

TEST REPORT

Report Number.: R13338409-E1

- Applicant : LEVITON MFG CO INC 20497 SW TETON PO BOX 2210 TUALATIN, OR 97062-2210
 - Model : BLE-B8224
 - FCC ID : 2ASLN-ODS15
 - IC : 25037-ODS15
- EUT Description : BLE Logic Board
- Test Standard(s) : FCC 47 CFR PART 15 SUBPART C (2021) ISED RSS-247 ISSUE 2:2019 ISED RSS-GEN ISSUE 5 + A1:2019

Date Of Issue: 2021-02-09

Prepared by:

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REPORT REVISION HISTORY

Rev.	lssue Date	Revisions	Revised By
v1	2021-02-09	Initial Issue	Niklas Haydon

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	LEVITON MFG CO INC 20497 SW TETON PO BOX 2210 TUALATIN, OR 97062-2210			
EUT DESCRIPTION:	BLE Logic Board			
MODEL:	BLE-B8224			
	De dista d Canada d D			

SERIAL NUMBER: Radiated Sample: 1R Conducted Sample: 1C

SAMPLE RECEIPT DATE: 2021-01-26

DATE TESTED: 2021-02-01 to 2021-02-03

APPLICABLE STANDARDS					
STANDARD	TEST RESULTS				
CFR 47 Part 15 Subpart C (2021)	Complies				
ISED RSS-247 Issue 2:2019	Complies				
ISED RSS-GEN Issue 5 + A1:2019	Complies				

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. government.

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Approved & Released For UL LLC. By:

3-1-

Brian Kiewra Project Engineer Consumer Technology Division UL LLC.

Prepared By:

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2. TEST RESULTS SUMMARY

This report contains data provided by the applicant which can impact the validity of results. UL LLC is only responsible for the validity of results after the integration of the data provided by the customer.

FCC Clause	ISED Clause	Requirement	Result	Comment
See Comment		Duty Cycle	Reporting	ANSI C63.10 Section
See Comment			purposes only	11.6.
	RSS-GEN 6.7		Reporting	ANSI C63.10 Section
-		9978 OBW	purposes only	6.9.3.
15.247 (a) (2)	RSS-247 5.2 (a)	6dB BW	Compliant.	None.
15.247 (b) (3)	RSS-247 5.4 (d)	Output Power	Compliant.	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)	PSD	Compliant.	None.
15.247 (d)	RSS-247 5.5	Conducted Spurious Emissions	Compliant.	None.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions	Compliant.	None.
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions	Compliant.	None.

3. 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, KDB 414788 D01 Radiated Test Site v01r01, RSS-GEN Issue 5 + A1, and RSS-247 Issue 2.

4. FACILITIES AND ACCREDITATION

UL LLC is accredited by NVLAP, Laboratory Code 200246-0, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
\boxtimes	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	US0067	2180C	703469

5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

5.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

5.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Radio Frequency (Spectrum Analyzer)	141.2 Hz
Occupied Channel Bandwidth	1.22%
PE output newer conducted	1.3 dB (PK)
RF output power, conducted	0.45 dB (AV)
RF output power, radiated (SAC) < 180 MHz	6.18 dB
RF output power, radiated (SAC) >=180 MHz	3.23 dB
Power Spectral Density, conducted	2.47 dB
Unwanted Emissions, conducted	1.94 dB
All emissions, radiated	6.01 dB
Conducted Emissions (0.150-30MHz) - LISN	3.40 dB
Temperature	0.57°C
Humidity	3.39%
DC Supply voltages	1.70%
Time	3.39%

Uncertainty figures are valid to a confidence level of 95%.

5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided: Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB) 36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided: Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss. 36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

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6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a Smart Wallbox Sensors: 15A Switch.

6.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range	Mode	Output Power	Output Power
(MHz)		(dBm)	(mW)
2402 - 2480	BLE	9.28	8.47

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an PCB antenna, with a maximum gain of 1.5dBi.

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was v0.1 [firmware = Min RF Test CY_BTSDK2.7 application].

The test utility software used during testing was CyBlueTool v0.1.107.1.

6.5. WORST-CASE CONFIGURATION AND MODE

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

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

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.

The only supported data rates as provided by the client was 1 Mbps.

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6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Use	Product Type	e Manufacturer Model		Comments		
EUT	Wall Box Dimmer	Leviton	BLE-B8224	None		
SIM	Lightbulb	GE	100W	Used as load		
AE Terminal Block AB 1492-EAJ35 None				None		
Note: EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment, or SIM - Simulator (Not Subjected to Test)						

I/O CABLES

Port #	Name	Туре*	Cable Max. >3m (Y/N)	Cable Shielded (Y/N)	Comments
0	Enclosure	N/E	_	—	None
1	Line	AC	Ν	Ν	None
2	Ground	AC	Ν	Ν	None
3	Neutral	AC	Ν	Ν	Connected to mains and loads
4	Load	AC	Ν	Ν	Connected to lightbulbs as loads
*Note: AC = AC Power Port DC = DC Power Port N/E = Non-Electrical I/O = Signal Input or Output Port (Not Involved in Process Control) TP = Telecommunication Ports					

TEST SETUP

The EUT is connected to a test laptop that contains software that exercises the radio card.

SETUP DIAGRAMS

Please refer to R13338409-EP1 for setup diagrams.

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7. MEASUREMENT METHOD

6 dB BW: ANSI C63.10 Subclause -11.8.1

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

Output Power: ANSI C63.10 Subclause -11.9.1.3 Method PKPM1 Peak-reading power meter Output Power: ANSI C63.10 Subclause -11.9.2.3.2 Method AVGPM-G (Measurement using a gated RF average-reading power meter)

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

Emissions non-restricted frequency bands: ANSI C63.10 Subclause -11.11 and 6.10.4

Emissions restricted frequency bands: ANSI C63.10 Subclause -11.12.1 and 6.10.5

General Radiated Spurious Emissions: ANSI C63.10-2013 Sections 6.3 to 6.6.

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2.

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8. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment					
ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SA0027		Keysight			
(PRE0126407	Spectrum Analyzer	Technologies	N9030A	2020-06-10	2021-06-10
HI0090		Fisher			
(PRE0191271)	Environmental Meter	Scientific	15-077-963	2020-06-26	2021-06-26
PWM002		Keysight			
(PRE0137344)	RF Power Meter	Technologies	N1911A	2020-07-31	2021-07-31
PWS005	Peak and Avg Power Sensor, 50MHz	Keysight			
(MY55090030)	to 18GHz	Technologies	N1921A	2020-05-26	2021-05-26
			Version		
SOFTEMI	Antenna Port Software	UL	2021.01.19	NA	NA
	Additional Equipment used				
		Acme			
NA	Isolation Transformer	Transformer	TF-2-79262-S	NA	NA

Test Equipment Used - Line-Conducted Emissions - Voltage (Morrisville - Conducted 1)

Equipment					
ÍD	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Coax cable, RG223, N-male				
CBL087	to BNC-male, 20-ft.	Pasternack	PE3W06143-240	2020-03-26	2021-03-26
HI0091	Environmental Meter	Fisher Scientific	14-650-118	2020-06-26	2021-06-26
	LISN, 50-ohm/50-uH, 2-	Fischer Custom	FCC-LISN-50-25-2-		
LISN003	conductor, 25A	Com.	01-550V	2020-08-18	2021-08-18
	EMI Test Receiver 9kHz-	Rohde &			
75141	7GHz	Schwarz	ESCI 7	2020-08-18	2021-08-18
	Transient Limiter, 0.009-				
ATA222	100MHz	Electro-Metrics	EM-7600	2020-03-26	2021-03-26
			CW2501M		
PS215	AC Power Source	Elgar	(s/n 1523A02397)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 (2020-08-18))

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - South Chamber)

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	0.009-30MHz	(Loop Ant.)			
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2020-08-20	2021-08-20
	30-1000 MHz				
AT0075	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2020-10-27	2021-10-27
	1-18 GHz				
AT0067	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	FTS Lindaren	3117	2020-04-28	2021-04-28
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	18 40 GHz	Li e Lindgioni	0111	2020 01 20	20210120
AT0063	Horn Antenna, 18- 26.5GHz	ARA	MWH-1826/B	2020-10-30	2021-10-30
	Gain-Loss Chains				
S-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2020-07-10	2021-07-10
S-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2020-07-10	2021-07-10
S-SAC03	Gain-loss string: 1- 18GHz	Various	Various	2020-07-06	2021-07-06
S-SAC04	Gain-loss string: 18-40GHz	Various	Various	2020-07-07	2021-07-07
	Receiver & Software				
SA0025	Spectrum Analyzer	Agilent	N9030A	2020-03-17	2021-03-17
SOFTEMI	EMI Software	UL	Version 9.5 (2020-08-18)		-18)
	Additional Equipment used				,
s/n 200037635	Environmental Meter	Fisher Scientific	06-662-4	2020-01-22	2022-01-22

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9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

	B (msec)	(msec)	x (linear)	Cycle (%)	Correction Factor (dB)	Minimum VBW (kHz)
2.4GHz Band						
BLE	0.392	0.625	0.627	62.72%	4.05	2.551

DUTY CYCLE PLOTS



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UL LLC 12 Laboratory Dr., RTP, NC 27709; USA

9.2. 99% **BANDWIDTH**

LIMITS

None; for reporting purposes only.

RESULTS

9.2.1. BLE (1Mbps)

Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	2402	1.0714
Middle	2440	1.0834
High	2480	1.0910



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9.3. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2) RSS-247 5.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

9.3.1. BLE (1Mbps)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.744	0.5
Middle	2440	0.780	0.5
High	2480	0.741	0.5



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HIGH CHANNEL

#VBW 300 kHz

Span 3.000 MHz Sweep 1.533 ms (1001 pts)

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Center 2.480000 GHz #Res BW 100 kHz

9.4. OUTPUT POWER

<u>LIMITS</u>

FCC §15.247 (b) (3) RSS-247 5.4 (d)

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.13 dB (including 10.28 dB pad and 0.85 dB cable) was entered as an offset in the power meter.

RESULTS

9.4.1. BLE (1Mbps)

Tested By:	84740/40882
Date:	2021-02-01

Channel	Frequency	Peak Power Reading	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	9.28	30	-20.72
Middle	2440	8.95	30	-21.05
High	2480	8.14	30	-21.86

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9.5. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to an average gated power meter.

The cable assembly insertion loss of 11.13 dB (including 10.28 dB pad and 0.85 dB cable) was entered as an offset in the power meter.

RESULTS

9.5.1. BLE (1Mbps)

Tested By:	84740/40882	
Date:	2021-02-01	

Channel	Frequency	AV power
	(MHz)	(dBm)
Low	2402	9.13
Middle	2440	8.80
High	2480	7.97

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9.6. 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.

RESULTS

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9.6.1. BLE (1Mbps)

Channel	Frequency	PSD	Limit	Margin
	(MHz)	(dBm/3kHz)	(dBm/3kHz)	(dB)
Low	2402	-5.85	8	-13.85
Middle	2440	-6.05	8	-14.05
High	2480	-6.70	8	-14.70





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9.7. CONDUCTED SPURIOUS EMISSIONS

<u>LIMITS</u>

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 -20dBc.

RESULTS

9.7.1. BLE (1Mbps)



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10. RADIATED TEST RESULTS

10.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

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

RSS-GEN, Section 8.9 and 8.10

Frequency Range (kHz)	Field Strength Limit (uA/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	6.37/F(kHz) @ 300 m	-
0.490-1.705	63.7/F(kHz) @ 30 m	-
1.705 - 30	0.08 @ 30m	-

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

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

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements in the 30-1000MHz range, 9kHz for peak and/or quasi-peak detection measurements in the 0.15-30MHz range and 200Hz for peak and/or quasi-peak detection measurements in the 9 to 150kHz range. Peak detection is used unless otherwise noted as quasi-peak or average (9-90kHz and 110-490kHz).

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

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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. The averaging type used is linear voltage averaging.

The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

3D antenna use - For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel).

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

KDB 414788 Open Field Site(OFS) and Chamber Correlation Justification

OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

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10.2. TRANSMITTER ABOVE 1 GHz

10.2.1. BLE (1Mbps)

<u>Antenna 1</u>

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency	Meter	Det	AT0067	Amp/Cbl/Fltr/Pad	DC	Corrected	Average	Margin	Peak	РК	Azimuth	Height	Polarity
	(GHz)	Reading		(dB/m)	(dB)	Corr	Reading	Limit	(dB)	Limit	Margin	(Degs)	(cm)	
		(dBuV)				(dB)	(dBuV/m)	(dBuV/m)		(dBuV/m)	(dB)			
1	* ** 2.39	36.87	Pk	32.1	-24	0	44.97	-	-	74	-29.03	198	162	Н
2	* ** 2.38958	39.52	Pk	32.1	-24	0	47.62	-	-	74	-26.38	198	162	Н
3	* ** 2.39	20.23	ADV	32.1	-24	4.05	32.38	54	-21.62	-	-	198	162	Н
4	* ** 2.3781	21.83	ADV	32.2	-23.9	4.05	34.18	54	-19.82	-	-	198	162	Н

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band ** - indicates frequency in Taiwan NCC LP0002 Restricted Band Pk - Peak detector ADV - Linear Voltage Average

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VERTICAL RESULT



Marker	Frequency	Meter	Det	AT0067	Amp/Cbl/Fltr/Pad	DC	Corrected	Average	Margin	Peak	РК	Azimuth	Height	Polarity
	(GHz)	Reading		(dB/m)	(dB)	Corr	Reading	Limit	(dB)	Limit	Margin	(Degs)	(cm)	
		(dBuV)				(dB)	(dBuV/m)	(dBuV/m)		(dBuV/m)	(dB)			
1	* ** 2.39	41.95	Pk	32.1	-24	0	50.05	-	-	74	-23.95	38	180	V
2	* ** 2.38956	42.74	Pk	32.1	-24	0	50.84	-	-	74	-23.16	38	180	V
3	* ** 2.39	20.27	ADV	32.1	-24	4.05	32.42	54	-21.58	-	-	38	180	V
4	* ** 2.3856	20.67	ADV	32.2	-23.9	4.05	33.02	54	-20.98	-	-	38	180	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

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BANDEDGE (HIGH CHANNEL)



HORIZONTAL RESULT

Marker	Frequency	Meter	Det	AT0067	Amp/Cbl/Fltr/Pad	DC	Corrected	Average	Margin	Peak	РК	Azimuth	Height	Polarity
	(GHz)	Reading		(dB/m)	(dB)	Corr	Reading	Limit	(dB)	Limit	Margin	(Degs)	(cm)	
		(dBuV)				(dB)	(dBuV/m)	(dBuV/m)		(dBuV/m)	(dB)			
1	* ** 2.4835	52.86	Pk	32.4	-24.4	0	60.86	-	-	74	-13.14	197	272	Н
2	* ** 2.48353	52.57	Pk	32.4	-24.4	0	60.57	-	-	74	-13.43	197	272	Н
3	* ** 2.4835	22.5	ADV	32.4	-24.4	4.05	34.55	54	-19.45	-	-	197	272	Н
4	** 2.50396	25.28	ADV	32.4	-24.7	4.05	37.03	54	-16.97	-	-	197	272	Н

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

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VERTICAL RESULT

Marker	Frequency	Meter	Det	AT0067	Amp/Cbl/Fltr/Pad	DC	Corrected	Average	Margin	Peak	РК	Azimuth	Height	Polarity
	(GHz)	Reading		(dB/m)	(dB)	Corr	Reading	Limit	(dB)	Limit	Margin	(Degs)	(cm)	
		(dBuV)				(dB)	(dBuV/m)	(dBuV/m)		(dBuV/m)	(dB)			
1	* ** 2.4835	52.39	Pk	32.4	-24.4	0	60.39	-	-	74	-13.61	38	164	V
2	* ** 2.48355	52.81	Pk	32.4	-24.4	0	60.81	-	-	74	-13.19	38	164	V
3	* ** 2.4835	21.16	ADV	32.4	-24.4	4.05	33.21	54	-20.79	-	-	38	164	V
4	* ** 2.48364	22.21	ADV	32.4	-24.4	4.05	34.26	54	-19.74	-	-	38	164	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

ADV - Linear Voltage Average

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HARMONICS AND SPURIOUS EMISSIONS



LOW CHANNEL RESULTS



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Marker	Frequency	Meter	Det	AT0067	Amp/Cbl/Fltr/Pad	DC Corr	Corrected	Avg Limit	Margin	Peak Limit	РК	Azimuth	Height	Polarity
	(GHz)	Reading		(dB/m)	(dB)	(dB)	Reading	(dBuV/m)	(dB)	(dBuV/m)	Margin	(Degs)	(cm)	
		(dBuV)					(dBuV/m)				(dB)			
1	* ** 4.80461	44.31	PK2	34	-30.9	0	47.41	-	-	74	-26.59	166	186	Н
	* ** 4.80377	34.27	ADV	34	-30.9	4.05	41.42	54	-12.58	-	-	166	186	Н
4	* ** 12.24622	34.24	PK2	38.8	-24.2	0	48.84	-	-	74	-25.16	227	361	Н
	* ** 12.24603	20.84	ADV	38.8	-24.2	4.05	39.49	54	-14.51	-	-	227	361	Н
5	* ** 15.4203	32.84	PK2	40.3	-21.9	0	51.24	-	-	74	-22.76	71	140	Н
	* ** 15.42181	20.02	ADV	40.3	-21.9	4.05	42.47	54	-11.53	-	-	71	140	Н
6	* ** 4.80362	43.74	PK2	34	-30.8	0	46.94	-	-	74	-27.06	183	150	V
	* ** 4.80372	33.57	ADV	34	-30.9	4.05	40.72	54	-13.28	-	-	183	150	V
8	* ** 11.02005	33.9	PK2	38.1	-24.1	0	47.9	-	-	74	-26.1	270	289	V
	* ** 11.02018	20.85	ADV	38.1	-24	4.05	39	54	-15	-	-	270	289	V
9	* ** 15.39969	32.73	PK2	40.3	-22.1	0	50.93	-	-	74	-23.07	10	352	V
	* ** 15.40078	20.31	ADV	40.3	-22.1	4.05	42.56	54	-11.44	-	-	10	352	V
2	7.20524	39.12	Pk	35.6	-27.9	0	46.82	-	-	-	-	0-360	101	Н
7	7.20524	40.69	Pk	35.6	-27.9	0	48.39	-	-	-	-	0-360	200	V
3	9.6087	30.52	Pk	36.6	-26.3	0	40.82	-	-	-	-	0-360	200	Н

RADIATED EMISSIONS

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band ** - indicates frequency in Taiwan NCC LP0002 Restricted Band

PK2 - Maximum Peak

ADV - Linear Voltage Average

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MID CHANNEL RESULTS



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RADIATED EMISSIONS

Marker	Frequency	Meter	Det	AT0067	Amp/Cbl/Fltr/Pad	DC Corr	Corrected	Avg Limit	Margin	Peak Limit	РК	Azimuth	Height	Polarity
	(GHz)	Reading		(dB/m)	(dB)	(dB)	Reading	(dBuV/m)	(dB)	(dBuV/m)	Margin	(Degs)	(cm)	
		(dBuV)					(dBuV/m)				(dB)			
1	* ** 4.88031	44.22	PK2	34	-30.8	0	47.42	-	-	74	-26.58	258	138	Н
	* ** 4.87969	34.32	ADV	34	-30.8	4.05	41.57	54	-12.43	-	-	258	138	Н
2	* ** 11.88649	34.57	PK2	38.6	-24.6	0	48.57	-	-	74	-25.43	257	378	Н
	* ** 11.88902	20.97	ADV	38.6	-24.6	4.05	39.02	54	-14.98	-	-	257	378	Н
3	* ** 15.63431	34.95	PK2	40.2	-24.3	0	50.85	-	-	74	-23.15	108	213	н
	* ** 15.63424	21.43	ADV	40.2	-24.3	4.05	41.38	54	-12.62	-	-	108	213	Н
4	* ** 4.88075	43.13	PK2	34	-30.8	0	46.33	-	-	74	-27.67	182	160	V
	* ** 4.87978	32.63	ADV	34	-30.8	4.05	39.88	54	-14.12	-	-	182	160	V
5	* ** 11.3699	33.19	PK2	38.1	-23.4	0	47.89	-	-	74	-26.11	183	362	V
	* ** 11.3691	20.34	ADV	38.1	-23.3	4.05	39.19	54	-14.81	-	-	183	362	V
6	* ** 15.77644	33.66	PK2	40.3	-23.5	0	50.46	-	-	74	-23.54	0	100	V
	* ** 15.77674	20.89	ADV	40.3	-23.5	4.05	41.74	54	-12.26	-	-	0	100	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band ** - indicates frequency in Taiwan NCC LP0002 Restricted Band PK2 - Maximum Peak ADV - Linear Voltage Average

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HIGH CHANNEL RESULTS





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RADIATED EMISSIONS

Marker	Frequency	Meter	Det	AT0067	Amp/Cbl/Fltr/Pad	DC Corr	Corrected	Avg Limit	Margin	Peak Limit	PK	Azimuth	Height	Polarity
	(GHz)	Reading		(dB/m)	(dB)	(dB)	Reading	(dBuV/m)	(dB)	(dBuV/m)	Margin	(Degs)	(cm)	
		(dBuV)					(dBuV/m)				(dB)			
1	* ** 4.96055	44.2	PK2	33.9	-31	0	47.1	-	-	74	-26.9	261	121	Н
	* ** 4.95974	33.49	ADV	33.9	-31	4.05	40.44	54	-13.56	-	-	261	121	Н
2	* ** 7.43926	38.49	PK2	35.6	-27.7	0	46.39	-	-	74	-27.61	156	167	Н
	* ** 7.43942	26.54	ADV	35.6	-27.7	4.05	38.49	54	-15.51	-	-	156	167	Н
3	* ** 11.39316	34.2	PK2	38.1	-23.6	0	48.7	-	-	74	-25.3	327	386	Н
	* ** 11.39315	20.23	ADV	38.1	-23.6	4.05	38.78	54	-15.22	-	-	327	386	Н
4	* ** 4.95967	41.35	PK2	33.9	-31	0	44.25	-	-	74	-29.75	164	174	V
	* ** 4.95966	29.61	ADV	33.9	-31	4.05	36.56	54	-17.44	-	-	164	174	V
5	* ** 7.43913	37.98	PK2	35.6	-27.7	0	45.88	-	-	74	-28.12	235	127	V
	* ** 7.43952	25.59	ADV	35.6	-27.7	4.05	37.54	54	-16.46	-	-	235	127	V
6	* ** 11.9593	33.86	PK2	38.6	-24.2	0	48.26	-	-	74	-25.74	48	155	V
	* ** 11.95963	20.61	ADV	38.6	-24.2	4.05	39.06	54	-14.94	-	-	48	155	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band ** - indicates frequency in Taiwan NCC LP0002 Restricted Band PK2 - Maximum Peak ADV - Linear Voltage Average

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10.3. WORST CASE BELOW 30MHZ

Note for below 30 MHz scans: All measurements were made at a test distance of 3 m. The measured data was extrapolated from the test distance (3m) to the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz – 30 MHz) to clearly show the relative levels of fundamental and spurious emissions and demonstrate compliance with the requirement that the level of any spurious emissions be below the level of the intentionally transmitted signal. The extrapolation factor for the limits were 40*Log (test distance / specification distance).

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SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)



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Below 30MHz Data

Marker	Frequency	Meter	Det	AT0079	Cbl (dB)	Dist. Corr.	Corrected	Qp/Avg Limit	Pk Limit	Margin	Azimuth	Antenna
	(MHz)	Reading		(dB/m)		Factor (dB)	Reading	(dBuV/m)	(dBuV/m)	(dB)	(Degs)	Face
		(dBuV)					dB(uVolts/meter)					
1	.24537	41.98	Pk	10.8	.1	-80	-27.12	19.81	39.81	-46.93	0-360	On
2	.58275	35.03	Pk	10.8	.1	-40	5.93	32.29	-	-26.36	0-360	On
3	13.56171	18.52	Pk	10.4	.7	-40	-10.38	29.54	-	-39.92	0-360	On
4	.60805	35.24	Pk	10.8	.2	-40	6.24	31.93	-	-25.69	0-360	Off
5	13.5596	16.5	Pk	10.4	.7	-40	-12.4	29.54	-	-41.94	0-360	Off
6	17.50367	15.01	Pk	10.1	.8	-40	-14.09	29.54	-	-43.63	0-360	Off
7	1.04757	30.37	Pk	11	.2	-40	1.57	27.2	-	-25.63	0-360	Flat
8	13.5596	22.67	Pk	10.4	.7	-40	-6.23	29.54	-	-35.77	0-360	Flat
9	17.36032	20.57	Pk	10.2	.8	-40	-8.43	29.54	-	-37.97	0-360	Flat

Pk - Peak detector

Marker	Frequency	Meter	Det	AT0079	Cbl (dB)	Dist. Corr.	Corrected	Qp/Avg Limit	Pk Limit	Margin	Azimuth	Antenna
	(MHz)	Reading		(dB/m)		Factor (dB)	Reading	(dBuA/m)	(dBuA/m)	(dB)	(Degs)	Face
		(dBuV)					dB(uAmps/meter)					
1	.24537	41.98	Pk	-40.7	.1	-80	-78.62	-31.69	-11.69	-46.93	0-360	On
2	.58275	35.03	Pk	-40.7	.1	-40	-45.57	-19.21	-	-26.36	0-360	On
4	.60805	35.24	Pk	-40.7	.2	-40	-45.26	-19.57	-	-25.69	0-360	On
7	1.04757	30.37	Pk	-40.5	.2	-40	-49.93	-24.3	-	-25.63	0-360	Off
5	13.5596	16.5	Pk	-41.1	.7	-40	-63.9	-21.96	-	-41.94	0-360	Off
8	13.5596	22.67	Pk	-41.1	.7	-40	-57.73	-21.96	-	-35.77	0-360	Off
3	13.56171	18.52	Pk	-41.1	.7	-40	-61.88	-21.96	-	-39.92	0-360	Flat
9	17.36032	20.57	Pk	-41.3	.8	-40	-59.93	-21.96	-	-37.97	0-360	Flat
6	17.50367	15.01	Pk	-41.4	.8	-40	-65.59	-21.96	-	-43.63	0-360	Flat

Pk - Peak detector

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10.4. WORST CASE BELOW 1 GHZ

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)





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Below 1GHz Data

Marker	Frequency	Meter	Det	AT0075 AF	Amp/Cbl (dB)	Corrected	QPk Limit (dBuV/m)	Margin	Azimuth	Height	Polarity
	(MHz)	Reading		(dB/m)		Reading		(dB)	(Degs)	(cm)	
		(dBuV)				(dBuV/m)					
1	* ** 123.7368	35.16	Pk	20.1	-30.3	24.96	43.52	-18.56	0-360	200	Н
2	* ** 156.8103	38.47	Pk	18.7	-30	27.17	43.52	-16.35	0-360	399	Н
6	* ** 112.1313	34.83	Pk	19.1	-30.5	23.43	43.52	-20.09	0-360	101	V
7	* ** 169.9037	37.73	Pk	18	-29.8	25.93	43.52	-17.59	0-360	101	V
3	* ** 243.3056	34.19	Pk	17.7	-29.3	22.59	46.02	-23.43	0-360	101	Н
4	* ** 985.7021	27.04	Pk	29.3	-24.4	31.94	53.97	-22.03	0-360	399	Н
8	* ** 985.5021	27.77	Pk	29.3	-24.4	32.67	53.97	-21.3	0-360	101	V
5	68.6212	50.02	Pk	14.3	-31	33.32	-	-	0-360	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band ** - indicates frequency in Taiwan NCC LP0002 Restricted Band PK – Peak detector

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10.5. WORST CASE 18-26 GHZ

SPURIOUS EMISSIONS 18-26 GHz (WORST-CASE CONFIGURATION)



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UL LLC 12 Laboratory Dr., RTP, NC 27709; USA

TEL:(919) 549-1400

18 – 26GHz DATA

Marker	Frequency	Meter	Det	AT0063 AF	Amp/Cbl	Corrected	Average Limit	Margin	Peak Limit	Margin	Azimuth	Height	Polarity
	(GHz)	Reading		(dB/m)	(dB)	Reading	(dBuV/m)	(dB)	(dBuV/m)	(dB)	(Degs)	(cm)	
		(dBuV)				(dBuV/m)							
1	* ** 21.38035	44.94	Pk	34.6	-39.3	40.24	54	-13.76	74	-33.76	0-360	199	Н
2	* ** 22.03205	43.22	Pk	37	-39.2	41.02	54	-12.98	74	-32.98	0-360	250	Н
3	* ** 23.84076	42.68	Pk	34.9	-38.8	38.78	54	-15.22	74	-35.22	0-360	300	Н
4	* ** 20.30032	44.55	Pk	33.9	-38.8	39.65	54	-14.35	74	-34.35	0-360	300	V
6	* ** 22.55672	44.04	Pk	36.3	-39.3	41.04	54	-12.96	74	-32.96	0-360	250	V
7	* ** 23.96496	43.27	Pk	34.9	-38.7	39.47	54	-14.53	74	-34.53	0-360	201	V
5	21.87905	45.38	Pk	36.8	-39	43.18	-	-	-	-	0-360	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band ** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

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11. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a) RSS-Gen 8.8

Frequency of Emission (MHz)	Conducted Limit (dBuV)			
	Quasi-peak	Average		
0.15-0.5	66 to 56 "	56 to 46 "		
0.5-5	56	46		
5-30	60	50		

* Decreases with the logarithm of the frequency.

RESULTS

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11.1.1. AC Power Line Host



LINE 1 RESULTS

Marker	Frequency	Meter	Det	LISN VCF (dB)	Cbl/Limiter	Corrected	QP Limit	Margin	Average Limit	Margin
	(IVIHZ)	(dBuV)			(ab)	dBuV	(abuv)	(ав)	(abuv)	(ab)
1	.225	11.92	Pk	.1	9.7	21.72	62.63	-40.91	-	-
2	.228	.24	Av	.1	9.7	10.04	-	-	52.52	-42.48
3	1.359	26.92	Pk	0	9.8	36.72	56	-19.28	-	-
4	1.404	-3.87	Av	0	9.8	5.93	-	-	46	-40.07
5	1.503	14.19	Pk	0	9.8	23.99	56	-32.01	-	-
6	1.554	-3.43	Av	0	9.8	6.37	-	-	46	-39.63
7	13.338	23.22	Pk	.1	10	33.32	60	-26.68	-	-
8	13.56	8.3	Av	.1	10	18.4	-	-	50	-31.6
9	22.869	18.9	Pk	.2	10.1	29.2	60	-30.8	-	-
10	23.208	-1.01	Av	.2	10.1	9.29	-	-	50	-40.71

Pk - Peak detector Av - Average detection

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LINE 2 RESULTS



Marker	Frequency (MH ₇)	Meter Reading	Det	LISN VCF (dB)	Cbl/Limiter	Corrected Reading	QP Limit (dBuV)	Margin (dB)	Average Limit	Margin (dB)
	((dBuV)			(02)	dBuV	(ubur)	(0.5)	(ubur)	(42)
11	.351	26.32	Pk	.1	9.7	36.12	58.94	-22.82	-	-
12	.315	11.74	Av	.1	9.8	21.64	-	-	49.84	-28.2
13	1.119	26.93	Pk	0	9.8	36.73	56	-19.27	-	-
14	.942	12.28	Av	0	9.8	22.08	-	-	46	-23.92
15	4.548	26.28	Pk	.1	9.9	36.28	56	-19.72	-	-
16	5.097	9.17	Av	.1	9.9	19.17	-	-	50	-30.83
17	14.58	29.16	Pk	.1	10	39.26	60	-20.74	-	-
18	14.544	10.56	Av	.1	10	20.66	-	-	50	-29.34
19	27.243	21.81	Pk	.2	10.2	32.21	60	-27.79	-	-
20	27.369	4.41	Av	.2	10.2	14.81	-	-	50	-35.19

Pk - Peak detector Av - Average detection

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12. SETUP PHOTOS

Please refer to 13338409-EP1 for setup photos.

END OF TEST REPORT

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