FCC Part 15B TEST REPORT

Report No.: STS2306004E02

Issued for

Paul C. Buff, Inc.

2725 Bransford Ave., Nashville, Tennessee United States 37204

Product Name:	Celestial
Brand:	Paul C Buff
Model Number:	Celestial
Series Model(s):	N/A
FCC ID:	OUECEL500A
Test Standard:	FCC 47 CFR Part 15: Subpart B

Shenzhen STS Test Services Co., Ltd.
A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ,
Fuyong Sub-District, Bao'an District, Shenzhen, Guang Dong, China
TEL: +86-755 3688 6288 FAX: +86-755 3688 6277 E-mail:sts@stsapp.com

TEST RESULT CERTIFICATION

Applicant's Name ..... :	Paul C. Buff, Inc.
Address ..... :	2725 Bransford Ave., Nashville, Tennessee United States 37204
Manufacture's Name..... :	GRE Alpha Electronics Ltd.
Address ..... :	Unit 501, 5/F, No. 16 Science Park West Avenue, Phase 3, Hong Kong Science Park, Shatin, Hong Kong
Product Description ..... :	
Product Name ..... :	Celestial
Brand ..... :	Paul C Buff
Model Number..... :..	Celestial
Series Model(s) ..... :	N/A
Standards..... :	FCC 47 CFR Part 15: Subpart B
Test Procedure……..... :	ANSI C63.4-2014

This device described above has been tested by STS, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test ..... :	
Date of Receipt of Test Item ..... :	01 June 2023
Date of Performance of Tests ..... :	01 June 2023~09 June 2023
Date of Issue ..... :	09 June 2023
Test Result ..... :	**Pass**

Testing Engineer : Stan · Deng

(Star Deng)

Technical Manager : Bulun

(Bulun)

Authorized Signatory : Bovey Yang

(Bovey Yang)

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Revision History

Rev.	Issue Date	Report No.	Effect Page	Contents
00	09 June 2023	STS2306004E02	ALL	Initial Issue

1. SUMMARY OF THE TEST RESULTS

Test procedures according to the technical standards:

EMISSION			
Standard	Item	Result	Remarks
FCC 47 CFR Part 15: Subpart B	Conducted Emission	N/A	Meet Class B limit
	Radiated Emission	PASS	Meet Class B limit

NOTE:

(1) N/A=Not Applicable.

1.1 TEST FACTORY

Company Name:	SHENZHEN STS TEST SERVICES CO.,LTD.
Address:	A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ, Fuyong Sub-District, Bao'an District, Shenzhen, Guang Dong, China
Telephone:	+86-755 3688 6288
Fax:	+86-755 3688 6277
Registration No.:	FCC test Firm Registration Number: 625569
	IC test Firm Registration Number: 12108A
	A2LA Certificate No.: 4338.01

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %。

No.	Item	Uncertainty
1	Conducted Emission (9KHz-150KHz)	±2.14dB
2	Conducted Emission (150KHz-30MHz)	±2.54dB
3	All emissions,radiated(<1G) 30MHz-1000MHz	±3.94dB
4	All emissions,radiated(>1G) 1GHz-6GHz	±4.59dB
5	All emissions,radiated(>1G) 6GHz-18GHz	±5.22dB

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	Celestial
Brand	Paul C Buff
Model Number	Celestial
Series Model(s)	N/A
Model Difference	N/A
Product Description	The EUT is a Celestial. ITE equipment having a primary function of either (or a combination of) entry, storage, display, retrieval, transmission, processing, switching, or control of data and/or telecommunication messages and which may be equipped with one or more ports typically for information transfer.
Frequency Bands	RX: 2427-2457MHz
Modulation Mode	GFSK
Adapter	Input: 100-240VAC 50/60Hz Output: 20.5V, 2.5A
Battery	Rated Voltage: 18V Charge Limit Voltage: 21V Capacity: 45Wh
Hardware Version Number	1.0
Software Version Number	001.001.002

Note: For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

2.2 DESCRIPTION OF THE TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possibly have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description
Mode 1	Lighting mode+SRD
Mode 2	Flash Lighting mode+ SRD

For Radiated Test	
Final Test Mode	Description
Mode 1	Lighting mode+ SRD

Note:

1. For radiated emission test, test mode 1 was the worst case and only this mode was presented in this report.
2. We have be tested for all avaiable U.S. voltage and frequencies (For 120V, 50/60Hz) for which the device is capable of operation.

2.3 DESCRIPTION OF THE TEST SETUP

The EUT has been tested with associated equipment below and the test setup please refer to appendix 1 - test setup.

Necessary accessories

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
N/A	N/A	N/A	N/A	N/A	N/A

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
N/A	N/A	N/A	N/A	N/A	N/A

Note:

(1) For detachable type I/O cable should be specified the length in cm in『Length』column.

(2) “YES” is means “with core”; “NO” is means “without core”.

2.4 EQUIPMENTS LIST FOR ALL TEST ITEMS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
EMI Test Receiver	R&S	ESCI	101427	2022.09.29	2023.09.28
Bi-log Antenna	TESEQ	CBL6111D	45873	2021.10.08	2023.10.07
Horn Antenna	SCHWARZBECK	BBHA 9120D	1343	2022.09.28	2023.09.27
Pre-amplifier(1-26.5G)	Agilent	8449B	3008A02383	2022.07.04	2023.07.03
Pre-amplifier(0.1M-3GHz)	EM	EM330	060665	2022.07.04	2023.07.03
Spectrum Analyzer	Agilent	N9020A	MY49100060	2022.09.28	2023.09.27
RE Cable (9K-1G)	N/A	R01	N/A	2022.09.28	2023.09.27
RE Cable (1-26G)	N/A	R02	N/A	2022.09.28	2023.09.27
Temperature & Humidity	Mieo	HH660	N/A	2022.09.28	2023.09.27
Horn Antenna(18-40G)	A-INFO	LB-180400-KF	J211020657	2022.09.30	2023.09.29
Testing Software	EZ-EMC(Ver.STSLAB-03A1 RE)				

Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
EMI Test Receiver	R&S	ESCI	101427	2022.09.28	2023.09.27
LISN	R&S	ENV216	101242	2022.09.28	2023.09.27
LISN	ETS	3810/2NM	00023625	2022.09.28	2023.09.27
Absorbing Clamp	R&S	MDS-21	100668	2023.02.28	2024.02.27
CE Cable	N/A	C01	N/A	2022.09.28	2023.09.27
Temperature & Humidity	Mieo	HH660	N/A	2022.09.30	2023.09.29
Testing Software	EZ-EMC(Ver.STSLAB-03A1 CE)				

3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

FREQUENCY (MHz)	☐Class A (dBμV)		☐Class B (dBμV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 ~ 0.5	79.00	66.00	66 - 56 *	56 - 46 *
0.5 ~ 5	73.00	60.00	56.00	46.00
5 ~ 30	73.00	60.00	60.00	50.00

Note:

(1) The tighter limit applies at the band edges.

(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

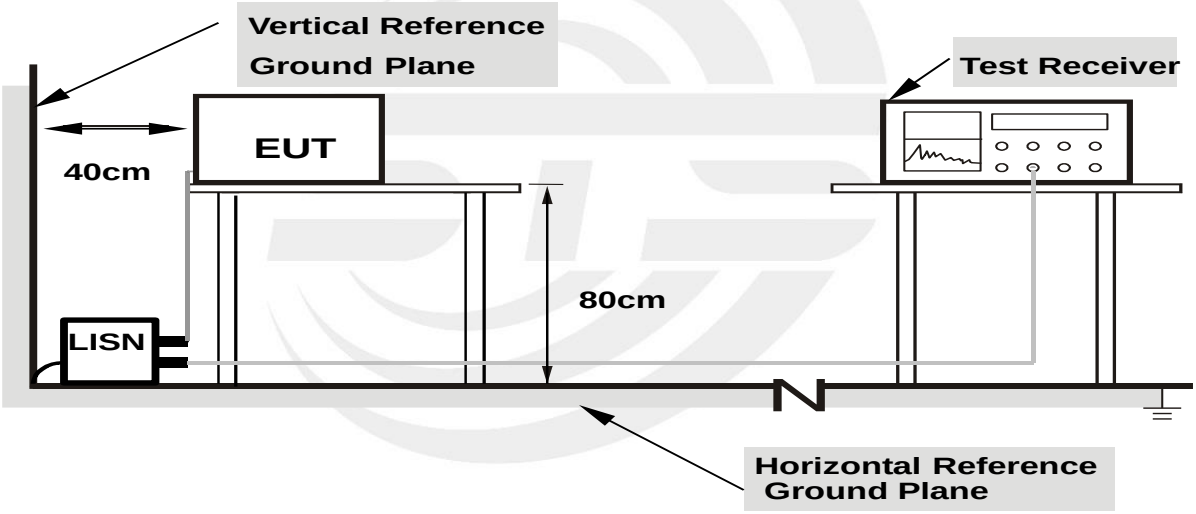
3.1.2 TEST PROCEDURE

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
d. For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.1.3 DEVIATION FROM TEST STANDARD

No deviation

3.1.4 TEST SETUP



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

3.1.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

3.1.6 TEST RESULTS

Temperature:	--℃	Relative Humidity:	--%
Phase:	N/A	Test Mode:	N/A
Test Voltage:	N/A	Test Date:	--

Note: N/A

3.2 RADIATED EMISSION MEASUREMENT

3.2.1 RADIATED EMISSION LIMITS

Below 1 GHz
Measurement Method and Applied Limits:
ANSI C63.4:

Frequency (MHz)	☐Class A		☒Class B
	Field strength (dBuV/m) (at 10m)	Field strength (dBuV/m) (at 3m)	Field strength (dBuV/m) (at 3m)
30 ~ 88	39	49.5	40
88 ~ 216	43.5	54	43.5
216 ~ 960	46.4	56.9	46
Above 960	49.5	60	54

Above 1 GHz
Measurement Method and Applied Limits:
ANSI C63.4:

Frequency (MHz)	☐Class A				☒Class B	
	(dBuV/m) (at 3m)		(dBuV/m) (at 10m)		(dBuV/m) (at 3m)	
	Peak	Average	Peak	Average	Peak	Average
Above 1000	80	60	69.5	49.5	74	54

Frequency Range of Radiated Disturbance Measurement

Highest frequency generated or Upper frequency of measurement used in the device or on which the device operates or tunes (MHz)	Range (MHz)
Below 1.705	30
1.705 ~ 108	1000
108 ~ 500	2000
500 ~ 1000	5000
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower

Note:

(1) The limit for radiated test was performed in the following: FCC PART 15B.

(2) The tighter limit applies at the band edges.

(3) Emission level (dBuV/m) = 20log Emission level (uV/m).

3.2.2 TEST PROCEDURE

a. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
b. EUT as the center to the edge of the auxiliary device, the distance from the maximum edge to the center of the antenna is 3 meter.
c. The height of antenna is varied from 1 meter to 4 meter above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meter and the rotatable table was turned from 0 degrees to 360 degree to find the maximum reading.
e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1GHz.
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

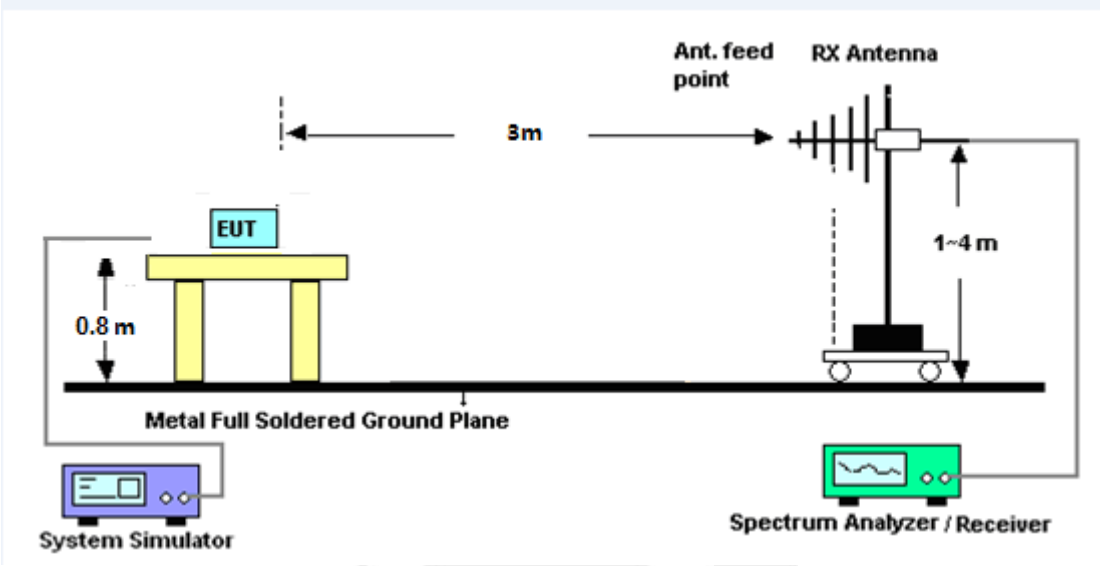
Note: Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

3.2.3 DEVIATION FROM TEST STANDARD

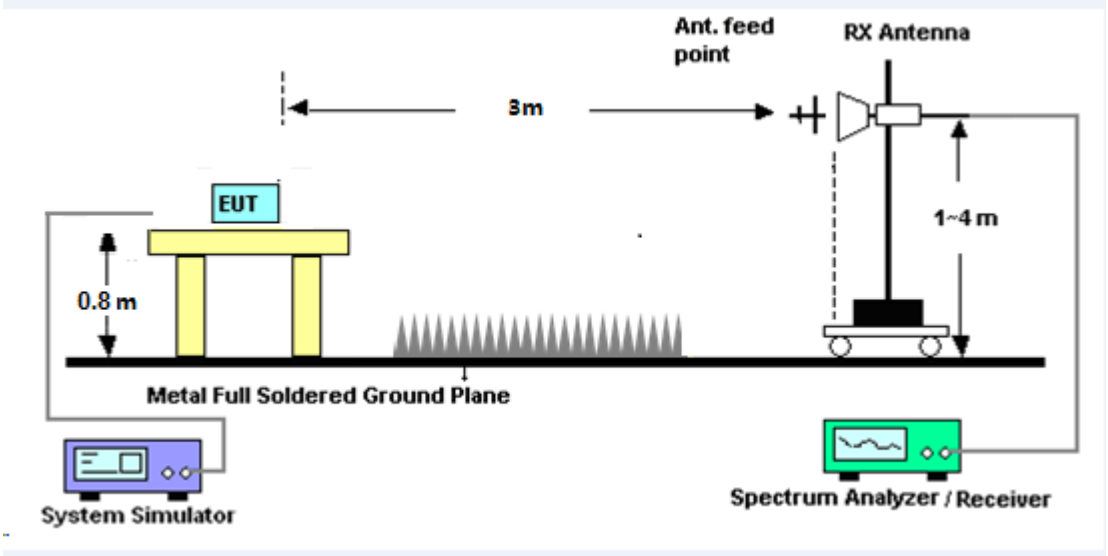
No deviation

3.2.4 TEST SETUP

（A）Radiated Emission Test-Up Frequency Below 1 GHz



（B）Radiated Emission Test-Up Frequency Above 1GHz



3.2.5 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.4 described unless otherwise a special operating condition is specified in the following during the testing.

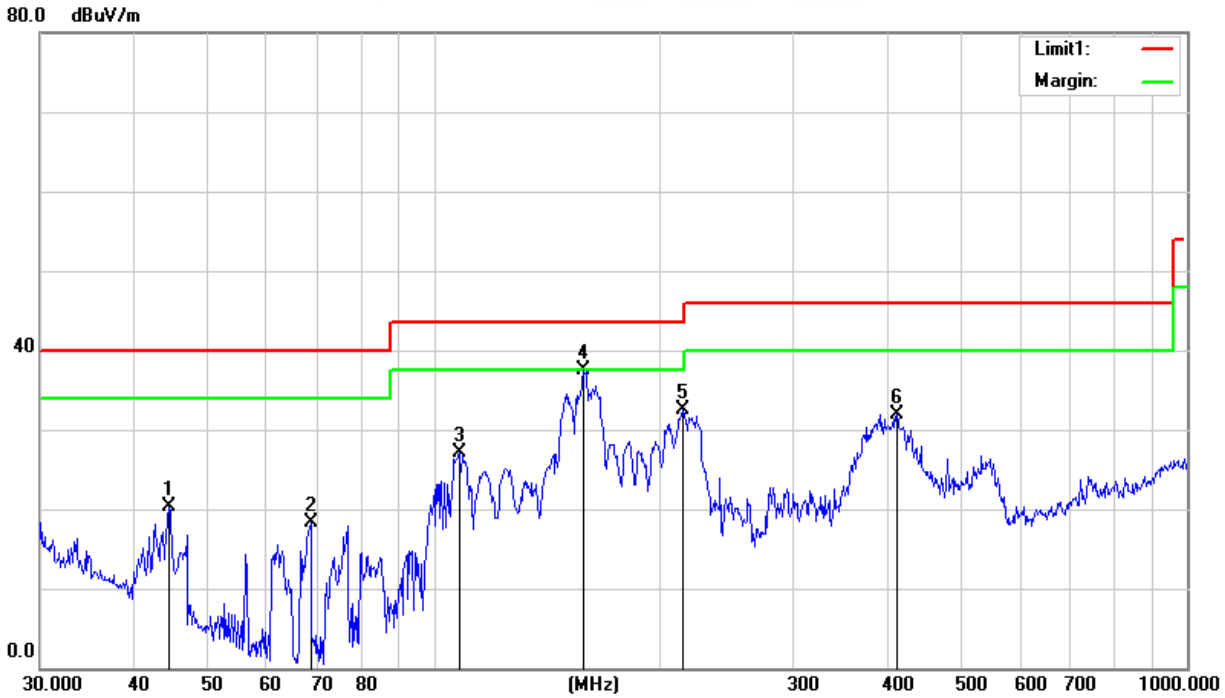
3.2.6 TEST RESULTS

30MHz - 1000MHz

Temperature:	25.3℃	Relative Humidity:	43%
Phase:	Horizontal	Test Mode:	Mode 1
Test Voltage:	DC 18V	Test Date:	2023.06.03

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	44.5867	39.18	-18.92	20.26	40.00	-19.74	QP
2	68.6310	44.30	-26.03	18.27	40.00	-21.73	QP
3	108.2667	46.72	-19.66	27.06	43.50	-16.44	QP
4	158.1123	55.98	-18.56	37.42	43.50	-6.08	QP
5	213.7633	53.38	-20.78	32.60	43.50	-10.90	QP
6	411.8240	44.66	-12.72	31.94	46.00	-14.06	QP

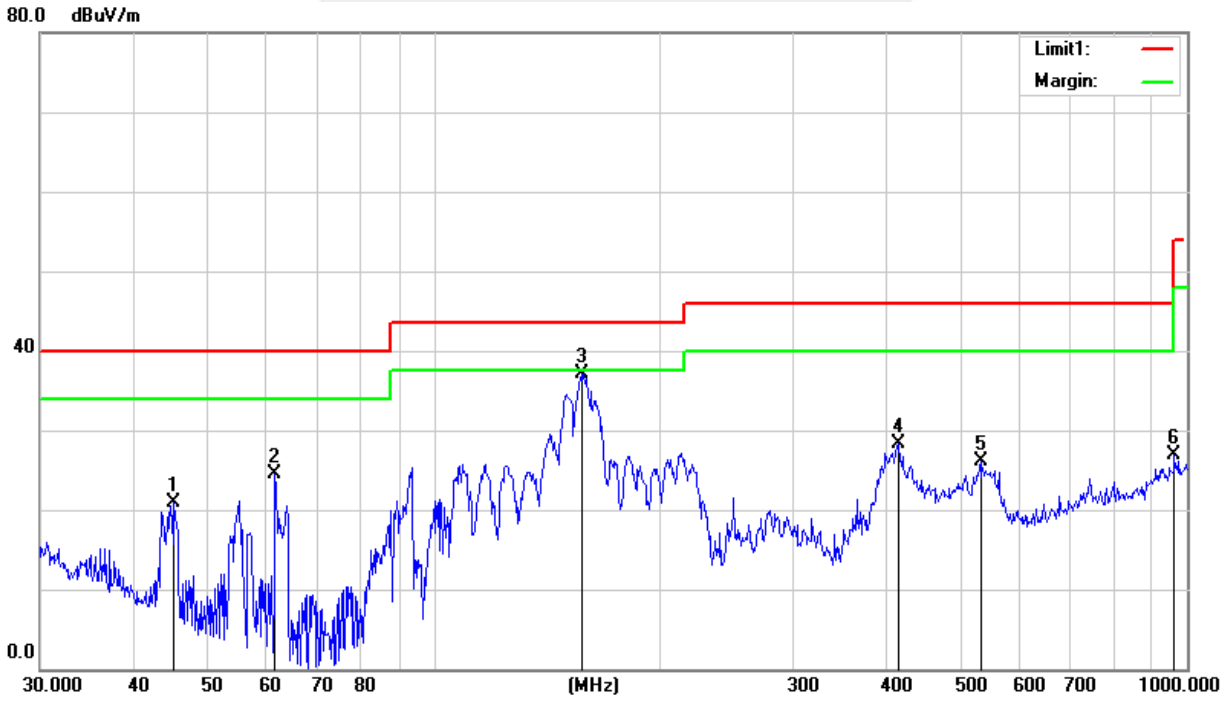
Remark:
1. All readings are Quasi-Peak
2. Margin = Result (Result =Reading + Factor)–Limit
3. Factor= Cable Loss +Antenna Factor-Amplifier Gain



Temperature:	25.3℃	Relative Humidity:	43%
Phase:	Vertical	Test Mode:	Mode 1
Test Voltage:	DC 18V	Test Date:	2023.06.03

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	45.2165	40.08	-19.23	20.85	40.00	-19.15	QP
2	61.5617	50.37	-25.93	24.44	40.00	-15.56	QP
3	157.0072	55.57	-18.49	37.08	43.50	-6.42	QP
4	413.2706	40.97	-12.66	28.31	46.00	-17.69	QP
5	531.9633	35.95	-9.93	26.02	46.00	-19.98	QP
6	962.1621	28.87	-1.92	26.95	54.00	-27.05	QP

Remark:
1. All readings are Quasi-Peak
2. Margin = Result (Result =Reading + Factor)–Limit
3. Factor= Cable Loss +Antenna Factor-Amplifier Gain

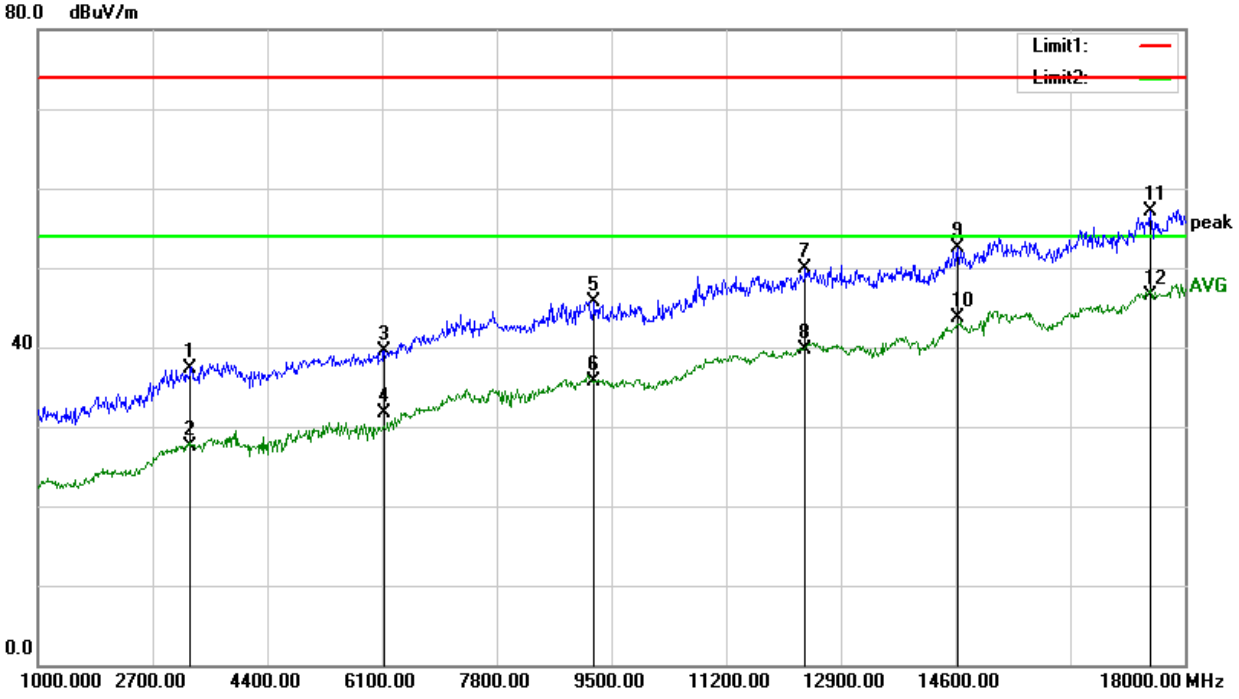


(1 GHz - 18GHz)

Temperature:	25.3℃	Relative Humidity:	43%
Phase:	Horizontal	Test Mode:	Mode 1
Test Voltage:	DC 18V	Test Date:	2023.06.03

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	3261.000	35.11	2.21	37.32	74.00	-36.68	Peak
2	3261.000	25.27	2.21	27.48	54.00	-26.52	AVG
3	6134.000	31.51	8.05	39.56	74.00	-34.44	Peak
4	6134.000	23.70	8.05	31.75	54.00	-22.25	AVG
5	9245.000	31.74	13.97	45.71	74.00	-28.29	Peak
6	9245.000	21.70	13.97	35.67	54.00	-18.33	AVG
7	12381.500	34.59	15.36	49.95	74.00	-24.05	Peak
8	12381.500	24.27	15.36	39.63	54.00	-14.37	AVG
9	14634.000	34.42	18.11	52.53	74.00	-21.47	Peak
10	14634.000	25.68	18.11	43.79	54.00	-10.21	AVG
11	17490.000	35.68	21.41	57.09	74.00	-16.91	Peak
12	17490.000	25.08	21.41	46.49	54.00	-7.51	AVG

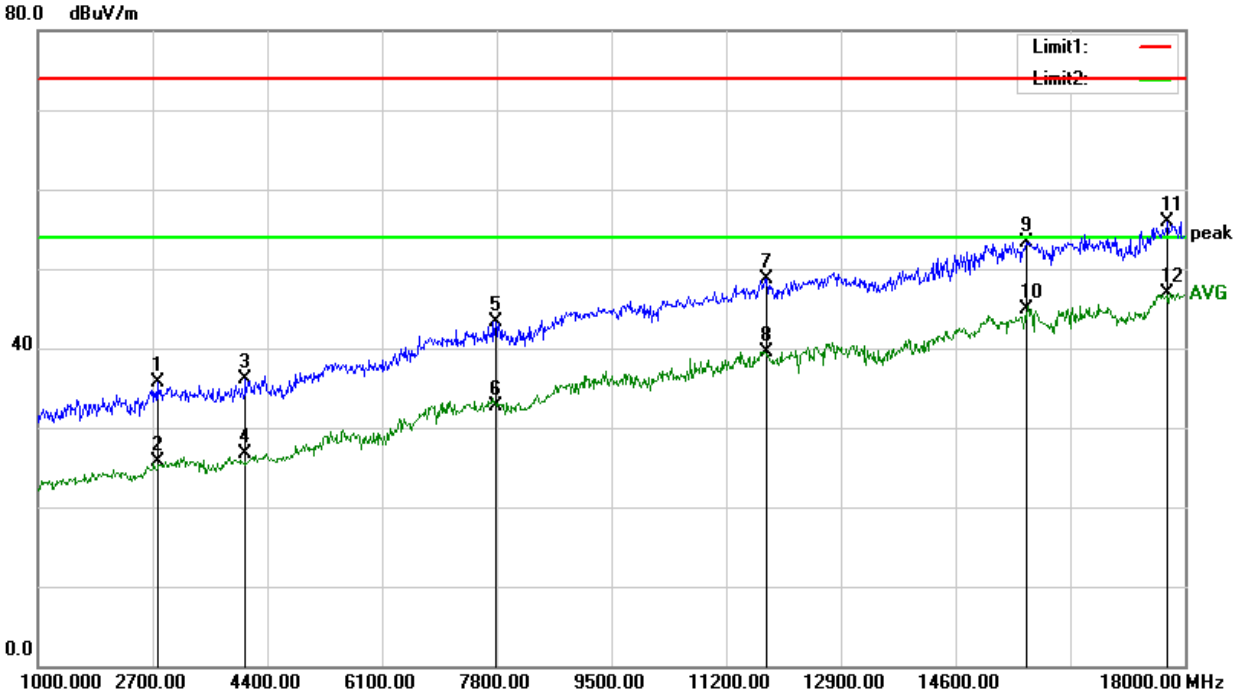
Remark:
1. All readings are Peak and Average values
2. Margin = Result (Result =Reading + Factor)–Limit
3. Factor= Cable Loss +Antenna Factor-Amplifier Gain



Temperature:	25.3℃	Relative Humidity:	43%
Phase:	Vertical	Test Mode:	Mode 1
Test Voltage:	DC 18V	Test Date:	2023.06.03

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	2768.000	34.65	1.05	35.70	74.00	-38.30	Peak
2	2768.000	24.66	1.05	25.71	54.00	-28.29	AVG
3	4077.000	31.66	4.44	36.10	74.00	-37.90	Peak
4	4077.000	22.30	4.44	26.74	54.00	-27.26	AVG
5	7783.000	32.14	11.11	43.25	74.00	-30.75	Peak
6	7783.000	21.55	11.11	32.66	54.00	-21.34	AVG
7	11795.000	34.03	14.63	48.66	74.00	-25.34	Peak
8	11795.000	24.96	14.63	39.59	54.00	-14.41	AVG
9	15662.500	36.35	16.94	53.29	74.00	-20.71	Peak
10	15662.500	28.04	16.94	44.98	54.00	-9.02	AVG
11	17753.500	32.22	23.68	55.90	74.00	-18.10	Peak
12	17753.500	23.21	23.68	46.89	54.00	-7.11	AVG

Remark:
1. All readings are Peak and Average values
2. Margin = Result (Result =Reading + Factor)–Limit
3. Factor= Cable Loss +Antenna Factor-Amplifier Gain



Notes:
1. Measuring frequencies from 1 GHz to 18GHz.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak and average detector mode of the emission shown in Actual FS column.
3. The frequency emission of 18-25GHz is at least 20dB lower than the limit, and the frequency emission mainly comes from environmental noise.

※※※※※END OF THE REPORT※※※※※