

Test Report No:
2370612R-RFNAOTHV02-A

VARIANT TEST REPORT

FCC Rules&Regulations

Product Name	UCS for LS24x
Brand Name	Cardo Systems, LTD
Model No.	UCS
FCC ID	Q95ER30
Applicant's Name / Address	Cardo Systems, LTD 101 E. Park Blvd, Suite 600, Plano TX, 75074 USA
Manufacturer's Name / Address	Cardo Systems, LTD 101 E. Park Blvd, Suite 600, Plano TX, 75074 USA
Test Method Requested, Standard	FCC CFR Title 47 Part 15 Subpart C Section 15.247 ANSI C63.10-2013
Verdict Summary	IN COMPLIANCE
Documented By	 Hailey Peng
Approved By	 Rueyyan Lin
Date of Receipt	Jul. 20, 2023
Date of Issue	Aug. 31, 2023
Report Version	V1.0

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Competences and Guarantees

DEKRA is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, DEKRA has a calibration and maintenance program for its measurement equipment.

DEKRA guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated in the report and it is based on the knowledge and technical facilities available at DEKRA at the time of performance of the test.

DEKRA is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA.

General Conditions

1. The test results relate only to the samples tested.
2. The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.
3. This report must not be used to claim product endorsement by TAF or any agency of the government.
4. The test report shall not be reproduced without the written approval of DEKRA Testing and Certification Co., Ltd.
5. Measurement uncertainties evaluated for each testing system and associated connections are given here to provide the system information for reference. Compliance determinations do not take into account measurement uncertainties for each testing system, but are based on the results of the compliance measurement.

Revision History

Version	Description	Issued Date
V1.0	Initial issue of report	Aug. 31, 2023

Permissive Change

Report No.	Version	Description	Issued Date
22C0561R-RFUSV01S-A	V1.0	Original application.	Feb. 22, 2023
2370612R-RFNAOTHV02-A	V1.0	Change the hardware design of antenna. a. Change the position of the antenna, and the antenna type, gain and pattern of new antenna are same as the original antenna. b. On the bottom side, there is a simple movement between the coax connector and 12 pin connectors. c. Remove one hole from antenna PCB board. 1. After SAR estimation, the power setting has been reduced. 2. After evaluating, it was verified for Transmitter Radiated Spurious Emission for 8DPSK 2480 MHz only, and it is worst result of original test report.	Aug. 31, 2023

Summary of Test Result

Report Clause	Test Items	Result (PASS/FAIL)	Remark
3	Maximum Conducted Output Power	PASS	-
4	Transmitter Radiated Spurious Emission	PASS	-

Comments and Explanations

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Comments and Remarks

The product specification and testing instructions for the EUT declared in the report are provided by the manufacturer who will take all responsibilities for the accuracy.

1. General Information

1.1. EUT Description

Frequency Range	2400 ~ 2483.5 MHz
Operating Frequency	2402 ~ 2480 MHz
Channel Number	79 Channels
Mode	Bluetooth BR / EDR
Type of Modulation	Frequency Hopping Spread Spectrum
Data Rate	Bluetooth BR uses a GFSK (1 Mbps)
	Bluetooth EDR uses a combination of $\pi/4$ -DQPSK (2 Mbps) and 8DPSK (3 Mbps)

Accessories Information				
No.	Equipment Name	Brand Name	Model No.	Description
1	USB to Type C Cable	Hailink	USB 2.0 A/M to Type C cable 28# L=60cm	0.6 meter, shielded cable, w/o ferrite core
2	Speaker	Transound	40mm speakers	speakers with 3.5mm jack
3	Wired Microphone	Transound	Wired Microphone	N/A
4	Boom Microphone	Transound	Boom Microphone	N/A
5	Glue Plate	Cardo	Glue Plate	N/A

Antenna Information				
Ant.	Brand Name	Model No.	Type	Gain (dBi)
0	N/A	N/A	PCB	0

1.2. EUT Information

EUT Power Type	From Host system (DC 5V) / Battery (DC 3.7V)			
EUT Function	☒	Point-to-multipoint	☐	Point-to-point

1.3. Testing Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ 47 CFR FCC Part 15
- ♦ ANSI C63.10-2013

The following reference test guidance is not within the scope of accreditation of TAF:

- ♦ KDB 558074 D01 v05r02
- ♦ KDB 414788 D01 v01r01

1.4. Testing Location Information

Testing Location Information		
Test Laboratory : DEKRA Testing and Certification Co., Ltd.		
1 (TAF: 3024)	ADD: No.372-2, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County 31061, Taiwan, R.O.C. TEL: +886-3-582-8001 FAX: +886-3-582-8958	
2 (TAF: 3024)	ADD: No.372, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County 31061, Taiwan, R.O.C. TEL: +886-3-582-8001 FAX: +886-3-582-8958	
Test site number for address 1 includes HC-SR02. Test site number for address 2 includes HC-CB02, HC-CB03, HC-CB04, HC-SR10 and HC-SR12.		

Test Condition	Test Site No.	Test Engineer	Test Environment (°C / %)	Test Date
RF Conducted Emission	HC-SR12	Clemens Fang	22 / 65	2023/08/24
Radiated Emission	HC-CB04	Ling Chen	24.3 / 60	2023/07/31

1.5. Measurement Uncertainty

Uncertainties have been calculated according to the DEKRA internal document with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)).

Test item	Uncertainty
Maximum Conducted Output Power	± 1.16 dB
Transmitter Radiated Spurious Emission	± 3.52 dB below 1 GHz ± 3.56 dB above 1 GHz

1.6. List of Test Equipment

HC-SR12

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Cal. Date	Next Cal. Date
High Speed Peak Power Meter Dual Input	Anritsu	ML2496A	1602004	0.3-40 GHz	2022/11/02	2023/11/01
Pulse Power Sensor	Anritsu	MA2411B	1531043	0.3-40 GHz	2022/11/02	2023/11/01
EXA Signal Analyzer	Keysight	N9010A	MY51440132	10 Hz-44 GHz	2022/12/13	2023/12/12
Pulse Power Sensor	Anritsu	MA2411B	1531044	0.3-40 GHz	2022/11/02	2023/11/01
Signal and Spectrum Analyzer	R&S	FSV40	101869	10Hz-40GHz	2023/07/03	2024/07/02

HC-CB04

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Cal. Date	Next Cal. Date
Signal and Spectrum Analyzer	R&S	FSVA40	101435	10 Hz-40 GHz	2023/05/29	2024/05/28
Signal Analyzer	R&S	FSVA40	101455	10 Hz-40 GHz	2022/09/29	2023/09/28
EXA Signal Analyzer	Keysight	N9010A	MY51440132	10 Hz-44 GHz	2022/12/13	2023/12/12
Trilog Broadband Antenna	Schwarzbeck	VULB 9168	1209	30 MHz-2 GHz	2023/06/13	2024/06/12
Double Ridged Horn Antenna	RF SPIN	DRH18-E	211212A18EN	1G-18GHz	2022/11/15	2023/11/14
Horn Antenna	Schwarzbeck	BBHA 9170	203	18G-40GHz	2023/02/13	2024/02/12
Pre-Amplifier	EMCI	EMC01820I	980364	30M-8 GHz,20 dB	2023/06/06	2024/06/05
Pre-Amplifier	EMEC	EM01G18GA	060835	1-18 GHz,50 dB	2023/07/24	2024/07/23
Pre-Amplifier	DEKRA	AP-400C	201801231	18G-40 GHz,48 dB	2022/09/27	2023/09/26
EMI Test Receiver	R&S	ESR7	102260	10 Hz-7 GHz	2022/12/01	2023/11/30
Magnetic Loop Antenna	Teseq	HLA 6121	44287	0.01-30 MHz	2022/10/21	2023/10/20
Coaxial Cable(10m)	Suhner	SF102_SF104	HC-CB04	30M-18 GHz	2022/08/08	2023/08/07
Coaxial Cable(3m)	Suhner,Rosnol	SF102_UP0264	HC-CB04_1	18G-40 GHz	2022/08/14	2023/08/13
Radiated Software	AUDIX	e3 V9	HC-CB04_1	N/A	N/A	N/A

Note: All equipment upon which need to calibrated are with calibration period of 1 year.

2. Test Configuration of EUT

2.1. Test Condition

EUT Operational Condition	
Testing Voltage	AC 120V/60Hz

2.2. Test Frequency Mode

Test Software Version	Bluetest3 v3.2.2.144
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Modulation	Frequency (MHz)	Power Setting
GFSK	2402	3
	2441	3
	2480	3
8-DPSK	2402	3
	2441	3
	2480	3

2.3. The Worst Case Measurement Configuration

Tests Item	Maximum Conducted Output Power
Test Condition	Conducted measurement at transmit chains

Tests Item	Transmitter Radiated Spurious Emission
Test Condition	Radiated measurement If EUT consist of multiple antenna assembly (multiple antenna are used in EUT regardless of spatial multiplexing MIMO configuration), the radiated test should be performed with highest antenna gain of each antenna type.
Operating Mode < 1GHz	Transmit
Operating Mode > 1GHz	Transmit
The EUT was performed at X axis, Y axis and Z axis position for transmitter radiated spurious emission test. The worst case was found at X axis, so the measurement will follow this same test configuration.	

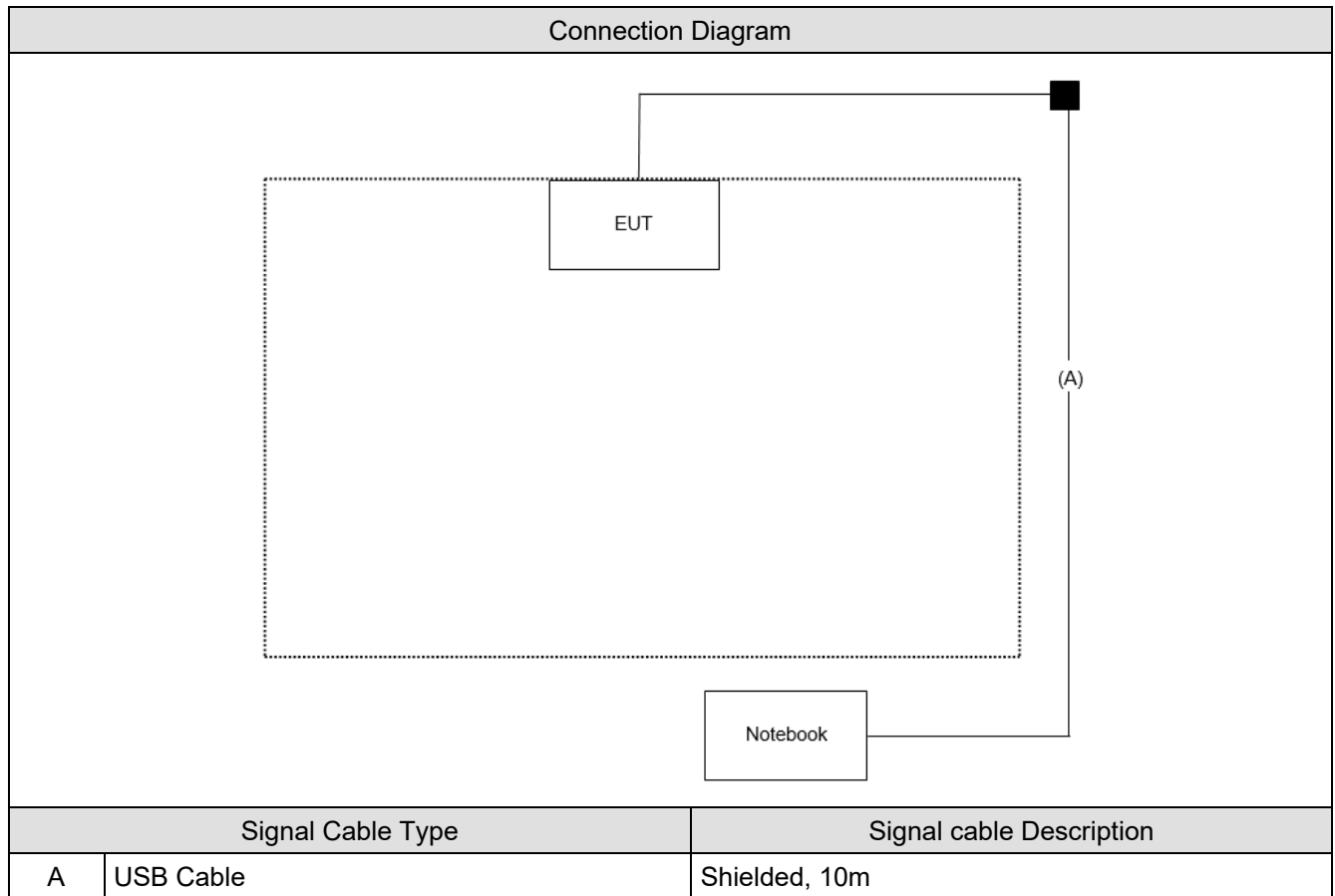
Note:

Determining compliance shall be based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.4. Tested System Details

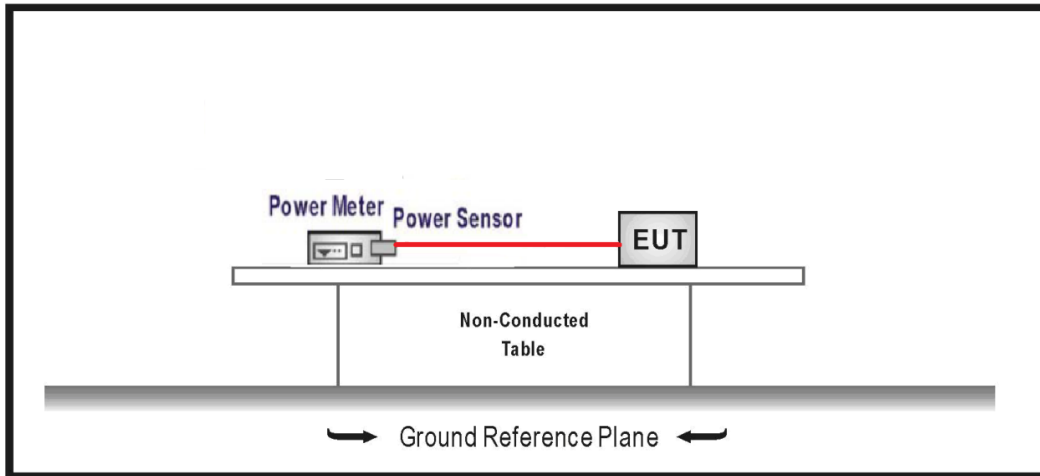
No.	Equipment	Brand Name	Model No.	Serial No.
1	Notebook	HP	HSTNN-I33C-4	N/A

2.5. Configuration of Tested System



3. Maximum Conducted Output Power

3.1. Test Setup



3.2. Test Limit

For frequency hopping systems operating in the 902 ~ 928 MHz band:

1. Number of Hopping Frequencies ≥ 50 : 1 watt (30dBm)
2. $50 >$ Number of Hopping Frequencies ≥ 25 : 0.25 watt (23.98dBm)

For frequency hopping systems operating in the 2400 ~ 2483.5 MHz band:

1. Number of Hopping Frequencies ≥ 75 : 1 watt (30dBm)
2. $75 >$ Number of Hopping Frequencies ≥ 15 : 0.125 watts (20.97dBm)

For frequency hopping systems operating in the 5725 ~ 5850 MHz band:

Number of Hopping Frequencies ≥ 75 : 1 watt (30dBm)

3.3. Test Procedures

The EUT was setup according to ANSI C63.10: 2013 and tested according to FHSS test procedure of KDB 558074.

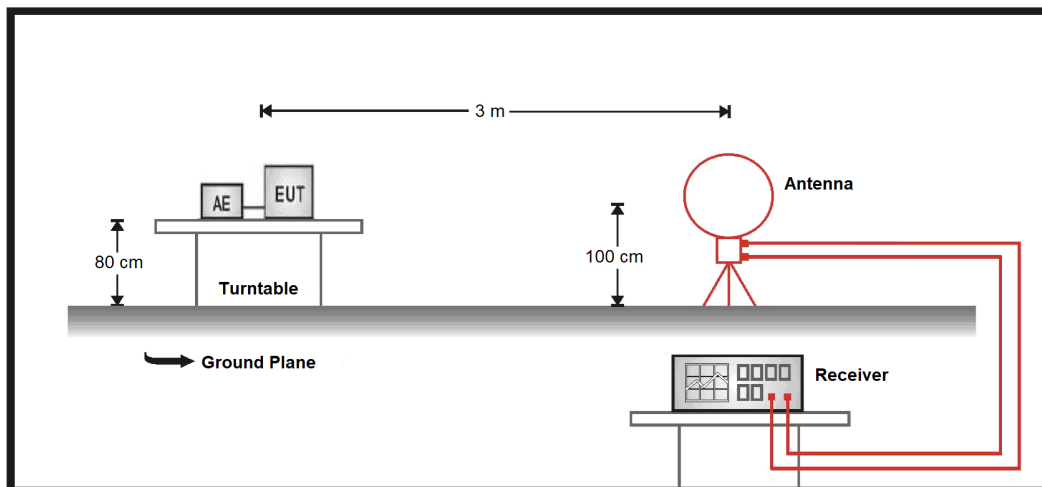
3.4. Test Result of Maximum Conducted Output Power

Refer as Appendix A

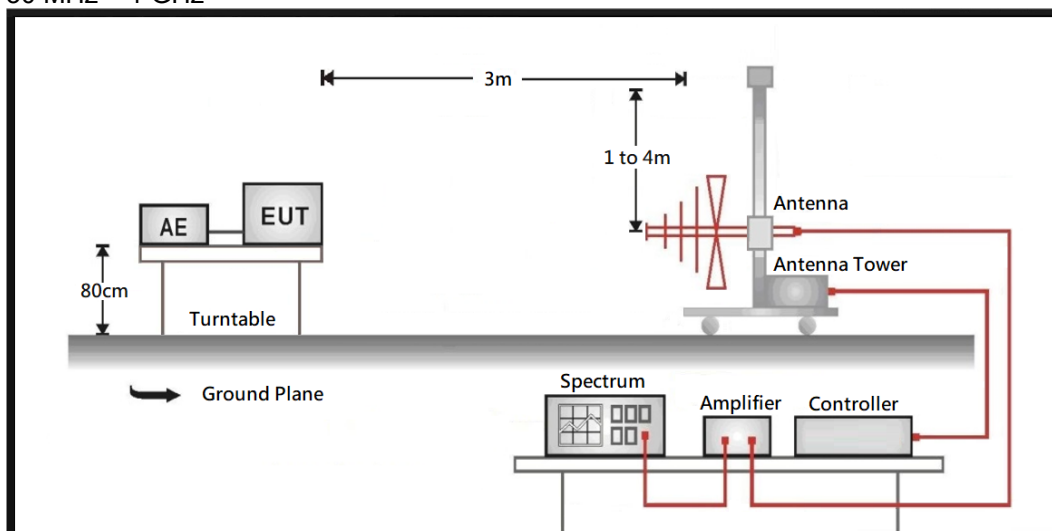
4. Transmitter Radiated Spurious Emission

4.1. Test Setup

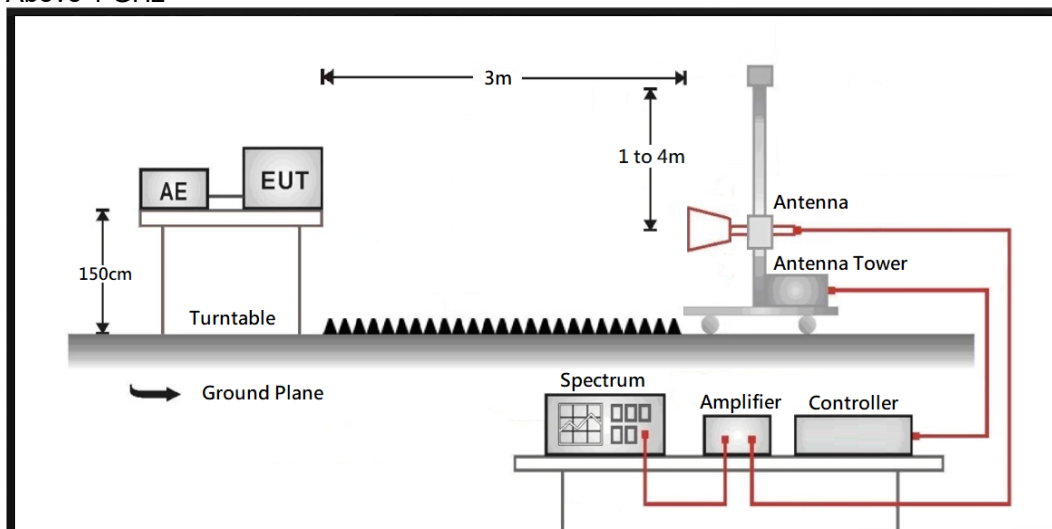
9 kHz ~ 30 MHz



30 MHz ~ 1 GHz



Above 1 GHz



4.2. Test Limit

Frequency (MHz)	Field strength (uV/m)	Field strength (dBuV/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	20 log (2400/F(kHz))	300
0.490 – 1.705	24000/F(kHz)	20 log (24000/F(kHz))	30
1.705 - 30	30	29.5	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

Remarks:

1. Field strength (dBuV/m) = 20 log Field strength (uV/m)
2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

4.3. Test Procedure

The EUT was setup according to ANSI C63.10: 2013 and tested according to FHSS test procedure of KDB 558074.

The EUT and its simulators are placed on a turn table which is 0.8 or 1.5 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level. Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10: 2013 on radiated measurement.

On any frequency or frequencies from 9 kHz(include The the lowest oscillator frequency generated within the device up to the 10th harmonic) to 1000 MHz, the limit shown are based on measuring equipment employing a quasi-peak detector function and on any frequency or frequencies above 1000 MHz the radiated limit shown are based upon the use of measurement instrumentation employing an average detector function. When average radiated emission measurement are included emission measurement below 1000 MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.

The bandwidth below 1 GHz setting on the field strength meter is 120 kHz and above 1 GHz is 1 MHz.

4.4. Test Result of Transmitter Radiated Spurious Emission

Refer as Appendix B

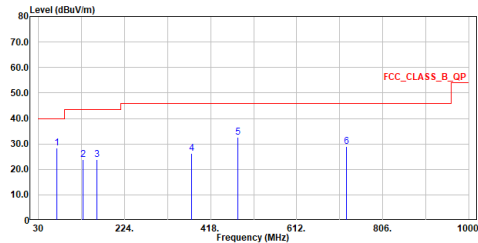
Appendix A. Test Result of Maximum Conducted Output Power

Modulation	Frequency (MHz)	Maximum Conducted Peak Output Power (dBm)	Limit (dBm)	Result
GFSK	2402	17.31	20.97	Pass
	2441	17.78	20.97	Pass
	2480	18.13	20.97	Pass
8-DPSK	2402	20.13	20.97	Pass
	2441	20.42	20.97	Pass
	2480	20.65	20.97	Pass

Appendix B. Test Result of Transmitter Radiated Spurious Emission

30 MHz ~ 1 GHz

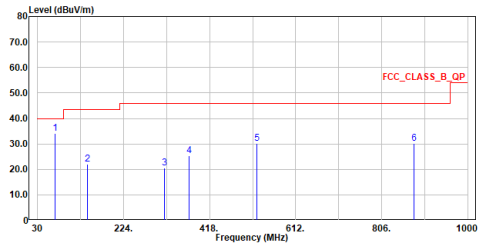
Site :HC-CB04
Condition :3m Horizontal
Mode :LF_DPSK_TX_2480MHz
Test By :Ling



No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBuV/m	Line	Limit	Level	dB	
1	71.565	28.46	40.00	-11.54	33.58	-5.12	Peak
2	129.716	23.77	43.50	-19.73	28.34	-4.57	Peak
3	161.969	23.74	43.50	-19.76	27.03	-3.29	Peak
4	375.999	26.16	46.00	-19.84	27.16	-1.00	Peak
5	479.983	32.50	46.00	-13.50	30.93	1.57	Peak
6	723.987	29.05	46.00	-16.95	22.99	6.06	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Cable Loss - Preamp Factor
3. Over Limit = Level - Limit Line
4. The emission under 30MHz was not included since the emission levels are very low against the limit.
5. The other emission levels were very low against the limit.

Site :HC-CB04
Condition :3m Vertical
Mode :LF_DPSK_TX_2480MHz
Test By :Ling

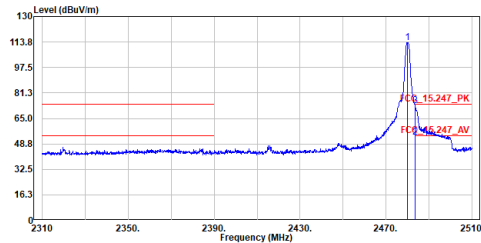


No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBuV/m	Line	Limit	Level	dB	
1	68.994	34.05	40.00	-5.95	38.48	-4.43	Peak
2	141.938	22.01	43.50	-21.49	25.83	-3.82	Peak
3	315.956	20.56	46.00	-25.44	23.05	-2.49	Peak
4	372.022	25.35	46.00	-20.65	26.45	-1.10	Peak
5	523.973	30.11	46.00	-15.89	27.62	2.49	Peak
6	879.381	30.18	46.00	-15.82	22.31	7.87	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Cable Loss - Preamp Factor
3. Over Limit = Level - Limit Line
4. The emission under 30MHz was not included since the emission levels are very low against the limit.
5. The other emission levels were very low against the limit.

Above 1 GHz

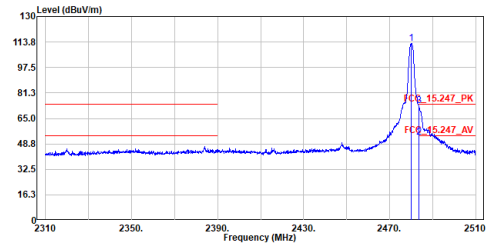
Site :HC-CB04
Condition :3m ,Horizontal
Mode :DPSK_TX_2480MHz
Test By :Ling



No.	Frequency MHz	Level dBuV/m	Limit dBuV/m	Over Limit dB	Read Level dBuV	Factor dB	Remark
1	2479.900	113.41	-----	-----	102.44	10.97	Peak
2	2483.500	53.12	54.00	-0.88	42.14	10.98	Average
3	2483.500	73.12	74.00	-0.88	62.14	10.98	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Cable Loss - Preamp Factor
3. Over Limit = Level - Limit Line
4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
5. The other emission levels were very low against the limit.

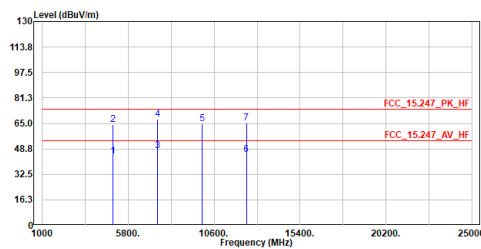
Site :HC-CB04
Condition :3m ,Vertical
Mode :DPSK_TX_2480MHz
Test By :Ling



No.	Frequency MHz	Level dBuV/m	Limit dBuV/m	Over Limit dB	Read Level dBuV	Factor dB	Remark
1	2480.100	112.64	-----	-----	101.67	10.97	Peak
2	2483.500	53.03	54.00	-0.97	42.05	10.98	Average
3	2483.500	73.03	74.00	-0.97	62.05	10.98	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Cable Loss - Preamp Factor
3. Over Limit = Level - Limit Line
4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
5. The other emission levels were very low against the limit.

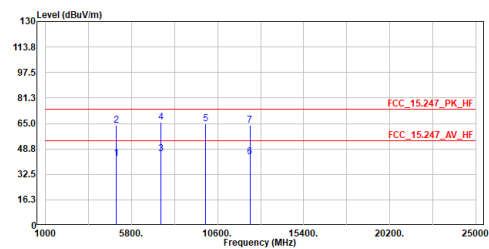
Site :HC-CB04
Condition :3m ,Horizontal
Mode :DPSK_TX_2480MHz
Test By :Ling



No.	Frequency MHz	Level dBuV/m	Limit dBuV/m	Over Limit dB	Read Level dBuV	Factor dB	Remark
1	4960.000	44.11	54.00	-9.89	59.32	-15.21	Average
2	4960.000	64.11	74.00	-9.89	79.32	-15.21	Peak
3	7440.000	47.49	54.00	-6.51	56.65	-9.16	Average
4	7440.000	67.49	74.00	-6.51	76.65	-9.16	Peak
5	9920.000	64.91	74.00	-9.09	70.96	-6.05	Peak
6	12400.000	45.15	54.00	-8.85	47.25	-2.10	Average
7	12400.000	65.15	74.00	-8.85	67.25	-2.10	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Cable Loss - Preamp Factor
3. Over Limit = Level - Limit Line
4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
5. The other emission levels were very low against the limit.

Site :HC-CB04
Condition :3m ,Vertical
Mode :DPSK_TX_2480MHz
Test By :Ling



No.	Frequency MHz	Level dBuV/m	Limit dBuV/m	Over Limit dB	Read Level dBuV	Factor dB	Remark
1	4960.000	42.66	54.00	-11.34	57.87	-15.21	Average
2	4960.000	63.66	74.00	-10.34	78.87	-15.21	Peak
3	7440.000	45.76	54.00	-8.24	54.92	-9.16	Average
4	7440.000	65.76	74.00	-8.24	74.92	-9.16	Peak
5	9920.000	64.94	74.00	-9.06	70.99	-6.05	Peak
6	12400.000	43.62	54.00	-10.38	45.72	-2.10	Average
7	12400.000	63.62	74.00	-10.38	65.72	-2.10	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Cable Loss - Preamp Factor
3. Over Limit = Level - Limit Line
4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
5. The other emission levels were very low against the limit.