave Crawford			Date
	Quality Manager			



2 Summary of Test

2.1 Results Summary

FCC Clause	ISED Clause	Requirement	Results	Comment
See Comment		Duty Cycle	Reporting	ANSI C63.10
			purposes only	Section 11.6
-	RSS-GEN 6.7	99% OBW	Reporting	ANSI C63.10
			purposes only	Section 6.9.3
15.247 (a) (2)	RSS-247 5.2 (a)	6dB BW	Pass	None
15.247 (b) (3)	RSS-247 5.4 (d)	Output Power	Pass	None
See comment		Average Power	Reporting	Per ANSI C63.10
			purposes only	Section 11.9.2.3.2
15.247 (e)	RSS-247 5.2 (b)	Power Spectral Density	Pass	None
15.247 (d)	RSS-247 5.5	Conducted Spurious	Pass	None
		Emissions		
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions	Pass	None
15.207	RSS-GEN 8.8	AC Mains Conducted	Pass	None
		Emissions		

2.2 Test Methodology

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, RSS-GEN Issue 5, and RSS-247 Issue 2.



2.3 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

The listed uncertainties are the worst-case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining PASS/FAIL results

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Disturbance at mains port using AMN	150kHz to 30 MHz	2.74 dB
Worst Case Radiated Disturbance	9kHz to 30 MHz	2.56 dB
Worst Case Radiated Disturbance	30 MHz to 1000 MHz	5.87 dB
Worst Case Radiated Disturbance	1 GHz to 18 GHz	5.48 dB
Worst Case Radiated Disturbance	18 to 26.5 GHz	5.54 dB

2.4 Modification Record

There were no modifications required for compliance.



3 Product Description

3.1 Functional Description

The EUT is a USB dongle with a 2.5mm port and accessory cable. The 2.5mm port supplies power to ultraviolet LEDS attached to the accessory cable. There is Bluetooth 4.0 radio in the dongle with a SISO radio. The EUT is powered by an AC/DC adapter shipped with the product.

3.2 General Description of EUT

Product	USB Dongle with accessory cable		
Brand	Ultimate Ears		
Model	B00046		
Sample Status	Engineering sample		
Serial Number	None		
Modulation Type	GFSK		
Modulation Technology	DTS		
Transfer Rate	BT 4.0: 1 Mbps		
Operating Frequency	BT 4.0: 2402 MHz to 2480 MHz		
Number of channels	BT 4.0: 40		
Output power	0.98 mW		
Antenna type	Chip Antenna		
Antenna Connector	None (Internal Antenna)		
Operating Software	The utility software used for testi	ng is Hercules Setup Utility	
Firmware	The EUT firmware installed was 0.0.2		
Power Supply Rating	5.1Vdc/1.4A		
Highest Internal Frequency	2480 MHz		
Ports	Type Number		
	2.5mm (3-pole) 1		
	USB-A Male 1		

Notes:

1. The EUT is shipped with an AC/DC adapter as shown in the following table

Name	Brand	Model Number	Part Number	Serial Number
AC/DC adapter	Ultimate Ears	AD2118M20	534-000834	2041BAH

2. The EUT is shipped with an accessory cable as shown in the following table

			0	
Name	Brand	Model Number	Part Number	Serial Number
2.5mm large earbud cable	Ultimate Ears	B00047	None	Engineering sample

3. The antenna provided to the EUT is shown in the following table. The antenna gain is provided by the manufacturer.

Antenna Gain (dBi)	Frequency Range (GHz)	Antenna Type	Connector Type
-18.5	2.4-2.4835	Chip	None



4 Configurations and Operational Modes

Radiated emissions below 1 GHz, above 18 GHz and power line conducted emissions were performed with the EUT set to transmit at the channel with the highest output power as worst case-scenario.

Band edge and radiated emissions between 1GHz and 18 GHz were performed with the EUT set to transmit at the highest power on low, middle and high channels.

The EUT is typically plugged in to an AC/DC adapter which can be placed in any orientation. Therefore, radiated testing was performed with the EUT positioned in all three orthogonal axes and the orientation that produced the worst case emission with respect to the limit are reported.

There is only one data rate and modulation available to the EUT.



4.1 Description of Test Modes40 channels are provided to EUT:

Channel	Center Frequency (MHz)	Channel	Center Frequency (MHz)
0	2402	20	2442
1	2404	21	2444
2	2406	22	2446
3	2408	23	2448
4	2410	24	2450
5	2412	25	2452
6	2414	26	2454
7	2416	27	2456
8	2418	28	2458
9	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480



4.2 Tested Channel Detail

Radiated Emissions Test (1-18 GHz)

-Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture)

-Following channels were selected for the final test as listed below

Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
0 to 39	0, 19,39	GFSK	1

Radiated Emissions Test (Below 1 GHz and above 18 GHz)

-Channel with the highest output power was tested as worst-case scenario

Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
0 to 39	19	GFSK	1

Power Line Conducted Emission Test

-Channel with the highest output power was tested as worst-case scenario

Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
0 to 39	19	GFSK	1

Antenna Port Conducted Measurement

-Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture)

-Following channels were selected for the final test as listed below

Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
0 to 39	0, 19,39	GFSK	1



4.3 Configurations

Configuration 1					
	EUT Inf	ormation			
Name	Brand Model Number Serial Number Firmware				
USB Dongle	Ultimate Ears	B00046	Engineering	0.0.2	
			Sample		
	SUPPORT	EQUIPMENT			
Name Brand Model Number Serial Number					
Large Earbud Cable Ultimate Ears B00047 None					
Laptop Dell Latitude 5300 D9QZKW					
CP210x USB to UART Bridge	CP210x USB to UART Bridge Silicon Labs CP210X WTW201102/012Q13N10				

	Cables					
Name	Brand	Length	Connector 1	Connector 2	Shielded (Yes/No)	Ferrite (Yes/No)
2.5mm cable with ear bud mold	Ultimate Ears	1.54m	2.5mm male	Ear bud mold holder with LED contacts	No	No
AC extension cablex2	Generic	1m	2-prong male	2-prong female	No	No
USB to UART cable	Silicon Labs	1m	USB-A Male	UART wires	No	No

4.4 Operational Modes

Mode	Description
1	EUT is powered from AC/DC adapter. Adapter is connected to
(Radiated Emissions,	115V/60Hz. The 2.5mm accessory cable is connected to the EUT
Antenna Port Conducted Emissions,	and it is terminated with it's typical load. The typical load is the LED
AC Power line conducted emissions)	gel ear molds.

Hercules Utility software v3.2.8 is used to set the EUT into test mode. Low channel mode: 2402MHz, 1Mbps, Modulated, Fixed channel transmission Middle channel mode: 2440MHz, 1Mbps, Modulated, Fixed channel transmission High channel mode: 2480MHz, 1Mbps, Modulated, Fixed channel transmission



5 Measurement Method

On time and duty cycle: ANSI C63.10 Section 11.6 <u>6dB BW:</u> ANSI C63.10 Subclause-11.8.1 <u>Occupied BW (99%):</u> ANSI C63.10 Section 6.9.3 <u>Peak Output Power:</u> ANSI C63.10 Subclause-11.9.1.1 Method RBW≥DTS Bandwidth <u>Average Output Power:</u> ANSI C63.10 Subclause-11.9.2.3.2 Method AVGPM-G <u>PSD:</u> ANSI C63.10 Subclause 11.10.2 Method PKPSD (peak PSD) <u>Radiated Emissions restricted frequency bands:</u> ANSI C63.10 Subclause 11.12.1 <u>Conducted emissions in non-restricted frequency bands:</u> ANSI C63.10 Subclause 11.11 <u>Band Edge:</u> ANSI C63.10 Subclause 11.13.3.4 Trace averaging across ON and OFF times of the EUT followed by a duty cycle correction. If peak measurements are below average limit then no average measurements were taken. <u>AC Power Line Conducted Emissions:</u> ANSI C63.10 Section 6.3

Radiated Spurious Emissions Below 30 MHz: ANSI C63.10 Section 6.4



6 Antenna Port Test Results

Frequency Range	30 MHz-26.5GHz		
Input Power	115V/60Hz	Test Mode	1
Environmental Conditions	21°C, 32 %RH, 101.8 kPa	Configuration	1
Tested By	Jacob Borg	Test Date	11/12/20-11/20/20

<u>Test Equipment</u>

ATL ID	Description	Manufacturer	Model	Serial	Calibration	Calibration
					Date	Due
111	Signal	Rohde & Schwarz	FSV40, FW3.60	101434	3/31/2020	3/21/2021
	Analyzer					
127	RF Switch w/	Rohde & Schwarz	OSP120, FW	101426	3/31/2020	3/21/2021
	Power Meter		2.63.180410			
	10dB	Weinschel	10dB		NCR	NCR
	Attenuator					
	WMS32	Rohde & Schwarz	V10.40.10	NA	NA	NA
	Measurement					
	Software					

Note: 1. The calibrations above are traceable to NIST/USA.

Sample Calculation

Final reading (dBm) = Measured reading (dBm) +Cable loss (dB)+attenuator loss



6.1 On time and Duty Cycle <u>Limits</u> None; for reporting purposes only

<u>Procedure</u>

ANSI C63.10 Section 11.6 Zero-Span Spectrum Analyzer Method

<u>Test Results</u>

Mode	On time B (msec)	Period (msec)	Duty Cycle (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
BT 4.0: 1 Mbps	2.0836	2.2045	0.945	94.5	0.245	0.479

Test Engineer	Jacob Borg
Test Date	11/12/2020

Specti	um											
Ref Le Att TRG: VI	evel - D	-10.00 3	dBm O dB 😑 SWT	= 10 ms =	RBW 5 M VBW 20 M	Hz Hz						•
●1Pk Ma	эх											
-20 dBm			M1.		093		D3	[1]			2.2	-0.03 dB 04545 ms
-30 dBm	TF	RG -29	000 dBm====							 	2.2	20000 ms
-40 dBm			_									
-50 dBm												
-60 dBm												
-70 dBm											_	
-80 dBm									_		_	
-90 dBm												
-100 dB	m——											
CF 2.48	3 GHz				11	.001 pt	s					1.0 ms/
Marker												
Туре	Ref	Trc	X-valu	e	Y-valu	e	Function Function Resul		sult			
M1		1	2	2.22 ms	-23.40	dBm						
D2	M1	1	2.083	636 ms	-0.:	24 dB						
D3	M1	1	2.204	545 ms	-0.1	J3 dB	<u></u>			 	_	
							Meas			1.364	12	mn#2020

Duty Cycle 1 Mbps

Date: 12.NOV.2020 23:16:55



6.2 99% Bandwidth <u>Limits</u> None; for reporting purposes only

<u>Procedure</u>

ANSI C63.10 Section 6.9.3

<u>Results</u>

DUT Frequency (MHz)	Bandwidth (MHz)	Limit (MHz)	Emissions Designator ITU-CODE	Band Edge Left (MHz)	Band Edge Right (MHz)	Result
2402	0.910		910KF1D	2401.545	2402.455	NA
2440	0.920		920KF1D	2439.535	2440.455	NA
2480	0.900		900KF1D	2479.545	2480.455	NA

Test Engineer	Jacob Borg
Test Date	11/20/2020

Low Channel, 1 Mbps



Measurement						
Setting	Instrument Value	Target Value				
Start Frequency	2.40100 GHz	2.40100 GHz				
Stop Frequency	2.40300 GHz	2.40300 GHz				
Span	2.000 MHz	2.000 MHz				
RBW	10.000 kHz	>= 10.000 kHz				
VBW	30.000 kHz	>= 30.000 kHz				
SweepPoints	200	~ 200				
Sweeptime	189.620 µs	AUTO				
Reference Level	-20.000 dBm	-20.000 dBm				
Attenuation	0.000 dB	AUTO				
Detector	MaxPeak	MaxPeak				
SweepCount	100	100				
Filter	3 dB	3 dB				
Trace Mode	Max Hold	Max Hold				
Sweeptype	FFT	AUTO				
Preamp	off	off				
Stablemode	Trace	Trace				
Stablevalue	0.30 dB	0.30 dB				
Run	9 / max. 150	max. 150				
Stable	3/3	3				
Max Stable Difference	0.10 dB	0.30 dB				

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Mid Channel, 1 Mbps



High Channel, 1 Mbps





Setting	Instrument Value	Target Value
Start Frequency	2.43900 GHz	2.43900 GHz
Stop Frequency	2.44100 GHz	2.44100 GHz
Span	2.000 MHz	2.000 MHz
RBW	10.000 kHz	>= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	200	~ 200
Sweeptime	189.620 µs	AUTO
Reference Level	-20.000 dBm	-20.000 dBm
Attenuation	0.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	7 / max. 150	max. 150
Stable	3/3	3
Max Stable Difference	0.11 dB	0.30 dB

Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.47900 GHz	2.47900 GHz
Stop Frequency	2.48100 GHz	2.48100 GHz
Span	2.000 MHz	2.000 MHz
RBW	10.000 kHz	>= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	200	~ 200
Sweeptime	189.620 µs	AUTO
Reference Level	-20.000 dBm	-20.000 dBm
Attenuation	0.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	6 / max. 150	max. 150
Stable	3/3	3
Max Stable Difference	0.19 dB	0.30 dB



6.3 6 dB Bandwidth <u>Limits</u> FCC 15.247 (a) (2) RSS-247 5.2 (a) The minimum 6 dB bandwidth shall be at least 500 kHz.

<u>Procedure</u>

ANSI C63.10 Subclause-11.8.1

<u>Results</u>

DUT Frequency	Bandwidth	Limit Min	Limit Max	Band Edge	Band Edge	Max Level	Result
(MHz)	(MHz)	(MHz)	(MHz)	Left (MHz)	Right (MHz)	(dBm)	
2402	0.514852	0.5		2401.742574	2402.257426	-1.4	Pass
2440	0.514852	0.5		2439.742574	2440.257426	-0.3	Pass
2480	0.514852	0.5		2479.742574	2480.257426	-0.2	Pass

Test Engineer	Jacob Borg
Test Date	11/20/2020

Low Channel, 1 Mbps

6 dB Bandwidth



Measurement						
Setting	Instrument Value	Target Value				
Start Frequency	2.40100 GHz	2.40100 GHz				
Stop Frequency	2.40300 GHz	2.40300 GHz				
Span	2.000 MHz	2.000 MHz				
RBW	100.000 kHz	~ 100.000 kHz				
VBW	300.000 kHz	~ 300.000 kHz				
SweepPoints	101	~ 20				
Sweeptime	18.938 µs	AUTO				
Reference Level	-20.000 dBm	-20.000 dBm				
Attenuation	0.000 dB	AUTO				
Detector	MaxPeak	MaxPeak				
SweepCount	100	100				
Filter	3 dB	3 dB				
Trace Mode	Max Hold	Max Hold				
Sweeptype	FFT	AUTO				
Preamp	off	off				
Stablemode	Trace	Trace				
Stablevalue	0.50 dB	0.50 dB				
Run	12 / max. 150	max. 150				
Stable	5/5	5				
Max Stable Difference	0.04 dB	0.50 dB				

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Mid Channel, 1 Mbps



High Channel, 1 Mbps





Measurement			Measurement		
Setting	Instrument Value	Target Value	Setting	Instrument Value	Target Value
Start Frequency	2.43900 GHz	2.43900 GHz	Start Frequency	2.47900 GHz	2.47900 GHz
Stop Frequency	2.44100 GHz	2.44100 GHz	Stop Frequency	2.48100 GHz	2.48100 GHz
Span	2.000 MHz	2.000 MHz	Span	2.000 MHz	2.000 MHz
RBW	100.000 kHz	~ 100.000 kHz	RBW	100.000 kHz	~ 100.000 kHz
VBW	300.000 kHz	~ 300,000 kHz	VBW	300.000 kHz	~ 300.000 kHz
SweepPoints	101	~ 20	SweepPoints	101	~ 20
Sweeptime	18.938 us	AUTO	Sweeptime	18.938 µs	AUTO
Reference Level	-20.000 dBm	-20,000 dBm	Reference Level	-20.000 dBm	-20.000 dBm
Attenuation	0.000 dB	AUTO	Attenuation	0.000 dB	AUTO
Detector	MaxPeak	MaxPeak	Detector	MaxPeak	MaxPeak
SweepCount	100	100	SweepCount	100	100
Filter	3 dB	3 dB	Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold	Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO	Sweeptype	FFT	AUTO
Preamp	off	off	Preamp	off	off
Stablemode	Trace	Trace	Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB	Stablevalue	0.50 dB	0.50 dB
Run	8 / max. 150	max. 150	Run	12 / max. 150	max. 150
Stable	5/5	5	Stable	5/5	5
Max Stable Difference	0.05 dB	0.50 dB	Max Stable Difference	0.05 dB	0.50 dB



6.4 Output Power

<u>Limits</u> FCC 15.247 (b) (3) RSS-247 5.4 (d)

Channel	Frequency	Direction	FCC/ISED Power	ISED EIRP Limit
	(MHz)	Gain (dBi)	Limit (dBm)	(dBm)
Low 0	2402	-18.5	30	36
Mid 19	2440	-18.5	30	36
High 39	2480	-18.5	30	36

For systems using digital modulation in the 902-928, 2400-2483.5MHz, and 5725-5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of direction gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Test Procedure

ANSI C63.10:2013 Section 11.9.1.1 − RBW ≥ DTS BW

<u>Results</u>

Channel	Frequency (MHz)	Antenna 1 Measured Power (dBm)	Power Limit (dBm)	Margin	Pass/Fail
Low 0	2402	-1.1	30	31.1	Pass
Mid 19	2440	-0.1	30	30.1	Pass
High 39	2480	-0.1	30	30.1	Pass

Test Engineer	Jacob Borg	
Test Date	11/20/2020	



Low Channel, 1 Mbps



Measurement			measurement		
Setting	Instrument Value	Target Value	Setting	Instrument Value	Target Value
Start Frequency	2.39900 GHz	2.39900 GHz	Start Frequency	2.43700 GHz	2.43700 GHz
Stop Frequency	2.40500 GHz	2.40500 GHz	Stop Frequency	2.44300 GHz	2.44300 GHz
Span	6.000 MHz	6.000 MHz	Span	6.000 MHz	6.000 MHz
RBW	2.000 MHz	>= 1.000 MHz	RBW	2.000 MHz	>= 1.000 MHz
VBW	10.000 MHz	>= 6.000 MHz	VBW	10.000 MHz	>= 6.000 MHz
SweepPoints	101	~ 101	SweepPoints	101	~ 101
Sweeptime	953.450 ns	AUTO	Sweeptime	953.450 ns	AUTO
Reference Level	-10.000 dBm	-10.000 dBm	Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	AUTO	Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak	Detector	MaxPeak	MaxPeak
SweepCount	100	100	SweepCount	100	100
Filter	3 dB	3 dB	Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold	Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO	Sweeptype	FFT	AUTO
Preamp	off	off	Preamp	off	off
Stablemode	Trace	Trace	Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB	Stablevalue	0.10 dB	0.10 dB
Run	4 / max. 150	max. 150	Run	6 / max. 150	max. 150
Stable	3/3	3	Stable	5/5	5
Max Stable Difference	0.06 dB	0.50 dB	Max Stable Difference	0.01 dB	0.10 dB

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High Channel, 1 Mbps



Connector 1

× Peak Connector 1

Measurement					
Setting	Instrument Value	Target Value			
Start Frequency	2.47700 GHz	2.47700 GHz			
Stop Frequency	2.48300 GHz	2.48300 GHz			
Span	6.000 MHz	6.000 MHz			
RBW	2.000 MHz	>= 1.000 MHz			
VBW	10.000 MHz	>= 6.000 MHz			
SweepPoints	101	~ 101			
Sweeptime	953.450 ns	AUTO			
Reference Level	-10.000 dBm	-10.000 dBm			
Attenuation	10.000 dB	AUTO			
Detector	MaxPeak	MaxPeak			
SweepCount	100	100			
Filter	3 dB	3 dB			
Trace Mode	Max Hold	Max Hold			
Sweeptype	FFT	AUTO			
Preamp	off	off			
Stablemode	Trace	Trace			
Stablevalue	0.10 dB	0.10 dB			
Run	6 / max. 150	max. 150			
Stable	5/5	5			
Max Stable Difference	0.01 dB	0.10 dB			



6.5 Average Power

<u>Limits</u> None; for reporting purposes only

Test Procedure

ANSI C63.10:2013 Section 11.9.2.3.2 Method AVGPM-G The transmitter output is connected to a RF RMS power meter

<u>Results</u>

Channel	Frequency (MHz)	Antenna 1 Measured Power (dBm)
Low 0	2402	-1.2
Mid 19	2440	-0.2
High 39	2480	-0.3

Test Engineer	Jacob Borg
Test Date	11/20/2020



6.6 Power Spectral Density Limits FCC 15.247 (e) RSS-247 (5.2)(b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Test Procedure

ANSI C63.10 Subclause 11.10.2 Method PKPSD (peak PSD)

Results

Channel	Frequency	Antenna 1 Measured	Power Limit	Margin	Pass/Fail
	(IVIHZ)	(dBm/3 kHz)	(abm/3kHz)	(ab)	
Low 0	2402.0275	-6.634	8.0	14.634	Pass
Mid 19	2439.9375	-5.553	8.0	13.553	Pass
High 39	2479.9775	-6.344	8.0	16.344	Pass

Test Engineer	Jacob Borg
Test Date	11/20/2020

Low Channel, 1 Mbps



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Mid Channel, 1 Mbps



High Channel, 1 Mbps



Limit

PSD

Measurement			Measurement		
Setting	Instrument Value	Target Value	Setting	Instrument Value	Target Value
Start Frequency	2.43925 GHz	2.43925 GHz	Start Frequency	2.47925 GHz	2.47925 GHz
Stop Frequency	2.44075 GHz	2.44075 GHz	Stop Frequency	2.48075 GHz	2.48075 GHz
Span	1.500 MHz	1.500 MHz	Span	1.500 MHz	1.500 MHz
RBW	10.000 kHz	<= 10.000 kHz	RBW	10.000 kHz	<= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz	VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	300	~ 300	SweepPoints	300	~ 300
Sweeptime	1.500 ms	AUTO	Sweeptime	1.500 ms	AUTO
Reference Level	-20.000 dBm	-20.000 dBm	Reference Level	-20.000 dBm	-20.000 dBm
Attenuation	0.000 dB	AUTO	Attenuation	0.000 dB	AUTO
Detector	MaxPeak	MaxPeak	Detector	MaxPeak	MaxPeak
SweepCount	100	100	SweepCount	100	100
Filter	3 dB	3 dB	Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold	Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	Sweep	Sweeptype	Sweep	Sweep
Preamp	off	off	Preamp	off	off
Stablemode	Trace	Trace	Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB	Stablevalue	0.50 dB	0.50 dB
Run	6 / max. 150	max. 150	Run	5 / max. 150	max. 150
Stable	2/2	2	Stable	2/2	2
Max Stable Difference	0.21 dB	0.50 dB	Max Stable Difference	0.41 dB	0.50 dB



6.7 Conducted Spurious Emissions Limits FCC 15.247 (d) RSS-247 (5.5)

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20dB

Test Procedure

ANSI C63.10 Subclause 11.11

<u>Results</u>

Test Engineer	Jacob Borg	
Test Date	11/20/2020	

Low Channel (2402 MHz), 1 Mbps

Inband Peak

Frequency	Level
(MHz)	(dBm)
2401.825000	-1.4







<u>Result table</u>

Frequency	Level	Margin	Limit
(MHz)	(dBm)	(dB)	(dBm)
4803.975000	-49.1	27.6	-21.4
4804.025000	-49.4	27.9	-21.4
4804.325000	-50.8	29.3	-21.4
4804.375000	-51.0	29.6	-21.4
4803.925000	-51.0	29.6	-21.4
4804.075000	-51.8	30.4	-21.4
4803.675000	-52.1	30.6	-21.4
4804.125000	-52.2	30.8	-21.4
4803.725000	-52.2	30.8	-21.4
4803.875000	-52.4	31.0	-21.4
4804.275000	-52.5	31.0	-21.4
4803.625000	-52.5	31.1	-21.4
4803.825000	-52.8	31.3	-21.4
4804.175000	-53.0	31.6	-21.4
4804,225000	-53.5	32.0	-21.4

Measurement Settings

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	29400	~ 29400
Sweeptime	29.400 ms	AUTO
Reference Level	-30.000 dBm	-30.000 dBm
Attenuation	0.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	4 / max. 150	max. 150
Stable	3/3	3
Max Stable Difference	0.00 dB	0.50 dB



Mid Channel (2440 MHz), 1 Mbps

Dand Pea Frequency (MHz) 2439.941000	Ak Level (dBm) -0.5									
				Spurio	us					
0										
-20 -										
ag + .⊑ .40 + ∎										
في الم -60			ulau ka Maini di							
0.03		5	1	0	1	5	2	20	1	+
1.1		0		Freque	ency in Gl	Hz	0-16			

Results Table

Measurement Settings

Frequency	Level	Margin	Limit	
(MHz)	(dBm)	(dB)	(dBm)	
4880.325000	-52.9	32.4	-20.5	<u> </u>
4880.375000	-53.2	32.7	-20.5	_
4879.675000	-53.4	32.9	-20.5	_
4880.275000	-53.6	33.2	-20.5	
4880.025000	-53.7	33.2	-20.5	
4879.975000	-53.9	33.4	-20.5	1
4879.625000	-54.0	33.5	-20.5	:
4880.075000	-54.2	33.7	-20.5	_
4880.125000	-54.5	34.0	-20.5	_
4879.875000	-54.8	34.4	-20.5	_
4879.825000	-54.9	34.4	-20.5	
4880.175000	-55.0	34.5	-20.5	
4879.925000	-55.1	34.6	-20.5	
4879.775000	-55.2	34.7	-20.5	
4879.725000	-55.3	34.8	-20.5	

Setting	Instrument	Target Value
ootting	Value	ranget value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	29400	~ 29400
Sweeptime	29.400 ms	AUTO
Reference Level	-30.000 dBm	-30.000 dBm
Attenuation	0.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	4 / max. 150	max. 150
Stable	3/3	3
Max Stable Difference	0.00 dB	0.50 dB



High Channel (2480 MHz), 1 Mbps

Inband Peak								
Frequency	Level							
(MHz)	(dBm)							
2479.975000	-0.6							





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<u>Result table</u>

Frequency	Level	Margin	Limit
(MHz)	(dBm)	(dB)	(dBm)
4960.025000	-46.1	26.7	-19.4
4960.075000	-46.4	27.0	-19.4
4959.675000	-47.2	27.9	-19.4
4959.975000	-47.4	28.0	-19.4
4959.725000	-47.7	28.3	-19.4
4959.625000	-48.0	28.6	-19.4
4960.125000	-48.3	28.9	-19.4
4959.925000	-48.5	29.1	-19.4
4960.325000	-48.6	29.2	-19.4
4960.175000	-48.6	29.2	-19.4
4960.375000	-48.6	29.2	-19.4
4959.825000	-48.9	29.5	-19.4
4959.775000	-49.0	29.6	-19.4
4960.275000	-49.2	29.8	-19.4
4959.875000	-49.3	29.9	-19.4

Measurement Settings

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	29400	~ 29400
Sweeptime	29.400 ms	AUTO
Reference Level	-30.000 dBm	-30.000 dBm
Attenuation	0.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	4 / max. 150	max. 150
Stable	3/3	3
Max Stable Difference	0.00 dB	0.50 dB



7 Radiated Emissions

Limits FCC 15.205 and 15.209 RSS-GEN, Section 8.9 and 8.10

Frequency Range	Field Strength limit (uV/m) at 3m	Field Strength limit (dBuV/m) at
(MHz)		3m
0.009-0.490	2400/F(kHz) at 300m	-
0.490-1.705	24000/F(kHz) at 30m	-
1.705-30	30 at 30m	-
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Note:

- 1. The lower limit shall apply at transition frequencies
- 2. Emission level (dBuV/m)=20log emission level
- 3. For frequencies above 1000 MHz, the field strengths are based on average detector, however the peak field strength of ant emissions shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

Test Procedure

ANSI C63.10 Subclause 11.12.1

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1 GHz; 1.5m above the ground plane for measurement above 1 GH. The antenna to EIT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100kHz for peak detection measurements or 120kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi peak.

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30kHz for peak measurements.

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and as applicable for average measurements. If peak measurement are found to meet the average limit then average measurements are not performed.



For below 30 MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel). The orientation which produced the worst-case emissions is reported.

The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table), using the free space impedance of 377 ohms. For example the measurement at frequency X kHz resulted in a level of Y dBuV/m which is equivalent to Y-51.5=Z dBuA/m which has the same margin , W dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

For Radiated Emission below 30 MHz







Test Equipment ATL Description Manufacturer Model Serial Calibration Calibration Date Due ID 95 **Test Receiver** Rohde & ESU26, FW 100317 1/3/20 1/3/21 Schwarz 114 Multi Device ETS 2090 101304 NCR Controller 123 Base Controller ETS Base Controller 00106683 NCR 137 Antenna Mast ETS 2070B 2070B NCR 167 Biconilog **ETS-Lindgren** 3142E 00506752 10/19/19 10/19/21 Antenna 121 EMI Chamber Raymond 3m Chamber NA 9/29/20 9/29/22 26 AC Power Pacific Power 115-ASX 140200 9/14/20 9/14/21 Source 026 480VAC, 50/60 Arco F.LL.E.030A.SR.W1 09485245 NCR NCR Hz, 30A Line Electronics Filter 209 Narda West DBL-0218N308 040 11/16/20 11/16/22 Low Noise Amplifier 1-18 GHz Low Noise Fairview SLNA-180-26-30-SMA 11/16/20 11/16/22 210 V00669F050-Amplifier 1-18 Microwave 82014A874 GHz 230 3GHz HP Filter Microtronics HPM50111-02 NA NCR NCR

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ATL	Description	Manufacturer	Model	Serial	Calibration	Calibration
ID					Date	Due
242	SMA Cable	Tensolite	SMA M-M 20cm	NA	NCR	NCR
231	DC to 18 GHz	Centric	C18S-3	NA	NCR	NCR
	attenuator					
243	SMA Cable	Tensolite	SMA M-M 20cm	NA	NCR	NCR
244	2.9mm SMA	MicroCoax	2.9mm M-M	NA	NCR	NCR
	Cable					
212	Low Noise	Narda West	DBL-1826N410	073	11/16/20	11/16/22
	Amplifier 18-					
	26.5 GHz					
142	Pyramidal Horn	ETS	3160-09	00123849	5/19/18	5/19/21
152	Loop Antenna	EST-Lindgren	6502	00204987	12/11/19	12/11/21

Note: 1. The calibrations above are traceable to NIST/USA.

2. The test was performed in a 3m chamber.

Supplementary Information

There is not any deviation from the test standards for the test method.

Summary ("worst case")

Mode	Result	Type	Freg	Level	Limit	Margin	Dist	Condition	Azimuth	Height	Comment
Widde	nesure	Type	(144-)			Margin	()	condition	(0)	(m)	connient
			(IVIHZ)	(aBuv/m)	(aBuv/m)		(m)		(°)	(m)	
BLE 1mbps,	Pass	Max	12011.45	51.53	74	22.47	3	Vertical	167	217	Peak
2402MHz Tx		Peak									below avg
											limit



7.1 Transmitter Above 1 GHz

<u>Results</u>

Frequency Range	cy Range 1-18 GHz 7		CH 0 (1 Mbps), CH 19		
			(1Mbps), CH39 (1Mbps)		
Input Power	115V/60 Hz	Test Mode	1		
Environmental Conditions	23°C, 41 %RH, 101.3kPA	Configuration	1		
Tested By	Jacob Borg	Test Date	11/18/2020-11/19/2020		

Remarks:

- 1. Emission level (dBµV/m) = Raw Value (dBµV) + Correction factor (dB/m)
- 2. Correction Factor (dB) = Antenna Factor (dB/m) + Attenuation Factor (dB) Pre-Amplifier Gain (dB)
- 3. Margin (dB) = Limit Value Emission Level
- 4. Emissions not reported in the table were more than 6 dB below the limit.



Graphical Data, Band edge (CH0 2402 MHz)



				,		-0-(-		/				
Name	Frequency	^p rocess State	MaxPeak	CAverage	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.
Unit	MHz		dBµV/m	dBµV/m	dBµV/m	dB	ms	kHz	cm		deg	dB/m
1	2389.961500	FINAL	39.98		73.98	34.00	5000.0	1000.000	265.0	V	275.0	5.7
2	2402.008000	FINAL	71.00		120.00	49.00	5000.0	1000.000	200.0	Н	53.0	5.6
		Graphi	cal Data	a, Spuric	ous Resi	ults 1-3	3 GHz (CH	0 2402 N	MHz)			
	ē -											
8	61 61											
8	0											
7	5										FCC 15.209 F	<u>²K. Limit</u>
7	0											

Tabular Data, Band edge (CH0 2402 MHz)







Graphical Data, Spurious Results 3-18 GHz (CH0 2402 MHz)

Tabular Data (CH0 2402 MHz)

Name	Frequency	^o rocess State	MaxPeak	CAverage	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.	VBW (MHz)
Unit	MHz		dBµV/m	dBµV/m	dBµV/m	dB	ms	kHz	cm		deg	dB/m	
1	4804.131000	FINAL	47.57		74.00	26.43	5000.0	1000.000	175.0	Н	110.0	-23.0	3
2	4804.330000		48.69		74.00	25.31	5000.0	1000.000	174.0	V	220.0	-23.0	3
3	7205.565000	FINAL	48.71		74.00	25.29	5000.0	1000.000	218.0	V	211.0	-19.3	3
4	7206.471666	FINAL	48.58		74.00	25.42	5000.0	1000.000	186.0	Н	226.0	-19.3	3
5	12009.112667	FINAL	51.27		74.00	22.73	5000.0	1000.000	225.0	Н	140.0	-12.6	3
6	12011.144667	FINAL	51.53		74.00	22.47	5000.0	1000.000	217.0	V	167.0	-12.6	3









Graphical Data, Spurious Results 3-18 GHz (CH19 2440 MHz)

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Tabular Data (CH19 2440 MHz)

Name	Frequency	Process State	MaxPeak	RMS Avg	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.	Video Bandwidth
Unit	MHz		dBµV/m	dBµV/m	dBµV/m	dB	ms	kHz	cm		deg	dB/m	MHz
1	4879.800667	FINAL	48.77		74.00	25.23	5000.0	1000.000	186.0	V	138.0	-22.9	3
2	4880.005000	FINAL	47.97		74.00	26.03	5000.0	1000.000	225.0	Н	62.0	-22.9	3
3	7319.672000	FINAL	50.40		74.00	23.60	5000.0	1000.000	192.0	Н	232.0	-19.4	3
4	7320.454666	FINAL	48.67		74.00	25.33	5000.0	1000.000	221.0	V	209.0	-19.4	3
5	9760.178667	FINAL	47.02		74.00	26.98	5000.0	1000.000	225.0	Н	204.0	-15.7	3
6	11688.470333	FINAL	48.22		74.00	25.78	5000.0	1000.000	225.0	V	4.0	-13.1	3

Graphical Data, Band edge (CH39 2480 MHz) Vertical







Graphical Data, Band edge (CH39 2480 MHz) Horizontal









Graphical Data, Spurious Results 3-18 GHz (CH39 2480 MHz)

Tabular Data (CH39 2480 MHz) 1-18GHz

Nam	e Frequency	Process State	MaxPeak	RMS Avg	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.	Video Bandwidth
Uni	MHz		dBµV/m	dBµV/m	dBµV/m	dB	ms	kHz	cm		deg	dB/m	MHz
1	4959.663000	FINAL	47.09		54.00	6.91	5000.0	1000.000	175.0	V	39.0	-22.8	3
2	4959.951000	FINAL	47.21		54.00	6.79	5000.0	1000.000	125.0	Н	205.0	-22.8	3
3	7439.561333	FINAL	49.86		54.00	4.14	5000.0	1000.000	167.0	V	163.0	-19.5	3
4	7439.904667	FINAL	49.05		54.00	4.95	5000.0	1000.000	225.0	Н	140.0	-19.5	3
5	9919.145666	FINAL	47.24		54.00	6.76	5000.0	1000.000	111.0	Н	71.0	-15.1	3
6	9919.859000	FINAL	47.21		54.00	6.79	5000.0	1000.000	175.0	V	59.0	-15.1	3



7.2 Worst case 30 MHz to 1 GHz

Frequency Range	30 MHz to 1 GHz	Tested Channel	CH 19 (1Mbps)
Input Power	115V/60 Hz	Test Mode	1
Environmental Conditions	24°C, 40 %RH, 101.9kPA	Configuration	1
Tested By	James Schisler	Test Date	12/15/2020

Remarks:

- 1. Emission level $(dB\mu V/m) = Raw Value (dB\mu V) + Correction factor (dB/m)$
- 2. Correction Factor (dB) = Antenna Factor (dB/m) + Cable Factor (dB)
- 3. Margin (dB) = Limit Value Emission Level
- 4. Emissions not reported in the table were more than 6 dB below the limit.

Graphical Data, Radiated Emissions (CH19 2440 MHz) .3-1GHz





Frequency (MHz)	QuasiP eak (dBµV/ m)	Limit (dBµV/ m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
803.946244	30.43	46.00	15.57	5000.0	120.000	255.0	V	139.0	30.9
821.282833	30.53	46.00	15.47	5000.0	120.000	125.0	Н	158.0	31.0
857.149911	30.20	46.00	15.80	5000.0	120.000	136.0	V	291.0	30.7
926.817522	32.64	46.00	13.36	5000.0	120.000	275.0	Н	301.0	33.1
960.270811	32.04	53.90	21.86	5000.0	120.000	305.0	V	296.0	32.3
984.746767	31.81	53.90	22.09	5000.0	120.000	201.0	Н	12.0	32.1

Tabular Data (CH19 2440 MHz) .3-1GHz



7.3 Worst case 9 kHz to 30 MHz

Frequency Range	9 kHz to 30MHz	Tested Channel	CH 19 (1Mbps)
Input Power	115V/60 Hz	Test Mode	1
Environmental Conditions	22°C, 38 %RH, 101.1kPA	Configuration	1
Tested By	James Schisler	Test Date	11/18/2020

Remarks:

- 1. Emission level $(dB\mu V/m) = Raw Value (dB\mu V) + Correction factor (dB/m)$
- 2. Correction Factor (dB) = Antenna Factor (dB/m) + Cable Factor (dB)
- 3. Margin (dB) = Limit Value Emission Level
- 4. Emissions not reported in the table were more than 6 dB below the limit.

Graphical Data, Radiated Emissions (CH19 2440 MHz) 9kHz to 30 MHz





Tabular Data (CH19 2440 MHz) 9kHz to 30 MHz

Name	Frequency	Process State	MaxPeak	AvgLimit	Qpk Limit	Margin	Height	Pol	Azimuth	Corr.	Video Bandwidth
Unit	MHz		dBµV/m	dBµV/m		dB	cm		deg	dB/m	
1	0.019822	DAT_RED	56.24	121.26		65.02	105.0) Н	231.0	14.6	i VBW ≥ 3XRBW
2	0.061399	DAT_RED	48.17	111.59		63.42	105.0	н	0.0	11.6) VBW ≥ 3XRBW
3	0.126911	DAT_RED	55.94	105.48		49.54	105.0) Н	231.0	11.2	YBW ≥ 3×RBW
4	0.250744	DAT_RED	51.83	99.42		47.59	105.0	н	57.0	11.2	YBW≥3XRBW
5	0.545513	DAT_RED	47.34		72.87	25.53	105.0	н	295.0	11.2	YBW≥3XRBW
6	1.664888	DAT_RED	35.50		63.18	27.68	105.0	н	138.0	11.2	YBW≥3XRBW

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7.4 Worst case 18 GHz to 26.5 GHz

Frequency Range	9 kHz to 30MHz	Tested Channel	CH 19 (1Mbps)
Input Power	115V/60 Hz	Test Mode	1
Environmental Conditions	22°C, 38 %RH, 101.1kPA	Configuration	1
Tested By	James Schisler	Test Date	11/20/2020

Remarks:

- 1. Emission level (dBµV/m) = Raw Value (dBµV) + Correction factor (dB/m)
- Correction Factor (dB) = Antenna Factor (dB/m) + Cable Factor (dB) Pre-Amplifier Gain (dB)
- 3. Margin (dB) = Limit Value Emission Level
- 4. Emissions not reported in the table were more than 6 dB below the limit.



Graphical Data, Radiated Emissions (CH19 2440 MHz) 18 GHz to 26.5 GHz, Vertical





Graphical Data, Radiated Emissions (CH19 2440 MHz) 18 GHz to 26.5 GHz, Horizontal

Tabular Data (CH19 2440 MHz) 18 GHz to 26.5 GHz

Name	Frequency	^o rocess State	MaxPeak	Rms Avg	Limit	Margin	Meas. Time	Bandwidth	Pol	Azimuth	Corr.	VBW
Unit	MHz		dBµV/m	dBµV/m	dBµV/m	dB	ms	kHz		deg	dB/m	MHz
1	19182.244000	FINAL	51.73		74.00	22.27	1000.0	1000.000	V	11.0	14.1	3
2	20341.332000	FINAL	51.84		74.00	22.16	1000.0	1000.000	V	338.0	13.4	3
3	22079.273000	FINAL	51.65		74.00	22.35	1000.0	1000.000	V	23.0	14.5	3
Name	Frequency	^p rocess State	MaxPeak	RMS Avg	Limit	Margin	Meas. Time	Bandwidth	Pol	Azimuth	Corr.	VBW
Name Unit	Frequency MHz	^p rocess State	MaxPeak dBµV/m	RMS Avg dBµV/m	Limit dBµV/m	Margin dB	Meas. Time ms	Bandwidth kHz	Pol	Azimuth deg	Corr. dB/m	VBW MHz
Name Unit 1	Frequency MHz 18740.965000	Process State	MaxPeak dBµV/m 51.22	RMS Avg dBµV/m 	Limit dBµV/m 74.00	Margin dB 22.78	Meas. Time ms 1000.0	Bandwidth kHz 1000.000	Pol H	Azimuth deg 231.0	Corr. dB/m 14.3	VBW MHz 3
Name Unit 1 2	Frequency MHz 18740.965000 20443.015000	Process State FINAL FINAL	MaxPeak dBµV/m 51.22 51.91	RMS Avg dBµV/m 	Limit dBµV/m 74.00 74.00	Margin dB 22.78 22.09	Meas. Time ms 1000.0 1000.0	Bandwidth kHz 1000.000 1000.000	Pol H H	Azimuth deg 231.0 0.0	Corr. dB/m 14.3 13.4	VBW MHz 3 3



8 AC Power Line Conducted Emissions, 150 kHz to 30 MHz Limits

FCC 15.207 (a) RSS-Gen 8.8

Frequency (MHz)	Coupling Device	Detector Type/ resolution bandwidth	Limit (dBµV)
0.15 to 0.5	AMN	Quasi Peak / 9 kHz	66 to 56
0.5 to 5			56
0.5 to 30			60
0.15 to 0.5	AMN	Average / 9 kHz	56 to 46
0.5 to 5			46
0.5 to 30			50

Notes:

- 1. The lower limit applies at transition frequencies.
- 2. Emission level (dB μ V) = 20log Emission Level (μ V)
- 3. Decreases with the logarithm of the frequency.

Test Equipment

ATL ID	Description	Manufacturer	Model	Serial	Calibration	Calibration
					Date	Due
95	Test Receiver	Rohde &	ESU26	13026005k26	1/3/2020	1/3/2021
		Schwarz				
151	LISN	Rohde &	ENV216	101304	2/3/2020	2/3/2022
		Schwarz				
26	AC Power	Pacific Power	115-ASX	140200	9/14/2020	9/14/2021
	Source					
026	480VAC, 50/60	Arco	F.LL.E.030A.SR.W1	09485245	NCR	NCR
	Hz, 30A Line	Electronics				
	Filter					
NA	10dB Attenuator	JFW	50F-010	NA	NCR	NCR

Note: The calibrations above are traceable to NIST/USA. <u>Test Procedure</u>

- a. The EUT was placed on a non-conductive insulated support structure 80cm above the ground plane and plugged into power mains through a line impedance stabilization network (LISN). The EUT was arranged along the rear of the table 0.4 meters from the conducting wall of the shielded room in a manner consistent with ANSI C63.10.
- b. The frequency range from 150 kHz to 30 MHz was searched. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The test receiver system was set to peak detect function and specified bandwidth with maximum hold mode while the receiver was swept from 150 kHz to 30 MHz.

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- d. Any frequencies where peak emissions were found to be over the Quasi-peak or average limit were then revisited and a quasi -peak or average detector was used accordingly.
- e. Emission levels over 10 dB under the limit were not reported.



Note: For reference purposes only. For actual test configuration refer to related items – photographs of test configuration, block diagram of test configuration.

Supplementary Information

There is not any deviation from the test standards for the test method.



<u>Results</u>

Frequency Range	150 kHz to 30 MHz	Phase	Line (L)
Input Power	115V/60Hz	Test Mode	1
Environmental Conditions	23°C, 46 % RH, 100.8 kPa	Configuration	1
Tested By	James Schisler	Test Date	11/17/2020



Remarks:

- 1. Emission level (dBµV) = Raw Value (dBµV) + Correction factor (dB)
- Correction Factor (dB) = LISN Transducer Factor (dB) + Limiter Factor (dB) + Cable Factor (dB)
- 3. Margin (dB) = Limit Value Emission Level
- 4. Emissions not reported in the table were more than 6 dB below the limit.



Tabular Data

Name	Frequency	^o rocess State	QuasiPeak	CAverage	Limit	Margin	Meas. Time	Bandwidth	Line	Filter	Corr.
Unit	MHz		dBµV	dBµV	dBµV	dB	ms	kHz			dB
1	1.255157	FINAL		26.51	46.00	19.49	5000.0	9.000	L1	ON	20.0
2	1.047550	FINAL		25.39	46.00	20.61	5000.0	9.000	L1	ON	20.0
3	0.431529	FINAL	- 222	24.86	47.22	22.36	5000.0	9.000	L1	ON	20.2
4	1.113933	FINAL	30.42		56.00	25.58	5000.0	9.000	L1	ON	20.0
5	0.992407	FINAL	29.67	1 <u>88</u> 0	56.00	26.33	5000.0	9.000	L1	ON	20.0
6	0.435273	FINAL	29.31		57.15	27.84	5000.0	9.000	L1	ON	20.2



Frequency Range	150 kHz to 30 MHz	Phase	Neutral (N)		
Input Power	115V/60Hz	Test Mode	1		
Environmental Conditions	23°C, 46 % RH, 100.8 kPa	Configuration	1		
Tested By	Jim Schisler	Test Date	11/17/2020		



Graphical Data

Remarks:

- 1. Emission level (dB μ V) = Raw Value (dB μ V) + Correction factor (dB)
- Correction Factor (dB) = LISN Transducer Factor (dB) + Limiter Factor (dB) + Cable Factor (dB)
- 3. Margin (dB) = Limit Value Emission Level
- 4. Emissions not reported in the table were more than 6 dB below the limit.



Tabular Data

Name	Frequency	Process State	QuasiPeak	CAverage	Limit	Margin	Meas. Time	Bandwidth	Line	Filter	Corr.
Unit	MHz		dBµV	dB <mark>µ</mark> V	dBµV	dB	ms	kHz			dB
1	0.775351	FINAL		30.09	46.00	15.91	5000.0	9.000	N	ON	20.1
2	1.329033	FINAL		26.85	46.00	19.15	5000.0	9.000	N	ON	20.0
3	0.479006	FINAL		24.65	46.36	21.71	5000.0	9.000	N	ON	20.3
4	1.046885	FINAL	30.02		56.00	25.98	5000.0	9.000	N	ON	20.0
5	0.999357	FINAL	29.59		56.00	26.41	5000.0	9.000	N	ON	20.0
6	1.357557	FINAL	29.08		56.00	26.92	5000.0	9.000	N	ON	20.0



Setup Photos and Block Diagrams



Conducted emissions Block Diagram of EUT connections



AC Power Line Conducted emissions Setup (Front View)

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Conducted emissions Setup (Rear View)





Radiated emissions EUT Block Diagram



Radiated emissions 9kHz to 30 MHz EUT Setup (Front View)





Radiated emissions Setup 9kHz to 30 MHz (Rear View)



Radiated emissions 30MHz to 1GHz EUT Setup (Front View)





Radiated emissions Setup 30 MHz to 1 GHz (Rear View)



Radiated emissions 1GHz to 18GHz EUT Setup (Overall View)





Radiated emissions 1GHz to 18GHz EUT Setup (Z-axis, worst case View)



Radiated emissions 18 to 26.5 GHz EUT Setup (Front View)





Radiated emissions 1GHz to 18GHz EUT Setup (Overall View)



Antenna port conducted emissions Block Diagram of EUT connections





Antenna Port Conducted emissions Setup (Non Spurious Emissions tests)



Antenna Port Conducted emissions Setup (Spurious Emissions tests)