

MEASUREMENT REPORT

FCC ID: 2BCCIORBC1A
Application: Senquip Pty Ltd
Product: Senquip ORB
Model No.: ORB-C1
Brand Name: Senquip ORB
FCC Rule Part(s): Part 2, 22 (H), 24 (E), 27, 90 (S)
Result: Complies
Received Date: 2023-05-24
Test Date: 2023-06-10 ~ 2023-07-24

Reviewed By:

Sunny Sun

Approved By:

Robin Wu



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.26-2015. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
2305RSU054-U1	Rev. 01	Initial Report	2023-09-12	Valid

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1.4. Product Information

Product Name	Senquip ORB
Model No.	ORB-C1
Brand Name	Senquip ORB
IMEI	866233056081821
Cat M1 Band	Band 2/4/5/12/13/26
Operating Temperature	-40 ~ 85°C
Power Type	External supply: 10 ~ 75Vdc, typical 12Vdc; 4 x AA Long-life lithium; Internal rechargeable backup battery: 3.7V, 1800mAh LiPo.
Integrated Modular Information	
Cellular Modular Information	Model Number: BG96 FCC ID: XMR201709BG96
Remark:	
<ol style="list-style-type: none"> The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer. This device is based on the certification modular to assess the radiated spurious emission. 	

1.5. Radio Specification Under Testing

E-UTRA Specification	
Cat M1 Band	Band 2, 4, 5, 12, 13, 26
TX Frequency Range	Band 2: 1850 ~ 1910 MHz; Band 4: 1710 ~ 1755 MHz Band 5: 824 ~ 849 MHz; Band 12: 699 ~ 716 MHz Band 13: 777 ~ 787 MHz; Band 26: 814 ~ 849 MHz;
RX Frequency Range	Band 2: 1930 ~ 1990 MHz; Band 4: 2110 ~ 2155 MHz Band 5: 869 ~ 894 MHz; Band 12: 729 ~ 746 MHz Band 13: 746 ~ 756 MHz; Band 26: 859 ~ 894 MHz
Modulation	UL&DL up to 16QAM
Power Class	3

1.6. Description of Available Antennas

Technology	Frequency Range (MHz)	Antenna Type	MaxPeak Gain (dBi)
Cat M1 Band 2	1850 ~ 1910	SMD	2.5
Cat M1 Band 4	1710 ~ 1755		2.5
Cat M1 Band 5	824 ~ 849		1.0
Cat M1 Band 12	699 ~ 716		0.5
Cat M1 Band 13	777 ~ 787		0.5
Cat M1 Band 26	814~849		1.0

Note 1: All antenna information (Antenna type and Peak Gain) is provided by the manufacturer.

1.7. EIRP

Technology	Frequency Band (MHz)	Max Conducted Power (dBm)	Antenna Gain (dBi)	Max EIRP (dBm)	Limit (dBm)
Cat M1 Band 2	1850 ~ 1910	23.80	2.5	26.30	33
		23.93		26.43	
Cat M1 Band 4	1710 ~ 1780	22.43	2.5	24.93	30
		22.38		24.88	
Cat M1 Band 5	824 ~ 849	23.46	1.0	22.31	38.45
		23.84		22.69	
Cat M1 Band 12	699 ~ 716	23.40	0.5	21.75	34.77
		23.67		22.02	
Cat M1 Band 13	777 ~ 787	23.40	0.5	21.75	34.77
		23.91		22.26	
Cat M1 Band 26	814~849	23.14	1.0	21.99	38.45
		23.78		22.63	

Remark: The Max conducted power extracted from the FCC certificate from FCC ID "XMR201707BG96".

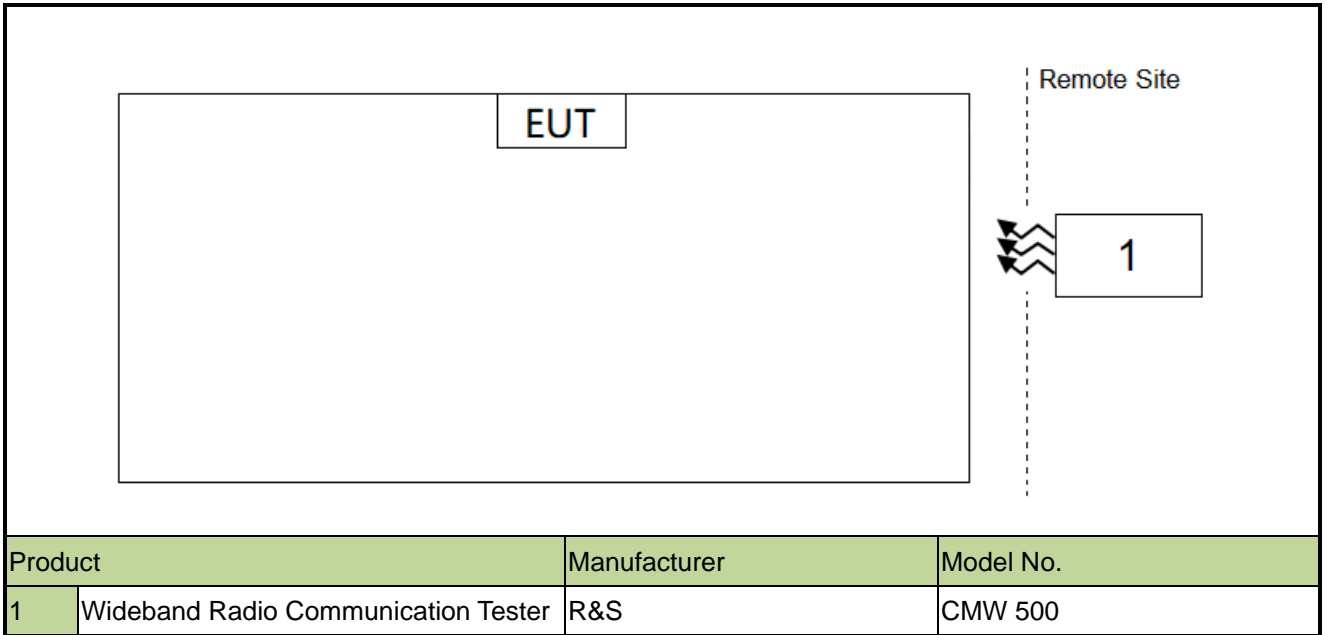
1.8. Test Methodology

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

- ANSI C63.26:2015
- FCC CFR 47 Part 2, Part 22, Part 24, Part 27, Part 90
- FCC KDB 971168 D01 v03r01: Power Meas License Digital Systems

2. Test Configuration

2.1. Test System Connection Diagram



2.2. Test Environment Condition

Ambient Temperature	15 ~ 35°C
Relative Humidity	20% ~ 75%RH

3. Measuring Instrument

Instrument Name	Manufacturer	Model No.	Asset No.	Cali. Interval	Cal. Due Date	Test Site
EMI Test Receiver	R&S	ESR3	MRTSUE06185	1 year	2023-12-28	SIP-AC1
Anechoic Chamber	RIKEN	SIP-AC1	MRTSUE06554	1 year	2023-12-22	SIP-AC1
Signal Analyzer	Keysight	N9010B	MRTSUE06559	1 year	2024-05-23	SIP-AC1
Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06599	1 year	2023-10-13	SIP-AC1
Preamplifier	EMCI	EMC051845SE	MRTSUE06600	1 year	2023-11-07	SIP-AC1
Preamplifier	EMCI	EMC184045SE	MRTSUE06602	1 year	2023-10-10	SIP-AC1
Signal Analyzer	Keysight	N9010B	MRTSUE06603	1 year	2023-10-25	SIP-AC1
Signal Analyzer	Keysight	N9020B	MRTSUE06604	1 year	2023-11-07	SIP-AC1
Horn Antenna	R&S	HF907	MRTSUE06610	1 year	2024-06-17	SIP-AC1
EMI Test Receiver	R&S	ESR3	MRTSUE06613	1 year	2024-05-23	SIP-AC1
Thermohygrometer	testo	608-H1	MRTSUE06616	1 year	2023-11-01	SIP-AC1
Thermohygrometer	testo	608-H1	MRTSUE06620	1 year	2023-11-27	SIP-AC1
Preamplifier	EMCI	EMC001330	MRTSUE06643	1 year	2024-01-12	SIP-AC1

Software	Version	Function
EMI V3	V 3.0.0	EMI Test Software
Controller_MF 7802BS	1.02	RE Antenna & Turntable

4. Decision Rules and Measurement Uncertainty

4.1. 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.)

4.2. Measurement Uncertainty

Where relevant, the following test 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 $k = 2$.

Radiated Spurious Emissions

Measurement Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$):

Horizontal: 9kHz ~ 300MHz: 5.04dB

300MHz ~ 1GHz: 4.95dB

1GHz ~ 40GHz: 6.40dB

Vertical: 9kHz ~ 300MHz: 5.24dB

300MHz ~ 1GHz: 6.03dB

1GHz ~ 40GHz: 6.40dB

5. Test Result

5.1. Summary

FCC Part Section(s)	Test Description	Test Condition	Test Result
2.1053, 22.917(a), 24.238(a), 27.53(c) (f) (g) (h), 90.691(a)	Spurious Emissions	Radiated	Pass

Notes:

- 1) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
- 2) All supported modulation types were evaluated. The worst-case emission of modulation was selected. Therefore, the Radiated Spurious Emission were presented the worst-case in the test report.
- 3) For radiated emission tests, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst-case emissions.
- 4) Band 26 (814 ~ 849 MHz) overlaps the entire frequency range of LTE Band 5 (824 ~ 849 MHz). Therefore, test data provided in this report covers Band 5 as well as Band 26.

5.2. Radiated Spurious Emissions Measurement

5.2.1. Test Limit

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB. The emission limit equal to -13dBm.

For LTE Band 13, For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz (-40dBm/MHz) equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW (-50dBm) EIRP for discrete emissions of less than 700 Hz bandwidth.

E (dB μ V/m) = EIRP (dBm) - 20 log D + 104.8; where D is the measurement distance in meters. The emission limit equal to 82.3dB μ V/m or 55.3 dB μ V/m.

5.2.2. Test Procedure

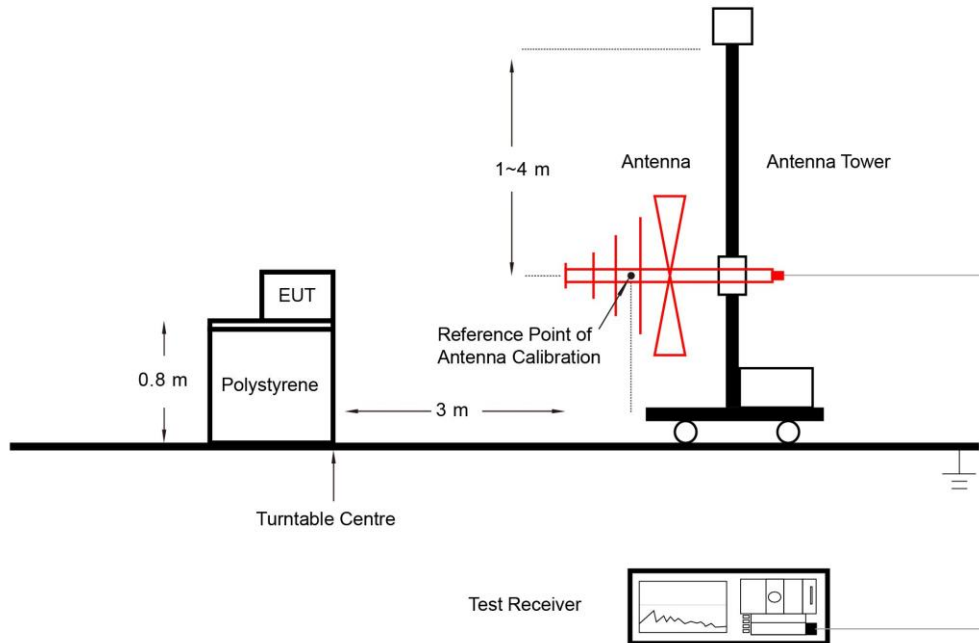
ANSI C63.26-2015 - Section 5.2.7 & 5.5

5.2.3. Test Setting

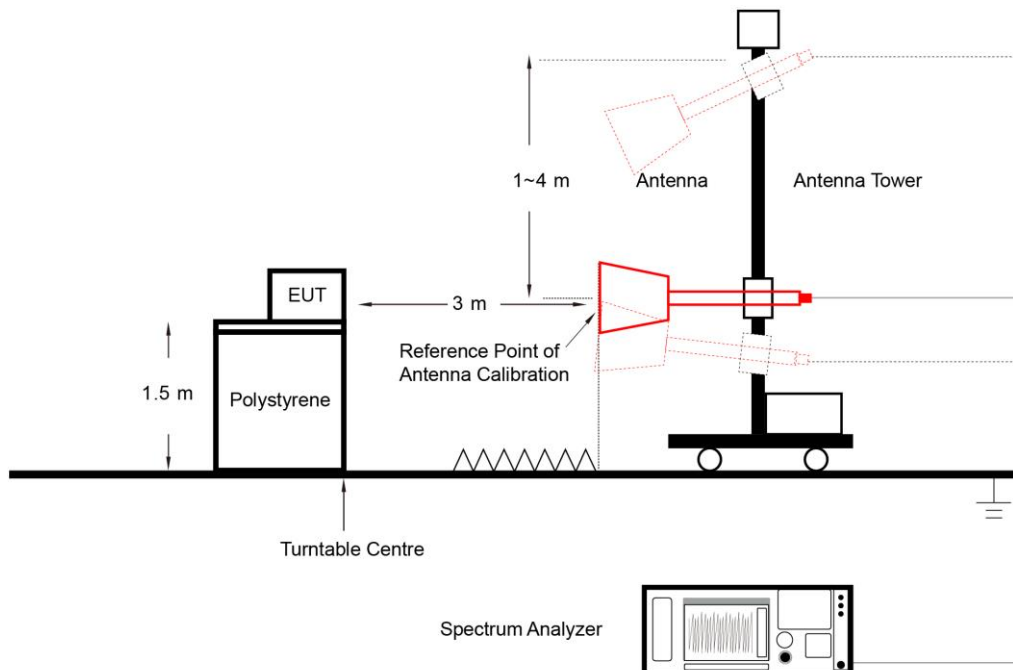
1. RBW = 1MHz
2. VBW \geq 3*RBW
3. Sweep time \geq 10 \times (number of points in sweep) \times (transmission symbol period)
4. Detector = Peak
5. Trace mode = max hold
6. The trace was allowed to stabilize

5.2.4. Test Setup

Below 1GHz Test Setup:



Above 1GHz Test Setup:



5.2.5. Test Result

Refer to Appendix A.1.

Appendix A - Test Result

A.1 Radiated Spurious Emissions Test Result

Test Site	SIP-AC1	Test Engineer	Barry Wu
Test Date	2023-06-10 ~ 2022-06-26	Test Band	Cat M1 Band 2, 1RB, QPSK

Frequency (MHz)	Reading Level (dB μ V)	Factor (dB/m)	Measure Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Detector	Polarization
Low Channel							
119.7	24.8	15.6	40.4	82.3	-41.9	Peak	Horizontal
827.3	11.1	28.5	39.6	82.3	-42.7	Peak	Horizontal
36.3	28.4	17.0	45.4	82.3	-36.9	Peak	Vertical
119.7	25.5	15.6	41.1	82.3	-41.2	Peak	Vertical
3703.0	86.0	-12.4	73.6	82.3	-8.7	Peak	Horizontal
7349.5	75.2	-6.9	68.3	82.3	-14.0	Peak	Horizontal
3703.0	80.0	-12.4	67.6	82.3	-14.7	Peak	Vertical
5556.0	72.1	-9.3	62.8	82.3	-19.5	Peak	Vertical

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Test Site	SIP-AC1	Test Engineer	Barry Wu
Test Date	2023-06-10 ~ 2022-06-26	Test Band	Cat M1 Band 4, 1RB, QPSK

Frequency (MHz)	Reading Level (dBμV)	Factor (dB/m)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
Low Channel							
59.6	21.7	17.5	39.2	82.3	-43.1	Peak	Horizontal
119.7	24.0	15.6	39.6	82.3	-42.7	Peak	Horizontal
35.8	26.6	17.0	43.6	82.3	-38.7	Peak	Vertical
59.6	23.4	17.5	40.9	82.3	-41.4	Peak	Vertical
3422.5	85.7	-12.8	72.9	82.3	-9.4	Peak	Horizontal
5131.0	81.7	-10.2	71.5	82.3	-10.8	Peak	Horizontal
3422.5	84.6	-12.8	71.8	82.3	-10.5	Peak	Vertical
6839.5	76.8	-7.6	69.2	82.3	-13.1	Peak	Vertical

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Test Site	SIP-AC1	Test Engineer	Barry Wu
Test Date	2023-06-10 ~ 2022-06-26	Test Band	Cat M1 Band 5/26, 1RB, QPSK

Frequency (MHz)	Reading Level (dB μ V)	Factor (dB/m)	Measure Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Detector	Polarization
Low Channel							
59.6	22.2	17.5	39.7	82.3	-42.6	Peak	Horizontal
989.8	17.9	30.3	48.2	82.3	-34.1	Peak	Horizontal
33.9	26.7	16.9	43.6	82.3	-38.7	Peak	Vertical
989.8	18.5	30.3	48.8	82.3	-33.5	Peak	Vertical
1648.0	93.1	-19.7	73.4	82.3	-8.9	Peak	Horizontal
2472.0	94.2	-16.3	77.9	82.3	-4.4	Peak	Horizontal
2472.0	91.7	-16.3	75.4	82.3	-6.9	Peak	Vertical
4120.0	82.4	-10.9	71.5	82.3	-10.8	Peak	Vertical

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Test Site	SIP-AC1	Test Engineer	Barry Wu
Test Date	2023-06-10 ~ 2022-06-26	Test Band	Cat M1 Band 12, 1RB, QPSK

Frequency (MHz)	Reading Level (dB μ V)	Factor (dB/m)	Measure Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Detector	Polarization
Low Channel							
59.6	22.7	17.5	40.2	82.3	-42.1	Peak	Horizontal
119.7	24.1	15.6	39.7	82.3	-42.6	Peak	Horizontal
35.8	27.3	17.0	44.3	82.3	-38.0	Peak	Vertical
119.7	26.0	15.6	41.6	82.3	-40.7	Peak	Vertical
2096.0	93.2	-17.8	75.4	82.3	-6.9	Peak	Horizontal
4196.0	78.3	-10.9	67.4	82.3	-14.9	Peak	Horizontal
2096.0	92.3	-17.8	74.5	82.3	-7.8	Peak	Vertical
4196.0	77.5	-10.9	66.6	82.3	-15.7	Peak	Vertical

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Test Site	SIP-AC1	Test Engineer	Barry Wu
Test Date	2023-06-10 ~ 2022-06-26	Test Band	Cat M1 Band 13, 1RB, QPSK

Frequency (MHz)	Reading Level (dB μ V)	Factor (dB/m)	Measure Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Detector	Polarization
Middle Channel							
59.6	22.5	17.5	40.0	82.3	-42.3	Peak	Horizontal
119.7	24.2	15.6	39.8	82.3	-42.5	Peak	Horizontal
33.4	28.1	17.0	45.1	82.3	-37.2	Peak	Vertical
59.6	23.8	17.5	41.3	82.3	-41.0	Peak	Vertical
1560.0	62.2	-16.1	46.1	55.2	-9.1	Peak	Horizontal
2340.0	87.5	-13.8	73.7	82.2	-8.5	Peak	Horizontal
1560.0	66.0	-16.1	49.9	55.2	-5.3	Peak	Vertical
2340.0	87.1	-13.8	73.3	82.2	-8.9	Peak	Vertical

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Test Site	SIP-AC1	Test Engineer	Barry Wu
Test Date	2023-06-10 ~ 2022-06-26	Test Band	Cat M1 Band 26, 1RB, QPSK

Frequency (MHz)	Reading Level (dB μ V)	Factor (dB/m)	Measure Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Detector	Polarization
Low Channel							
59.6	21.8	17.5	39.3	82.3	-43.0	Peak	Horizontal
119.7	23.2	15.6	38.8	82.3	-43.5	Peak	Horizontal
33.9	27.3	16.9	44.2	82.3	-38.1	Peak	Vertical
59.6	23.5	17.5	41.0	82.3	-41.3	Peak	Vertical
1628.0	95.8	-20.2	75.6	82.3	-6.7	Peak	Horizontal
2444.0	92.0	-16.5	75.5	82.3	-6.8	Average	Horizontal
2444.0	94.2	-16.5	77.7	82.3	-4.6	Peak	Vertical
4072.0	81.5	-11.2	70.3	82.3	-12.0	Peak	Vertical

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Appendix B - Test Setup Photograph

Refer to "2305RSU054-UT" file.

Appendix C - EUT Photograph

Refer to "2305RSU054-UE" file.