FCC Co-location Radio Test Report

For

Vehicle Gateway

Trade Name: Samsara

Model: 010-00008, 010-00006

Issued to

Samsara Inc.
1 De Haro Street, San Francisco, CA 94107, USA

Issued by

Compliance Certification Services Inc.
Wugu Laboratory
No.11, Wugong 6th Rd., Wugu Dist.,
New Taipei City, Taiwan.
Issued Date: April 3, 2024

Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	March 20, 2024	Initial Issue	ALL	Allison Chen
01	March 28, 2024	See the following Note Rev.(01)	P.9, 15-22	Allison Chen
02	April 3, 2024	See the following Note Rev.(02)	P.12	Allison Chen

Note:
Rev.(01)
1. Modify measurement equipment list and test data.
Rev.(02)
1. Modify test setup diagram in section 7.3.

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1. TEST RESULT CERTIFICATION

Applicant:	Samsara Inc. 1 De Haro Street, San Francisco, CA 94107, USA
Manufacturer:	Sercomm Corporation 8F, No. 3-1, YuanQu St., NanKang, Taipei 115, Taiwan
Equipment Under Test:	Vehicle Gateway
Trade Name:	Samsara
Model Number:	010-00008, 010-00006
Date of Test:	February 2, 2024

APPLICABLE STANDARDS	
STANDARD	**TEST RESULT**
FCC 47 CFR PART 27 SUBPART C FCC CFR 47 Part 2	Compliance
Statements of Conformity	
Determination of compliance is based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.	

We hereby certify that:

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in TIA/EIA-603-C and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of

Approved by:

Shawn Wu
Supervisor

2. EUT DESCRIPTION

<table>
<tr><td>Product</td><td>Vehicle Gateway</td></tr>
<tr><td>Trade Name</td><td>Samsara</td></tr>
<tr><td>Model:</td><td>010-00008, 010-00006</td></tr>
<tr><td>Model Discrepancy</td><td>For detailed description of the differences between series models, please see the table below:
<table>
<tr><th>Model name</th><th>Difference</th></tr>
<tr><td>010-00008</td><td>LTE Band: 2,4,5,12,14</td></tr>
<tr><td>010-00006</td><td>LTE Band: 2,4,5,12,13</td></tr>
</table></td></tr>
<tr><td>Received Date</td><td>December 11, 2023</td></tr>
<tr><td>Power Supply</td><td>EUT power by Power supply. (DC24V & DC12V)</td></tr>
<tr><td>Antenna Specification</td><td>1. WIFI 2.4GHz: PIFA Antenna / Gain: 2.4 dBi
2. BLE: PIFA Antenna / Gain: 2.4 dBi
3. WWAN LTE Band 12: PIFA Antenna / Gain: 0.9 dBi</td></tr>
<tr><td>Modulation Technique</td><td>1. WIFI 2.4GHz:
IEEE 802.11b mode: CCK
IEEE 802.11g mode: OFDM
IEEE 802.11n HT20 mode: OFDM
2. BLE:
GFSK for BLE 1 Mbps, GFSK for BLE 2 Mbps
3. WWAN LTE Band 12: QPSK, 16QAM</td></tr>
<tr><td>Frequency Range</td><td>1. WIFI 2.4GHz: 802.11b/g/n HT 20: 2412MHz ~ 2462MHz
2. BLE: 2402MHz-2480MHz
3. WWAN: LTE Band 12
<table>
<tr><th colspan="4">LTE Band 12</th></tr>
<tr><td>BW (MHz)</td><td colspan="3">Operation Frequency (MHz)</td></tr>
<tr><td>1.4</td><td>699.7</td><td>-</td><td>715.3</td></tr>
<tr><td>3</td><td>700.5</td><td>-</td><td>714.5</td></tr>
<tr><td>5</td><td>701.5</td><td>-</td><td>713.5</td></tr>
<tr><td>10</td><td>704.0</td><td>-</td><td>711.0</td></tr>
</table></td></tr>
</table>

Remark:
1. For more details, please refer to the User's manual of the EUT.
2. Disclaimer: Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.
3. Disclaimer: The variant model numbers / trademarks are assessed as identical in hardware and software to each other, hence all variants are fully covered by the test results in this test report without further verification test.

3. TEST METHODOLOGY

Both conducted and radiated testing were performed according to TIA -603-E, FCC CFR 47 Part 2, Part 27 Subpart C and ANSI C63.26: 2015.

Three channels had been tested for each channel bandwidth.

1. LTE_Band12_CH23060_10M_QPSK(1,0)/802.11b:704 MHz/2412 MHz
2. LTE_Band12_CH23060_10M_QPSK(1,0)/BLE 2M:704 MHz/2440 MHz

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

3.2 EUT EXERCISE

1. The transmitter output power was connected to the call box.
2. Set EUT at maximum output power via call box.
3. Set Call box at lowest, middle and highest channels for each band and modulation.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

According to the requirements in ANSI C63.26: 2015.Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in ANSI C63.26: 2015.

4. TEST SUMMARY

FCC Standard Sec.	Report Section	Test Item	Result
-	2	Antenna Requirement	Pass
§2.1051 27.53(g)	8.1	Spurious Radiation Measurement	Pass

5. INSTRUMENT CALIBRATION

5.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

5.2 MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

966A_Radiated Wi-Fi 2.4GHz					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Thermo-Hygro Meter	WISEWIND	1206	D07	2023-12-08	2024-12-07
Signal Analyzer	KEYSIGHT	N9010A	MY54200716	2023-10-13	2024-10-12
Loop Antenna	COM-POWER	AL-130	121051	2023-05-23	2024-05-22
Bi-Log Antenna	Sunol Sciences	JB3	A030105	2023-08-08	2024-08-07
Preamplifier	EMEC	EM330	060609	2023-02-22	2024-02-21
Cable	Huber+Suhner	104PEA	20995+21000+182330	2023-02-22	2024-02-21
Horn Antenna	ETC	MCTD 1209	DRH13M02003	2023-12-28	2024-12-27
Preamplifier	HP	8449B	3008A00965	2023-12-22	2024-12-21
Cable	EMCI	EMC101G	221213+221011+221012	2023-10-17	2024-10-16
High Pass Filters	Titan Microwave	T04H30001800070S01	22011402-4	2023-06-17	2024-06-16
Horn Antenna	SCHWARZBECK	BBHA9170	1047	2023-12-13	2024-12-12
Pre-Amplifier	EMCI	EMC184045SE	980860	2023-12-12	2024-12-11
Turn Table	CCS	CC-T-1F	N/A	N.C.R	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R	N.C.R
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R	N.C.R
Software	e3 V9-210616c				

Remark: Each piece of equipment is scheduled for calibration once a year and Loop Antenna is scheduled for calibration once three years.

5.3 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
RF Output Power	± 2.533 dB
Channel Bandwidth	± 2.532 MHz
Peak to average ratio	± 2.531 dB
Conducted Bandedge	± 2.532 dB
Conducted Unwanted Emissions	± 2.533 dB
Frequency Stability	± 2.579 Hz
Radiated Emission_9kHz-30MHz	± 3.778 dB
Radiated Emission_30MHz-200MHz	± 3.457 dB
Radiated Emission_200MHz-1GHz	± 3.962 dB
Radiated Emission_1GHz-6GHz	± 4.804 dB
Radiated Emission_6GHz-18GHz	± 4.781 dB
Radiated Emission_18GHz-26GHz	± 3.112 dB
Radiated Emission_26GHz-40GHz	± 3.314 dB

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

6. FACILITIES AND ACCREDITATIONS

6.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

☒ No.11, Wugong 6th Rd., Wugu Dist., New Taipei City, Taiwan.
Tel: 886-2-2299-9720 / Fax: 886-2-2299-9721

7. SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.

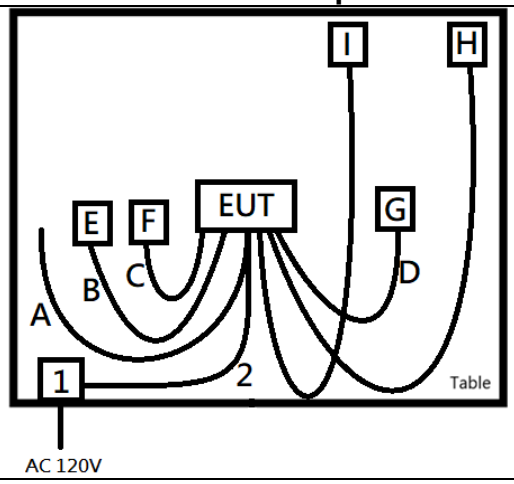
7.2 SUPPORT EQUIPMENT

Support Unit List						
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due	Remark
DC Power Source	GWINSTEK	SPS-3610	GPE880163	2023-11-16	2024-11-15	1
DC Power Cable	N/A	N/A	N/A	N/A	N/A	2
DC power Cable	N/A	N/A	N/A	N/A	N/A	A
USB Cable	LINDY	36761-ANTHRA	N/A	N/A	N/A	B
USB Cable	LINDY	36761-ANTHRA	N/A	N/A	N/A	C
USB Cable	LINDY	36761-ANTHRA	N/A	N/A	N/A	D
USB	HP	x306w 32G	N/A	N/A	N/A	E
USB	HP	x306w 32G	N/A	N/A	N/A	F
USB	HP	x306w 32G	N/A	N/A	N/A	G
CM32	N/A	N/A	N/A	N/A	N/A	H
Panic Button	N/A	020-0011	N/A	N/A	N/A	I

Remark:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

7.3 TEST SETUP DIAGRAM

RSE Setup	--
	--

8. TEST PROCEDURE AND RESULT

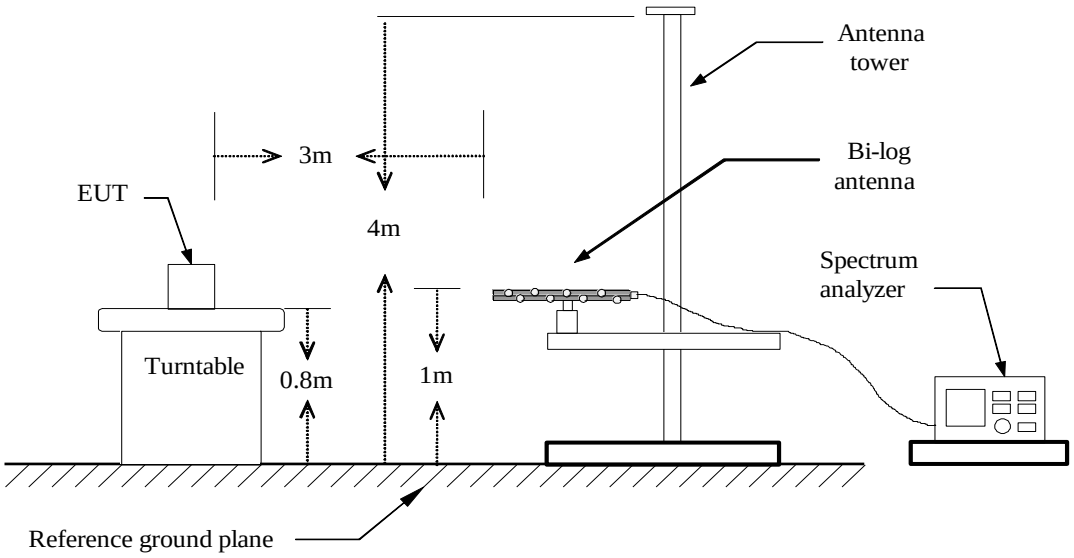
8.1 SPURIOUS RADIATION MEASUREMENT

LIMIT

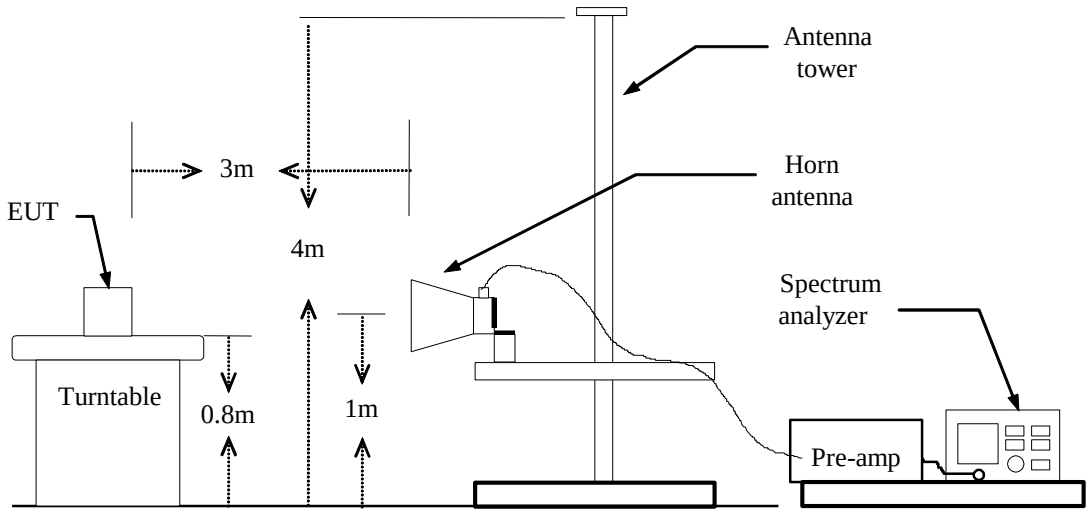
According to FCC §2.1053
The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 43 +10 log10(P) dB. The limit of emission equal to –13dBm

Test Configuration

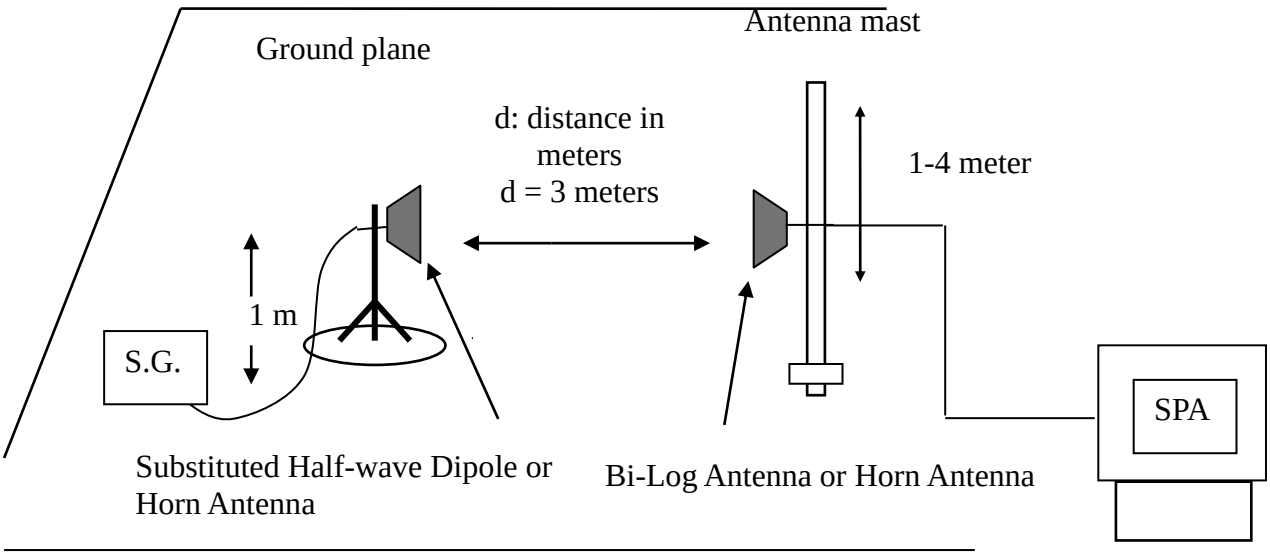
Below 1 GHz



Above 1 GHz



Substituted Method Test Set-up



TEST PROCEDURE

1. According to KDB 971168 D01 and ANSI C63.26.
2. The EUT was placed on a turntable
   (1) Below 1G : 0.8m
   (2) Above 1G : 1.5m
   (3) EUT set 3m from the receiving antenna
   (4) The table was rotated 360 degrees of the highest spurious emission to determine the position.
3. Set the spectrum analyzer , RBW=1MHz, VBW=3MHz.
4. A horn antenna was driven by a signal generator.
5. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission

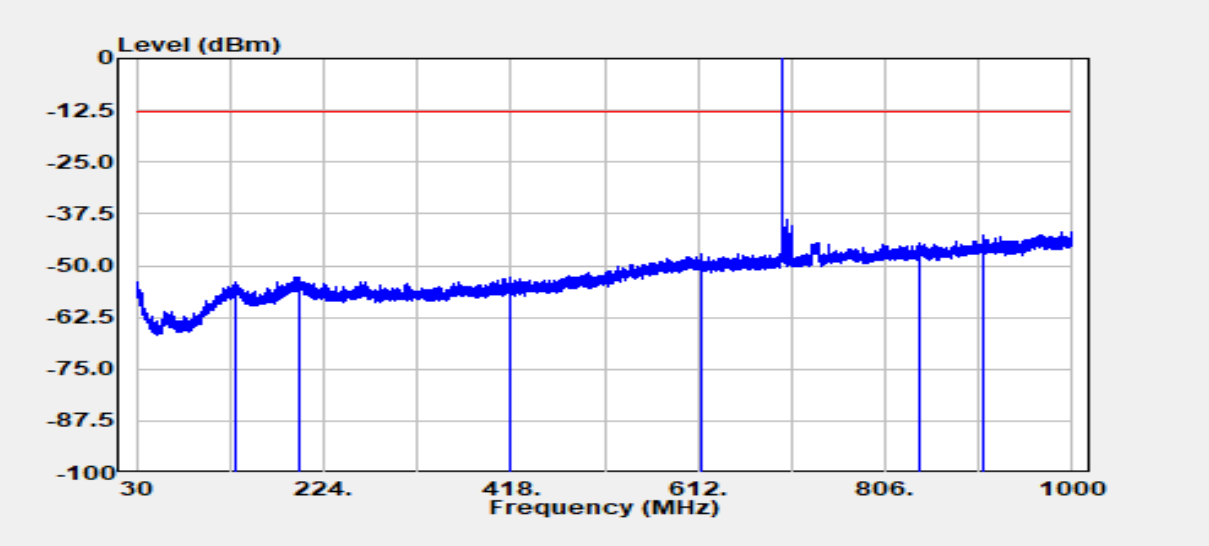
TEST RESULTS

Refer to the attached tabular data sheets.

TEST RESULTS

Co-Location

Project No	:TM-2312000115P	Test Date	:2024-02-02
Operation Band	:LTE_Band12_CH23060 _10M_QPSK(1,0)/802.11b	Temp./Humi.	:24.5/57
Frequency	:704 MHz/2412 MHz	Antenna Pol.	:VERTICAL
Operation Mode	:TX	Engineer	:Ray.Li
EUT Pol	:E2	Test Chamber	: 966A
Setting	:		

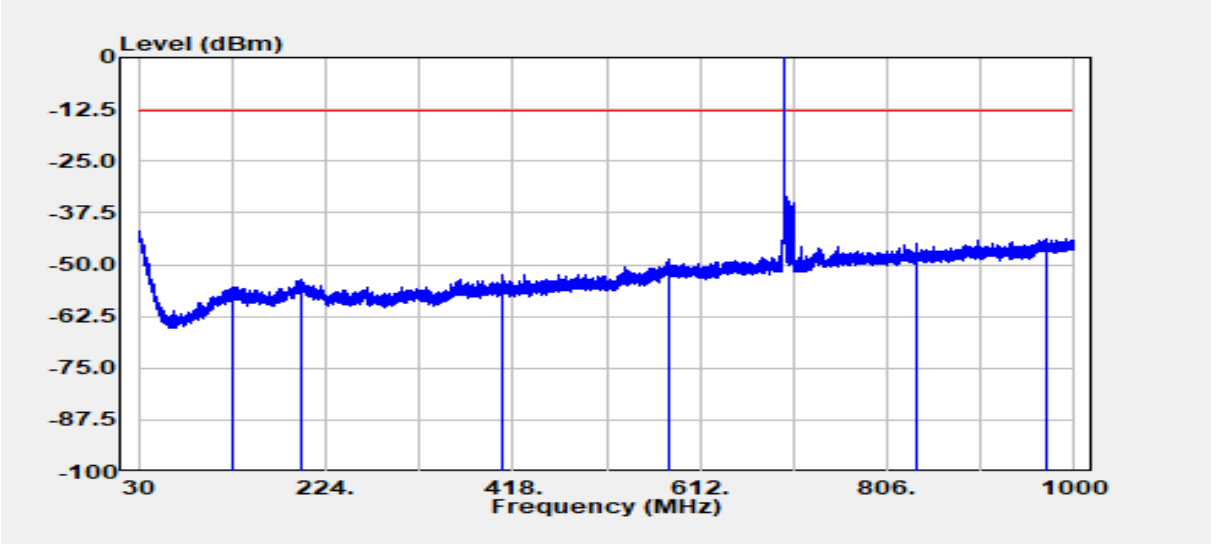


Freq.	EIRP/ERP	SG Output Level	Antenna Gain	Cable Loss	Limit	Margin
MHz	dBm	dBm	dBi/dBd	dB	dBm	dB
131.85	-54.14	-46.91	-7.04	0.20	-13.00	-41.14
199.07	-52.68	-50.16	-2.27	0.25	-13.00	-39.68
416.93	-52.81	-52.93	0.52	0.40	-13.00	-39.81
615.01	-47.27	-47.60	0.84	0.51	-13.00	-34.27
841.79	-44.64	-45.19	1.16	0.61	-13.00	-31.64
906.59	-42.80	-43.40	1.24	0.63	-13.00	-29.80

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.

Project No	:TM-2312000115P	Test Date	:2024-02-02
Operation Band	:LTE_Band12_CH23060 _10M_QPSK(1,0)/802.11b	Temp./Humi.	:24.5/57
Frequency	:704 MHz/2412 MHz	Antenna Pol.	:HORIZONTAL
Operation Mode	:TX	Engineer	:Ray.Li
EUT Pol	:E2	Test Chamber	: 966A
Setting	:		

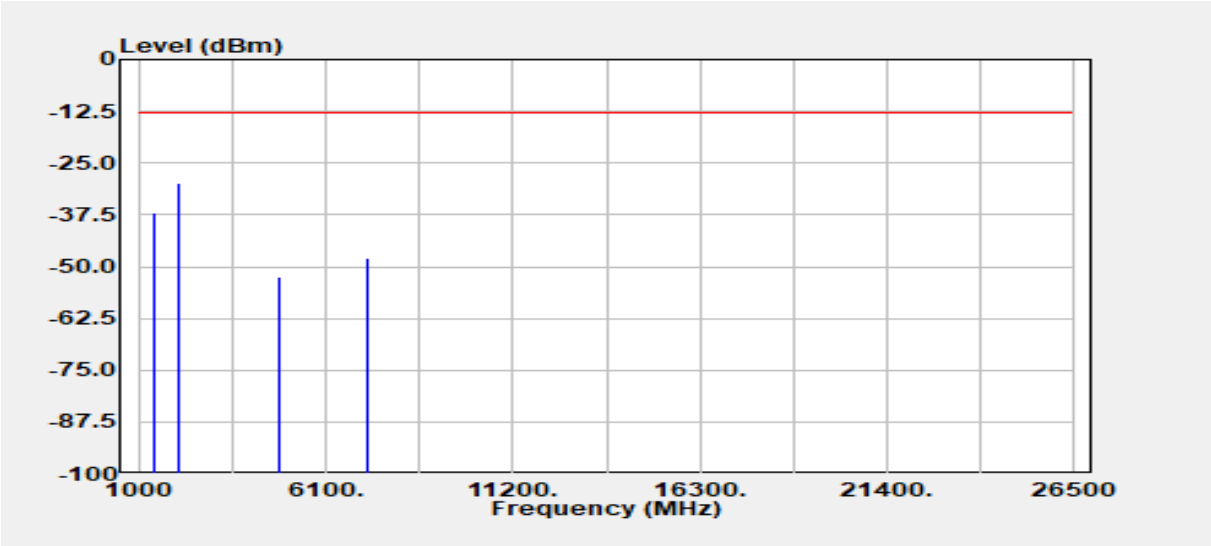


Freq. MHz	EIRP/ERP dBm	SG Output Level dBm	Antenna Gain dBi/dBd	Cable Loss dB	Limit dBm	Margin dB
127.29	-55.35	-47.49	-7.66	0.19	-13.00	-42.35
199.17	-53.76	-51.23	-2.28	0.25	-13.00	-40.76
407.23	-52.33	-52.60	0.67	0.39	-13.00	-39.33
579.60	-48.86	-49.28	0.92	0.49	-13.00	-35.86
836.26	-45.09	-45.59	1.10	0.60	-13.00	-32.09
971.29	-43.83	-44.56	1.38	0.65	-13.00	-30.83

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.

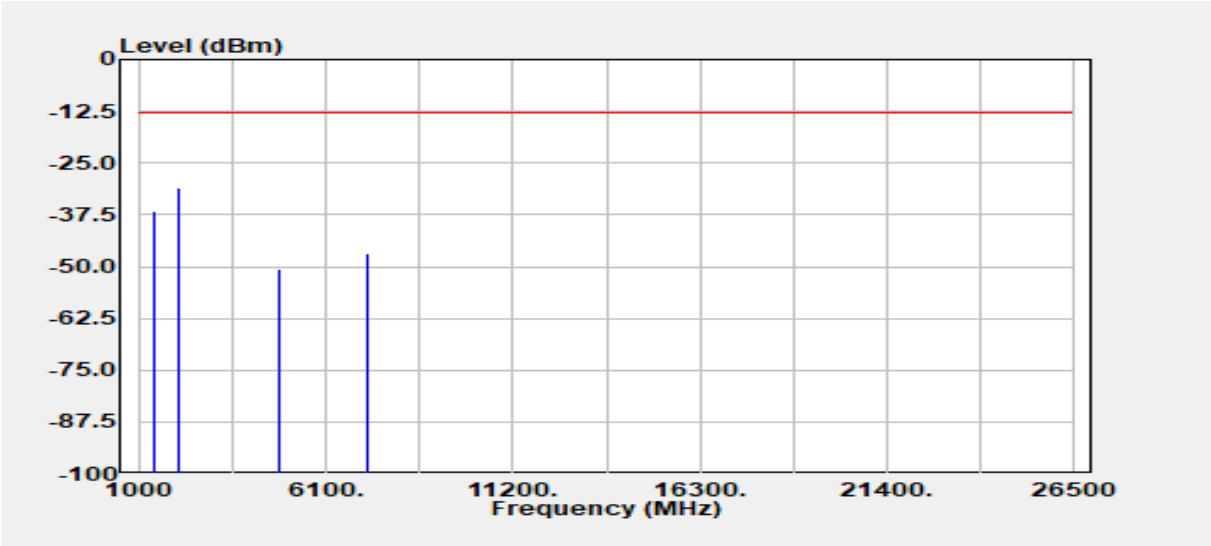
Project No	:TM-2312000115P	Test Date	:2024-02-02
Operation Band	:LTE_Band12_CH23060 _10M_QPSK(1,0)/802.11b	Temp./Humi.	:24.5/57
Frequency	:704 MHz/2412 MHz	Antenna Pol.	:Vertical
Operation Mode	:TX	Engineer	:Ray.Li
EUT Pol	:E2	Test Chamber	: 966A
Setting	:		



Freq.	EIRP/ERP	SG Output Level	Antenna Gain	Cable Loss	Limit	Margin
MHz	dBm	dBm	dBi/dBd	dB	dBm	dB
1408.00	-36.89	32.44	4.68	0.77	-13.00	-23.89
2112.00	-29.71	37.51	4.82	0.94	-13.00	-16.71
4824.00	-52.31	3.48	9.65	1.39	-13.00	-39.31
7236.00	-47.82	8.59	11.37	1.64	-13.00	-34.82

Remark:
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.

Project No	:TM-2312000115P	Test Date	:2024-02-02
Operation Band	:LTE_Band12_CH23060 _10M_QPSK(1,0)/802.11b	Temp./Humi.	:24.5/57
Frequency	:704 MHz/2412 MHz	Antenna Pol.	:Horizontal
Operation Mode	:TX	Engineer	:Ray.Li
EUT Pol	:E2	Test Chamber	: 966A
Setting	:		



Freq.	EIRP/ERP	SG Output Level	Antenna Gain	Cable Loss	Limit	Margin
MHz	dBm	dBm	dBi/dBd	dB	dBm	dB
1408.00	-36.48	31.93	4.68	0.77	-13.00	-23.48
2112.00	-31.08	36.35	4.82	0.94	-13.00	-18.08
4824.00	-50.74	3.74	9.65	1.39	-13.00	-37.74
7236.00	-46.87	8.71	11.37	1.64	-13.00	-33.87

Remark:
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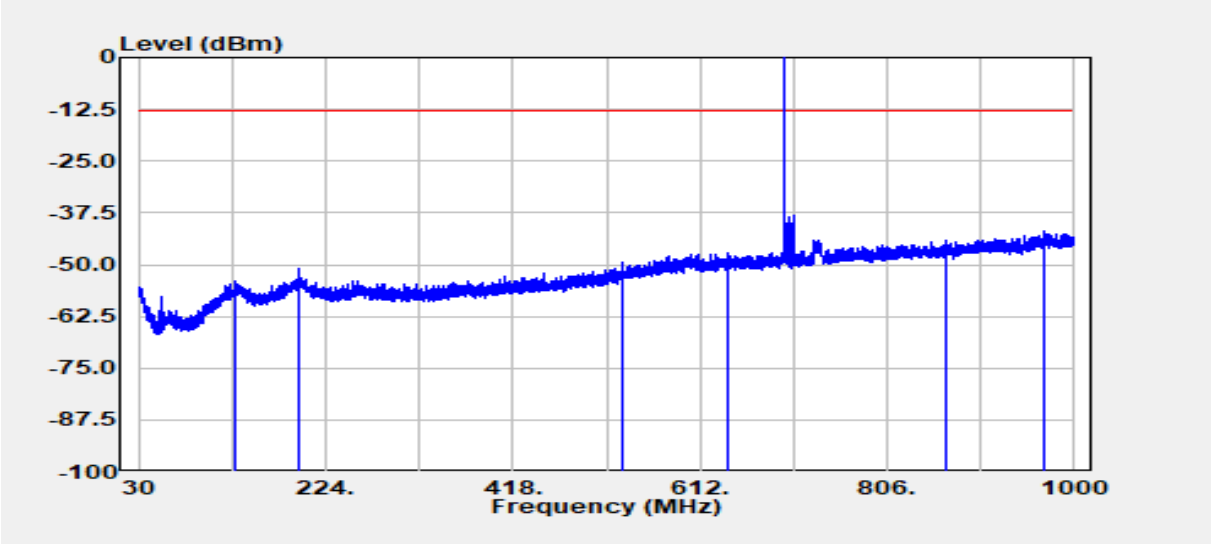
Project No	:TM-2312000115P	Test Date	:2024-02-02
Operation Band	:LTE_Band12_CH23060 _10M_QPSK(1,0)/BLE 2M	Temp./Humi.	:24.5/57
Frequency	:704 MHz/2440 MHz	Antenna Pol.	:VERTICAL
Operation Mode	:TX	Engineer	:Ray.Li
EUT Pol	:E2	Test Chamber	: 966A
Setting	:		



Freq. MHz	EIRP/ERP dBm	SG Output Level dBm	Antenna Gain dBi/dBd	Cable Loss dB	Limit dBm	Margin dB
130.78	-53.93	-46.56	-7.18	0.19	-13.00	-40.93
195.77	-50.95	-48.74	-1.96	0.25	-13.00	-37.95
531.68	-49.37	-49.87	0.97	0.47	-13.00	-36.37
639.84	-47.17	-47.44	0.78	0.52	-13.00	-34.17
867.79	-44.32	-44.73	1.03	0.62	-13.00	-31.32
968.18	-41.97	-42.66	1.34	0.65	-13.00	-28.97

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
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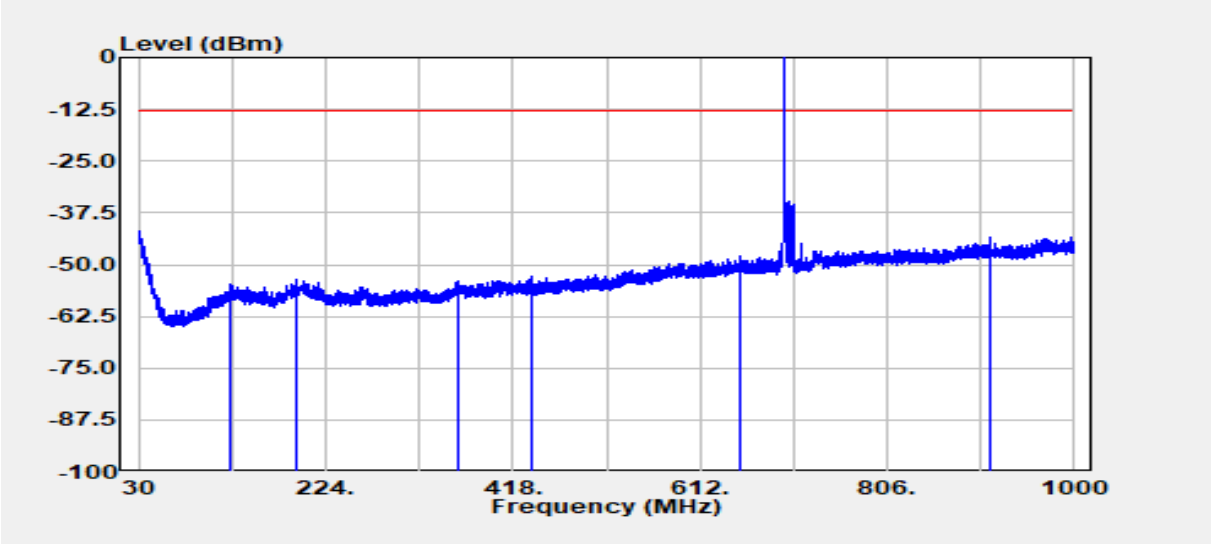
Project No	:TM-2312000115P	Test Date	:2024-02-02
Operation Band	:LTE_Band12_CH23060 _10M_QPSK(1,0)/BLE 2M	Temp./Humi.	:24.5/57
Frequency	:704 MHz/2440 MHz	Antenna Pol.	:HORIZONTAL
Operation Mode	:TX	Engineer	:Ray.Li
EUT Pol	:E2	Test Chamber	: 966A
Setting	:		

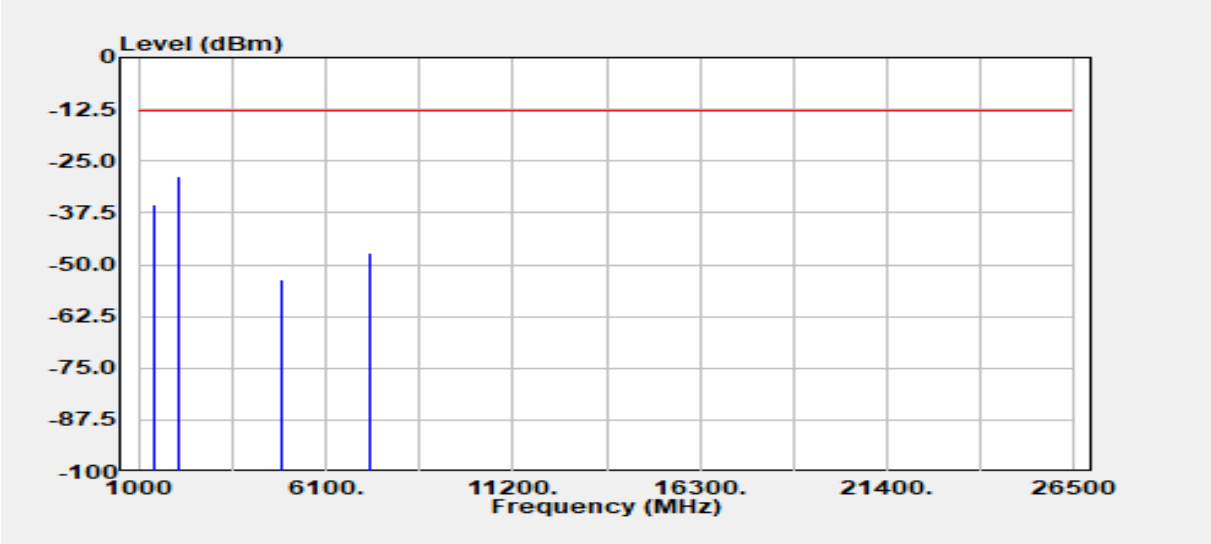


Freq. MHz	EIRP/ERP dBm	SG Output Level dBm	Antenna Gain dBi/dBd	Cable Loss dB	Limit dBm	Margin dB
125.74	-54.75	-46.90	-7.66	0.19	-13.00	-41.75
194.22	-53.54	-51.57	-1.72	0.25	-13.00	-40.54
362.03	-53.82	-54.31	0.85	0.36	-13.00	-40.82
438.66	-52.79	-52.73	0.36	0.41	-13.00	-39.79
653.71	-47.86	-48.13	0.79	0.52	-13.00	-34.86
911.73	-43.49	-44.22	1.36	0.63	-13.00	-30.49

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.

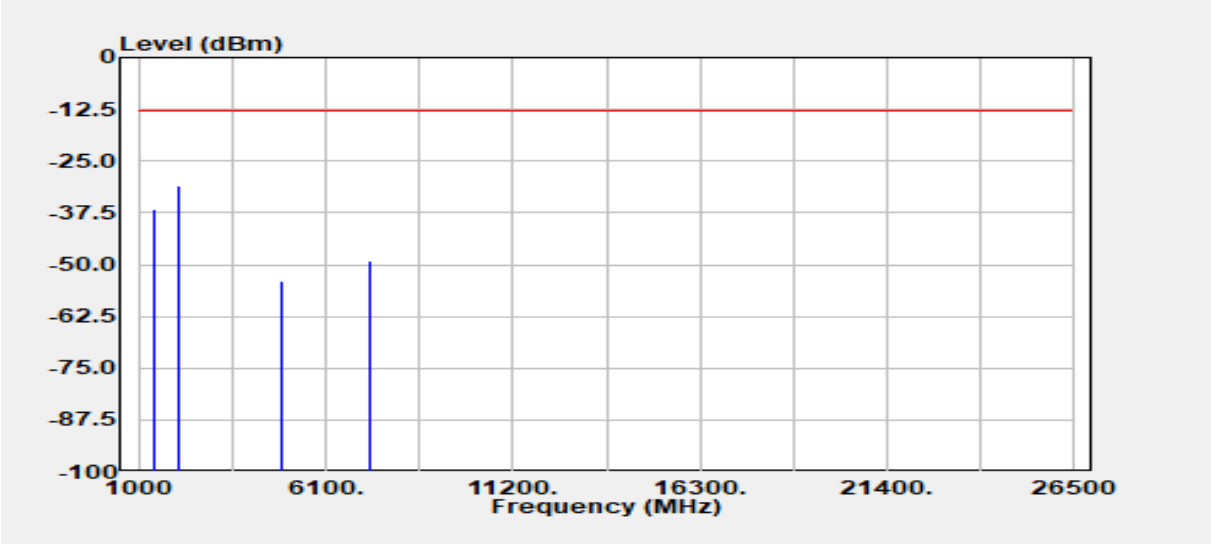
Project No	:TM-2312000115P	Test Date	:2024-02-02
Operation Band	:LTE_Band12_CH23060 _10M_QPSK(1,0)/BLE_2M	Temp./Humi.	:24.5/57
Frequency	:704 MHz/2440 MHz	Antenna Pol.	:VERTICAL
Operation Mode	:TX	Engineer	:Ray.Li
EUT Pol	:E2	Test Chamber	: 966A
Setting	:		



Freq. MHz	EIRP/ERP dBm	SG Output Level dBm	Antenna Gain dBi/dBd	Cable Loss dB	Limit dBm	Margin dB
1408.00	-35.64	-39.54	4.68	0.77	-13.00	-22.64
2112.00	-28.87	-32.75	4.82	0.94	-13.00	-15.87
4880.00	-53.40	-61.70	9.70	1.40	-13.00	-40.40
7320.00	-47.13	-56.97	11.50	1.65	-13.00	-34.13

Remark:
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.

Project No	:TM-2312000115P	Test Date	:2024-02-02
Operation Band	:LTE_Band12_CH23060 _10M_QPSK(1,0)/BLE_2M	Temp./Humi.	:24.5/57
Frequency	:704 MHz/2440 MHz	Antenna Pol.	:HORIZONTAL
Operation Mode	:TX	Engineer	:Ray.Li
EUT Pol	:E2	Test Chamber	: 966A
Setting	:		



Freq. MHz	EIRP/ERP dBm	SG Output Level dBm	Antenna Gain dBi/dBd	Cable Loss dB	Limit dBm	Margin dB
1408.00	-36.70	-40.61	4.68	0.77	-13.00	-23.70
2112.00	-30.95	-34.83	4.82	0.94	-13.00	-17.95
4880.00	-54.01	-62.31	9.70	1.40	-13.00	-41.01
7320.00	-49.04	-58.89	11.50	1.65	-13.00	-36.04

Remark:
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.

-- End of Test Report --