



BUREAU VERITAS

Test Report No.: W7L-P23040024RF01



FCC TEST REPORT (Part 15, Subpart C)

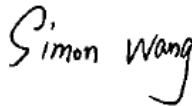

| | |
|------------|--|
| Applicant: | Marquardt GmbH |
| Address: | Schloss-str.16,78604 Rietheim-Weilheim,Germany |

| | |
|---------------------------|--|
| Manufacturer or Supplier: | Marquardt GmbH |
| Address: | Schloss-str.16,78604 Rietheim-Weilheim,Germany |
| Product: | BNCM |
| Brand Name: | Marquardt |
| Model Name: | GE1 |
| FCC ID: | IYZGE1 |
| Date of tests: | Apr. 24, 2023 ~ May. 17, 2023 |

The tests have been carried out according to the requirements of the following standard:

- FCC Part 15, Subpart C, Section 15.247**
- ANSI C63.10-2013**

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

| | |
|--|--|
| Prepared by Simon Wang Engineer / Mobile Department | Approved by Luke Lu Manager / Mobile Department |
|  Date: May. 17, 2023 |  Date: May. 17, 2023 |

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**BUREAU
VERITAS**

Test Report No.: W7L-P23040024RF01

RELEASE CONTROL RECORD

| ISSUE NO. | REASON FOR CHANGE | DATE ISSUED |
|-------------------|-------------------|---------------|
| W7L-P23040024RF01 | Original release | May. 17, 2023 |



1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

| APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247) | | |
|---|----------------------------------|------------|
| STANDARD SECTION | TEST TYPE AND LIMIT | RESULT |
| 15.207 | AC Power Conducted Emission | Compliance |
| 15.205 15.209 | Radiated Emissions | Compliance |
| 15.247(d) | Out of band Emission Measurement | Compliance |
| 15.247(a)(2) | 6dB bandwidth | Compliance |
| 15.247(b) | Conducted Output power | Compliance |
| 15.247(e) | Power Spectral Density | Compliance |
| 15.203 | Antenna Requirement | Compliance |



1.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

| MEASUREMENT | UNCERTAINTY |
|-----------------------------------|-------------|
| AC Power Conducted emissions | ±2.70dB |
| Radiated emissions (9KHz~30MHz) | ±2.68dB |
| Radiated emissions (30MHz~1GHz) | ±4.98dB |
| Radiated emissions (1GHz ~6GHz) | ±4.70dB |
| Radiated emissions (6GHz ~18GHz) | ±4.60dB |
| Radiated emissions (18GHz ~40GHz) | ±4.12dB |
| Conducted emissions | ±4.01dB |
| Occupied Channel Bandwidth | ±43.58KHz |
| Conducted Output power | ±2.06dB |
| Power Spectral Density | ±0.85 dB |

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



2 GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

| | |
|----------------------------|------------------------------|
| PRODUCT | BNCM |
| BRAND NAME | Marquardt |
| MODEL NAME | GE1 |
| NOMINAL VOLTAGE | DC12V |
| MODULATION | GFSK |
| TRANSMISSION RATE | BT_LE: 1 Mbps/2 Mbps |
| OPERATING FREQUENCY | 2402-2480MHz for BT-LE(GFSK) |
| MAX. OUTPUT POWER | BT-LE: 5.35mW (Maximum) |
| ANTENNA TYPE | Aux Antenna with 2.2dBi gain |
| HW VERSION | 1014222 |
| SW VERSION | 1010923 |
| I/O PORTS | Refer to user's manual |
| CABLE SUPPLIED | N/A |

NOTE:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. The EUT incorporates a SISO function. Physically, the EUT provides one transmitter and one receiver.

| MODULATION MODE | TX/RX FUNCTION |
|------------------------|-----------------------|
| BT_LE(1MHz) | 1TX /1RX |
| BT_LE(2MHz) | 1TX /1RX |

3. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.



2.2 DESCRIPTION OF TEST MODES

40 channels are provided for BT-LE (GFSK):

| CHANNEL | FREQ. (MHZ) | CHANNEL | FREQ. (MHZ) | CHANNEL | FREQ. (MHZ) | CHANNEL | FREQ. (MHZ) |
|---------|----------------|---------|----------------|---------|----------------|---------|----------------|
| 0 | 2402 | 10 | 2422 | 20 | 2442 | 30 | 2462 |
| 1 | 2404 | 11 | 2424 | 21 | 2444 | 31 | 2464 |
| 2 | 2406 | 12 | 2426 | 22 | 2446 | 32 | 2466 |
| 3 | 2408 | 13 | 2428 | 23 | 2448 | 33 | 2468 |
| 4 | 2410 | 14 | 2430 | 24 | 2450 | 34 | 2470 |
| 5 | 2412 | 15 | 2432 | 25 | 2452 | 35 | 2472 |
| 6 | 2414 | 16 | 2434 | 26 | 2454 | 36 | 2474 |
| 7 | 2416 | 17 | 2436 | 27 | 2456 | 37 | 2476 |
| 8 | 2418 | 18 | 2438 | 28 | 2458 | 38 | 2478 |
| 9 | 2420 | 19 | 2440 | 29 | 2460 | 39 | 2480 |



2.2.1 CONFIGURATION OF SYSTEM UNDER TEST

Please see section 5 photographs of the test configuration for reference.

2.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports. The worst case was found when positioned on Y axis for radiated emission. Following test modes were selected for the final test, and the final worst case is marked in boldface and recorded in the report:

| EUT CONFIGURE MODE | APPLICABLE TO | | | | MODE |
|--------------------------|---------------|-------|-----|------|------|
| | RE<1G | RE≥1G | PLC | APCM | |
| - | √ | √ | √ | √ | - |

Where **RE<1G**: Radiated Emission below 1GHz **RE≥1G**: Radiated Emission above 1GHz
PLC: Power Line Conducted Emission **APCM**: Antenna Port Conducted Measurement

NOTE: No need to concern of Conducted Emission due to the EUT is powered by battery.

RADIATED EMISSION TEST (BELOW 1GHz):

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

| MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION | DATA RATE (Mbps) |
|-------|-------------------|----------------|------------|------------------|
| BT-LE | 1 to 38 | 38 | GFSK | 2.0 |



RADIATED EMISSION TEST (ABOVE 1GHz):

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

| MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION | DATA RATE (Mbps) |
|-------|-------------------|----------------|------------|------------------|
| BT-LE | 0 to 39 | 0,19, 39 | GFSK | 1.0 |
| BT-LE | 1 to 38 | 1,19, 38 | GFSK | 2.0 |

POWER LINE CONDUCTED EMISSION TEST

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

| MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION | DATA RATE (Mbps) |
|-------|-------------------|----------------|------------|------------------|
| BT-LE | 1 to 38 | 38 | GFSK | 2.0 |

BANDEDGE MEASUREMENT:

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

| MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION | DATA RATE (Mbps) |
|-------|-------------------|----------------|------------|------------------|
| BT-LE | 0 to 39 | 0,19, 39 | GFSK | 1.0 |
| BT-LE | 1 to 38 | 1,19, 38 | GFSK | 2.0 |

ANTENNA PORT CONDUCTED MEASUREMENT:

This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

| MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION | DATA RATE (Mbps) |
|-------|-------------------|----------------|------------|------------------|
| BT-LE | 0 to 39 | 0,19, 39 | GFSK | 1.0 |
| BT-LE | 1 to 38 | 1,19, 38 | GFSK | 2.0 |



TEST CONDITION:

| APPLICABLE TO | ENVIRONMENTAL CONDITIONS | TEST VOLTAGE | TESTED BY |
|----------------------|---------------------------------|---------------------|------------------|
| RE<1G | 23deg. C, 70%RH | DC12V | Jace Hu |
| RE≥1G | 23deg. C, 70%RH | DC12V | Jace Hu |
| PLC | 25deg. C, 52%RH | DC12V | Carl Xie |
| APCM | 25deg. C, 60%RH | DC12V | James Fu |



2.3 DUTY CYCLE OF TEST SIGNAL

Please Refer to Appendix Of this test report.

WORST-CASE DATA:

| Measured Duty Cycle | | |
|---------------------|-------|----------------|
| Mode | | Duty Cycle [%] |
| | | ANT1 |
| BT LE | BT4.0 | 100 |
| | BT5.0 | 100 |

Note:

If Duty cycle of test signal < 98%, the duty factor shall be considered.



2.4 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C, Section 15.247

KDB 558074 D01 DTS Meas Guidance v05r02

ANSI C63.10-2013

Note :

1. All test items have been performed and recorded as per the above standards.
2. The EUT is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (Certification). The test report has been issued separately.

2.5 DESCRIPTION OF SUPPORT UNITS

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.

| NO. | PRODUCT | BRAND | MODEL NO. | SERIAL NO. | FCC ID |
|-----|---------|--------|---------------|------------|--------|
| 1 | Desktop | Lenovo | M73 SFF | PC04GRQV | N/A |
| 2 | Desktop | Lenovo | M73 SFF | PC06CS27 | N/A |
| 3 | Laptop | Lenovo | Thinkpad T450 | PC-049PT1 | N/A |

| NO. | SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS |
|-----|---|
| 1 | AC Line: Unshielded, Detachable 1.5m |
| 2 | AC Line: Unshielded, Detachable 1.5m |
| 3 | AC Line: Unshielded, Detachable 1.5m |



3 TEST TYPES AND RESULTS

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

| FREQUENCY OF EMISSION (MHz) | CONDUCTED LIMIT (dBµV) | |
|-----------------------------|------------------------|----------|
| | Quasi-peak | Average |
| 0.15 ~ 0.5 | 66 to 56 | 56 to 46 |
| 0.5 ~ 5 | 56 | 46 |
| 5 ~ 30 | 60 | 50 |

- NOTE:**
1. The lower limit shall apply at the transition frequencies.
 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.
 3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

3.1.2 TEST INSTRUMENTS

| Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Next Cal. |
|---------------------|---------------|-----------|------------|------------|------------|
| EMI Test Receiver | Rohde&Schwarz | ESR3 | 101900 | Feb. 14,23 | Feb. 13,24 |
| EMC32 test software | Rohde&Schwarz | EMC32 | NA | NA | NA |
| LISN network | Rohde&Schwarz | ENV216 | 101922 | Mar. 03,23 | Mar. 02,24 |

- NOTE:**
1. The test was performed in CE shielded room.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
 3. The FCC Site Registration No. is 525120; The Designation No. is CN1171.



3.1.3 TEST PROCEDURES

- 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. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

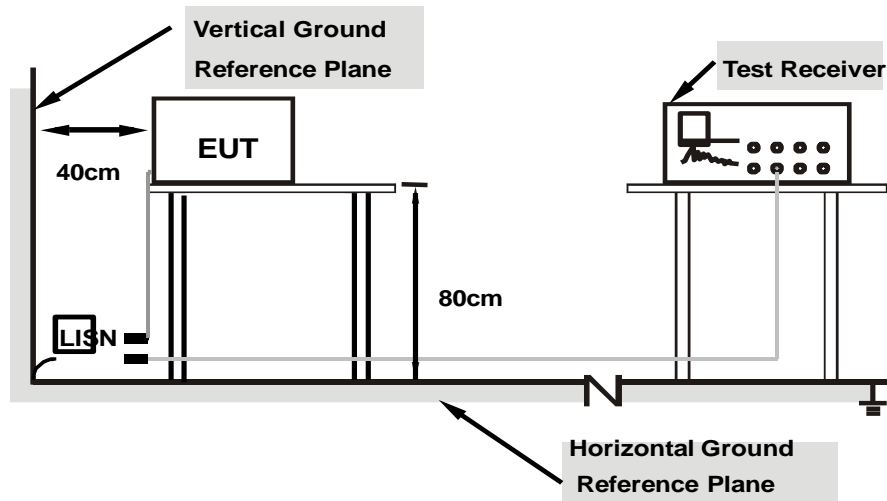
NOTE: All modes of operation were investigated and the worst-case emissions are reported.

3.1.4 DEVIATION FROM TEST STANDARD

No deviation.



3.1.5 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

For the actual test configuration, please refer to the attached file (Test Setup Photo).

3.1.6 EUT OPERATING CONDITIONS

- a. Turned on the power and connected of all equipment.
- b. EUT was operated according to the type used was description in manufacturer's specifications or the User's Manual.



3.1.7 TEST RESULTS

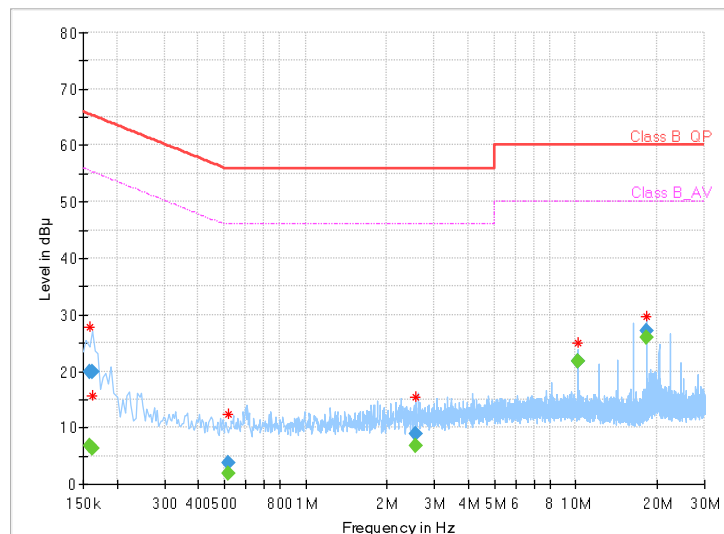
CONDUCTED WORST-CASE DATA:

| | | | |
|------------------------|----------------|---|---------------------------------------|
| Frequency Range | 150KHz ~ 30MHz | Detector Function & Resolution Bandwidth | Quasi-Peak (QP) / Average (AV), 9 kHz |
| Input Power | 120Vac, 60Hz | Environmental Conditions | 26deg. C, 51%RH |
| Tested By | Carl Xie | | |

| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|------|--------|------------|
| 0.158000 | --- | 6.80 | 55.57 | 48.77 | L1 | ON | 9.7 |
| 0.158000 | 19.88 | --- | 65.57 | 45.69 | L1 | ON | 9.7 |
| 0.162000 | --- | 6.34 | 55.36 | 49.02 | L1 | ON | 9.7 |
| 0.162000 | 19.83 | --- | 65.36 | 45.53 | L1 | ON | 9.7 |
| 0.516000 | --- | 1.91 | 46.00 | 44.09 | L1 | ON | 9.7 |
| 0.516000 | 3.68 | --- | 56.00 | 52.32 | L1 | ON | 9.7 |
| 2.556000 | --- | 6.83 | 46.00 | 39.17 | L1 | ON | 9.7 |
| 2.556000 | 8.79 | --- | 56.00 | 47.21 | L1 | ON | 9.7 |
| 10.180000 | --- | 21.75 | 50.00 | 28.25 | L1 | ON | 9.8 |
| 10.180000 | 21.87 | --- | 60.00 | 38.13 | L1 | ON | 9.8 |
| 18.324000 | --- | 26.06 | 50.00 | 23.94 | L1 | ON | 9.8 |
| 18.324000 | 27.19 | --- | 60.00 | 32.81 | L1 | ON | 9.8 |

- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
 2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
 3. The emission levels of other frequencies were very low against the limit.
 4. Margin value = Limit value - Emission level
 5. Correction factor = Insertion loss + Cable loss
 6. Emission Level = Correction Factor + Reading Value.

Full Spectrum



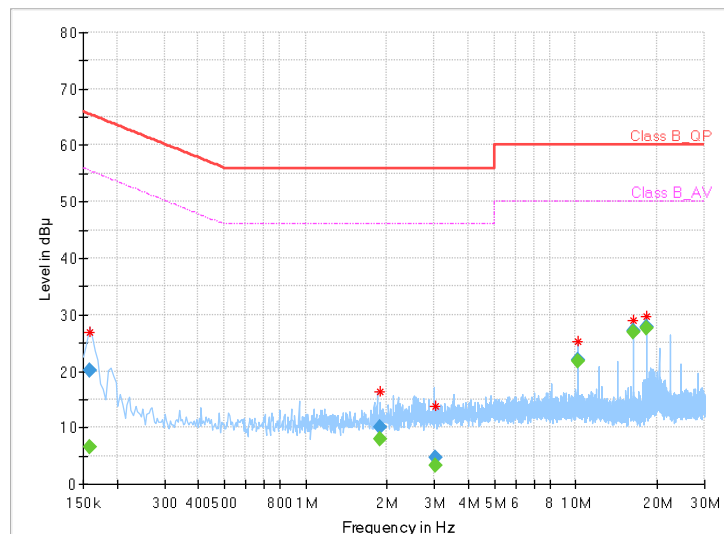


| | | | |
|------------------------|----------------|---|---------------------------------------|
| Frequency Range | 150KHz ~ 30MHz | Detector Function & Resolution Bandwidth | Quasi-Peak (QP) / Average (AV), 9 kHz |
| Input Power | 120Vac, 60Hz | Environmental Conditions | 26deg. C, 51%RH |
| Tested By | Carl Xie | | |

| Frequency (MHz) | QuasiPeak (dBUV) | CAverage (dBUV) | Limit (dBUV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|------|--------|------------|
| 0.158000 | --- | 6.51 | 55.57 | 49.06 | N | ON | 9.7 |
| 0.158000 | 20.17 | --- | 65.57 | 45.40 | N | ON | 9.7 |
| 1.882000 | --- | 8.03 | 46.00 | 37.97 | N | ON | 9.8 |
| 1.882000 | 10.07 | --- | 56.00 | 45.93 | N | ON | 9.8 |
| 3.012000 | --- | 3.23 | 46.00 | 42.77 | N | ON | 9.8 |
| 3.012000 | 4.78 | --- | 56.00 | 51.22 | N | ON | 9.8 |
| 10.180000 | --- | 21.81 | 50.00 | 28.19 | N | ON | 9.8 |
| 10.180000 | 21.94 | --- | 60.00 | 38.06 | N | ON | 9.8 |
| 16.288000 | --- | 26.79 | 50.00 | 23.21 | N | ON | 9.8 |
| 16.288000 | 27.20 | --- | 60.00 | 32.80 | N | ON | 9.8 |
| 18.324000 | --- | 27.60 | 50.00 | 22.40 | N | ON | 9.9 |
| 18.324000 | 27.85 | --- | 60.00 | 32.15 | N | ON | 9.9 |

- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
 2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
 3. The emission levels of other frequencies were very low against the limit.
 4. Margin value = Limit value -Emission level
 5. Correction factor = Insertion loss + Cable loss
 6. Emission Level = Correction Factor + Reading Value.

Full Spectrum





3.2 RADIATED EMISSION MEASUREMENT

3.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

| FREQUENCIES (MHz) | FIELD STRENGTH (microvolts/meter) | MEASUREMENT DISTANCE (meters) |
|----------------------|--------------------------------------|----------------------------------|
| 0.009 ~ 0.490 | 2400/F(kHz) | 300 |
| 0.490 ~ 1.705 | 24000/F(kHz) | 30 |
| 1.705 ~ 30.0 | 30 | 30 |
| 30 ~ 88 | 100 | 3 |
| 88 ~ 216 | 150 | 3 |
| 216 ~ 960 | 200 | 3 |
| Above 960 | 500 | 3 |

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.



3.2.2 TEST INSTRUMENTS

| Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Next Cal. |
|----------------------------|--------------|-----------------------------|-----------------------------|------------|------------|
| 3m Semi-anechoic Chamber | ETS-LINDGREN | 9m*6m*6m | Euroshieldpn-CT0001143-1216 | May. 19,20 | May. 18,23 |
| Bilog Antenna | ETS-LINDGREN | 3143B | 00161965 | Mar. 05,23 | Mar. 04,24 |
| Horn Antenna | ETS-LINDGREN | 3117 | 00168692 | Mar. 05,23 | Mar. 04,24 |
| Horn Antenna (18GHz-40GHz) | N/A | QWH-SL-18-40-K-SG/QMS-00361 | 15433 | Sep.04, 22 | Sep.03, 23 |
| Test Software | E3 | V 9.160323 | N/A | N/A | N/A |
| Test Software | JS1120-3 | 3.2.06 | N/A | N/A | N/A |
| 10dB Attenuator | JFW/USA | 50HF-010-SMA | N/A | May. 12,22 | May. 11,23 |
| 10dB Attenuator | JFW/USA | 50HF-010-SMA | N/A | May. 11,23 | May. 10,24 |
| MXE EMI Receiver | KEYSIGHT | N9038A-544 | MY54450026 | Feb. 20,23 | Feb. 19,24 |
| Signal Pre-Amplifier | EMSI | EMC 9135 | 980249 | May.12,22 | May.11,23 |
| Signal Pre-Amplifier | EMSI | EMC 9135 | 980249 | May.11,23 | May.10,24 |
| Signal Pre-Amplifier | EMSI | EMC 012645B | 980257 | May.12,22 | May.11,23 |
| Signal Pre-Amplifier | EMSI | EMC 012645B | 980257 | May.11,23 | May.10,24 |
| Signal Pre-Amplifier | EMSI | EMC 184045B | 980259 | Feb. 17,23 | Feb. 16,24 |
| DC Source | Kikusui/JP | PMX18-5A | 0000001 | Aug. 12,22 | Aug. 11,23 |
| Power Meter | Anritsu | ML2495A | 1506002 | Feb. 14,23 | Feb. 13,24 |
| Power Sensor | Anritsu | MA2411B | 1339352 | Feb. 14,23 | Feb. 13,24 |
| Loop Antenna | Schwarzbeck | FMZB 1519B | 00173 | Sep.03,22 | Sep.02,23 |

- NOTE:**
1. The calibration interval of the above test instruments is 12 months or 36 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
 2. The test was performed in 3m Chamber.
 3. The FCC Site Registration No. is 525120; The Designation No. is CN1171.



3.2.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters (for below 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna is a broadband antenna, and its height is varied from one meter to four meters 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 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, For battery operated equipment, the equipment tests shall be perform using fresh batteries. The turntable was rotated to maximize the emission level.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average (Duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor ($10 \log(1/\text{duty cycle})$).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (Duty cycle \geq 98%) for Average detection (AV) at frequency above 1GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

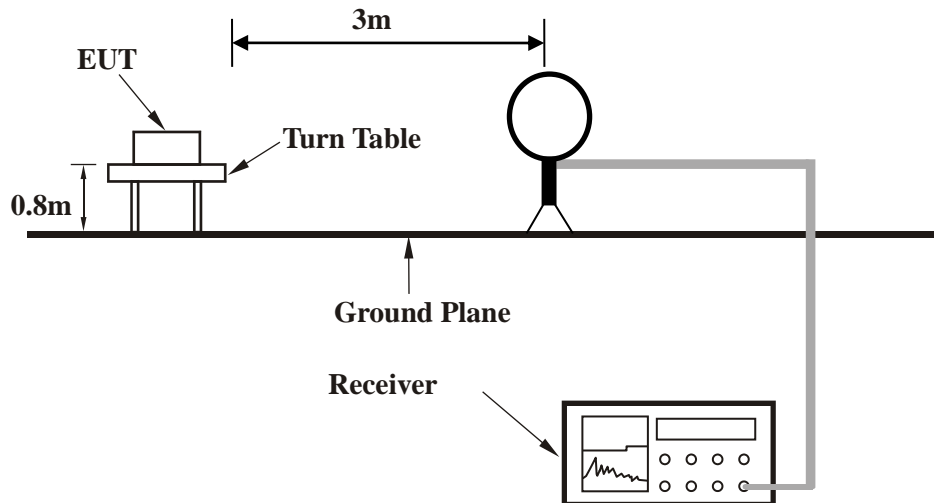
3.2.4 DEVIATION FROM TEST STANDARD

No deviation

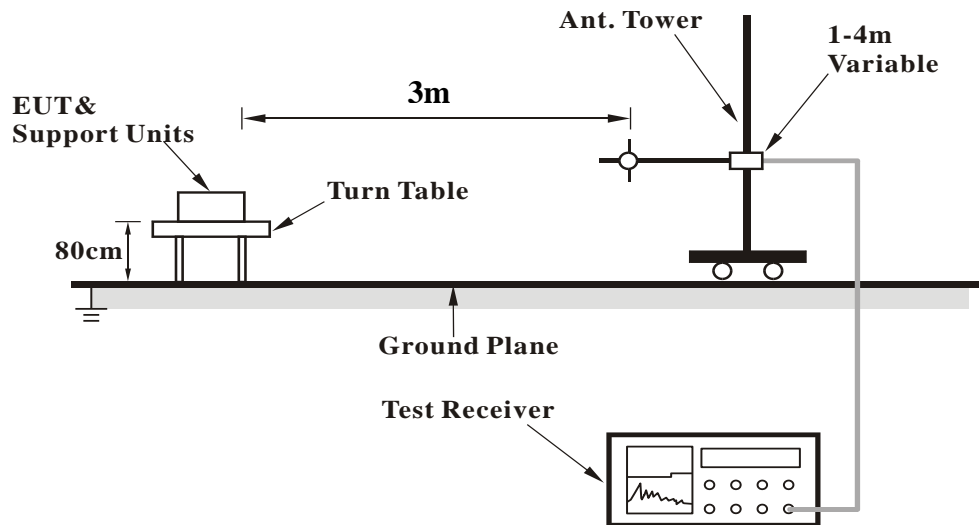


3.2.5 TEST SETUP

<Frequency Range 9KHz~30MHz >

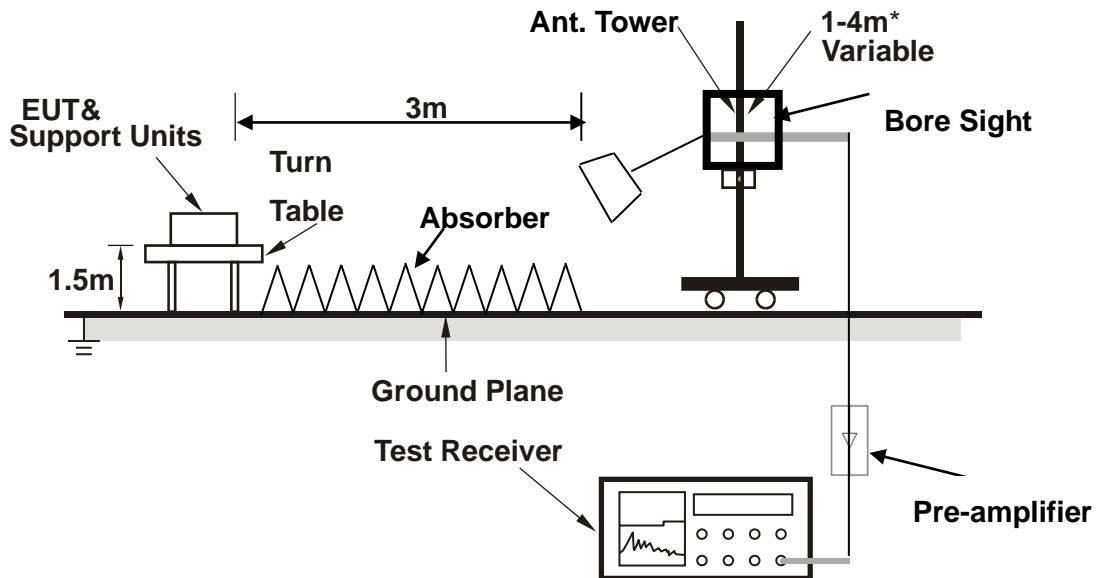


< Frequency Range 30MHz~1GHz >





<Frequency Range above 1GHz>



Note: Above 1G is a directional antenna

Depends on the EUT height and the antenna 3dB beamwidth both, refer to section 7.3 of CISPR 16-2-3.

For the actual test configuration, please refer to the attached file (Test Setup Photo).

3.2.6 EUT OPERATING CONDITIONS

- a. Set the EUT under full load condition and placed them on a testing table.
- b. Set the transmitter part of EUT under transmission condition continuously at specific channel frequency.
- c. The necessary accessories enable the EUT in full functions.



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Test Report No.: W7L-P23040024RF01

3.2.7 TEST RESULTS

NOTE : The 9K~30MHz amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required in the report.

BELOW 1GHz WORST-CASE DATA:

30 MHz – 1GHz data:

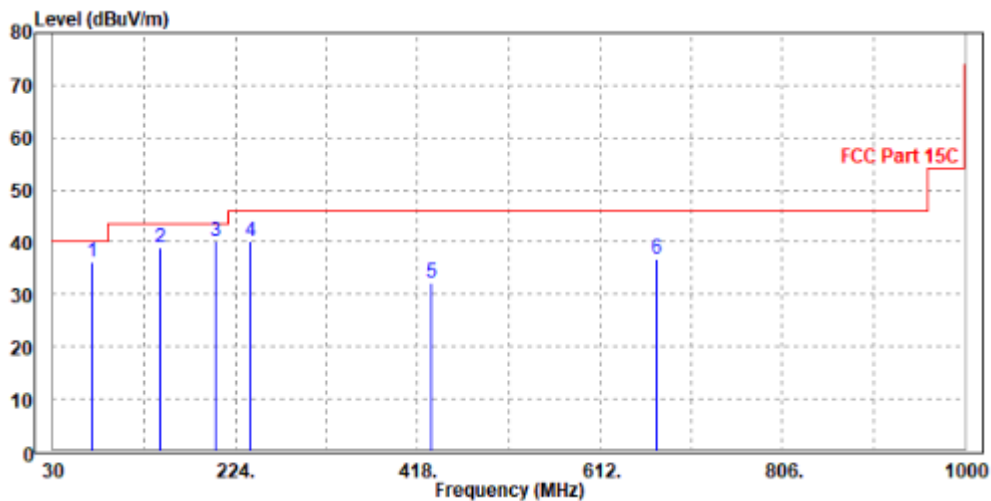
BT-LE_2M

| | | | |
|------------------------|---------------|-------------------------------|-----------------|
| CHANNEL | TX Channel 38 | ODETECTOR FUNCTION | Quasi-Peak (QP) |
| FREQUENCY RANGE | 30MHz ~ 1GHz | | |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | | | | |
|---|-------------------------------|-------------------------|-------------------|----------------|------------------------------|-----------------------|--------------------------|---------------------------|----------------------------|--------|--|
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB /m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK | |
| 71.71 | 36.07 | 64.86 | 40 | -3.93 | 7.7 | 0.47 | 36.96 | 106 | 258 | QP | |
| 144.46 | 38.85 | 65.42 | 43.5 | -4.65 | 9.37 | 0.65 | 36.59 | 198 | 205 | QP | |
| 203.63 | 40.03 | 64.12 | 43.5 | -3.47 | 11.46 | 0.74 | 36.29 | 107 | 84 | QP | |
| 240.49 | 40.06 | 62.45 | 46 | -5.94 | 13.08 | 0.81 | 36.28 | 154 | 211 | QP | |
| 431.58 | 32.14 | 50.7 | 46 | -13.86 | 16.8 | 1.12 | 36.48 | 186 | 18 | QP | |
| 672.14 | 36.66 | 51.26 | 46 | -9.34 | 21.07 | 1.44 | 37.11 | 163 | 197 | QP | |

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value



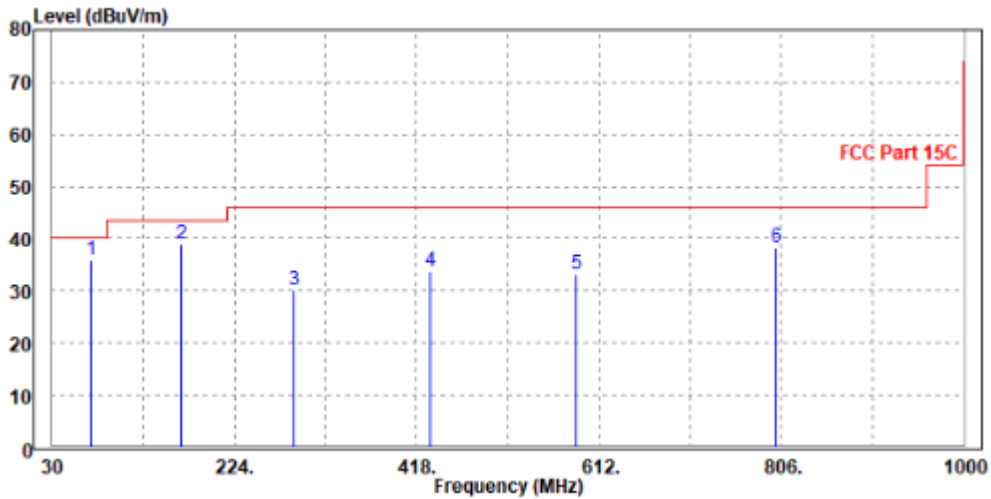


| | | | |
|------------------------|---------------|------------------------------|-----------------|
| CHANNEL | TX Channel 38 | DETECTOR FUNCTION | Quasi-Peak (QP) |
| FREQUENCY RANGE | 30MHz ~ 1GHz | | |

| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M | | | | | | | | | | |
|---|-------------------------------|-------------------------|-------------------|----------------|------------------------------|-----------------------|--------------------------|---------------------------|----------------------------|--------|
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB /m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 71.71 | 36.02 | 64.5 | 40 | -3.98 | 8.01 | 0.47 | 36.96 | 151 | 260 | QP |
| 167.74 | 39 | 63.75 | 43.5 | -4.5 | 11.02 | 0.69 | 36.46 | 114 | 101 | QP |
| 288.02 | 30.01 | 51.72 | 46 | -15.99 | 13.66 | 0.89 | 36.26 | 123 | 43 | QP |
| 431.58 | 33.72 | 52.37 | 46 | -12.28 | 16.71 | 1.12 | 36.48 | 184 | 313 | QP |
| 587.75 | 33.09 | 49.22 | 46 | -12.91 | 19.35 | 1.34 | 36.82 | 124 | 18 | QP |
| 800.18 | 38.29 | 52.31 | 46 | -7.71 | 21.6 | 1.58 | 37.2 | 160 | 312 | QP |

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value





ABOVE 1GHz TEST DATA:

Note: 1. For radiated emissions testing , the full testing range of different modes have been scanned , only the worst case harmonic data is reported in the sheet.

2. All other emissions were greater than 20dB below the limit was not recorded

BT-LE _1M

| | | | |
|------------------------|--------------|--------------------------|--------------|
| CHANNEL | TX Channel 0 | DETECTOR FUNCTION | Peak (PK) |
| FREQUENCY RANGE | 1GHz ~ 25GHz | | Average (AV) |

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB /m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
|-------------|-------------------------|-------------------|----------------|-------------|------------------------|-----------------|--------------------|---------------------|----------------------|---------|
| 2390 | 49.28 | 57.32 | 74 | -24.72 | 31.75 | 6.18 | 45.97 | 188 | 318 | Peak |
| 2390 | 41.98 | 50.02 | 54 | -12.02 | 31.75 | 6.18 | 45.97 | 188 | 318 | Average |
| 2402 | 104.31 | 112.3 | / | / | 31.79 | 6.19 | 45.97 | 188 | 318 | Peak |
| 2402 | 104.18 | 112.17 | / | / | 31.79 | 6.19 | 45.97 | 188 | 318 | Average |
| 2483.5 | 49.59 | 57.16 | 74 | -24.41 | 32.05 | 6.31 | 45.93 | 188 | 318 | Peak |
| 2483.5 | 42.79 | 50.36 | 54 | -11.21 | 32.05 | 6.31 | 45.93 | 188 | 318 | Average |

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB /m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
|-------------|-------------------------|-------------------|----------------|-------------|------------------------|-----------------|--------------------|---------------------|----------------------|---------|
| 2390 | 49.73 | 57.38 | 74 | -24.27 | 32.14 | 6.18 | 45.97 | 100 | 195 | Peak |
| 2390 | 43.07 | 50.72 | 54 | -10.93 | 32.14 | 6.18 | 45.97 | 100 | 195 | Average |
| 2402 | 101.96 | 109.58 | / | / | 32.16 | 6.19 | 45.97 | 100 | 195 | Peak |
| 2402 | 101.79 | 109.41 | / | / | 32.16 | 6.19 | 45.97 | 100 | 195 | Average |
| 2483.5 | 50.47 | 57.73 | 74 | -23.53 | 32.36 | 6.31 | 45.93 | 100 | 195 | Peak |
| 2483.5 | 43.04 | 50.3 | 54 | -10.96 | 32.36 | 6.31 | 45.93 | 100 | 195 | Average |

REMARKS:

- Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
Margin value = Emission level – Limit value.
- 2402MHz: Fundamental frequency.



| | | | |
|-----------------|---------------|-------------------|--------------|
| CHANNEL | TX Channel 19 | DETECTOR FUNCTION | Peak (PK) |
| FREQUENCY RANGE | 1GHz ~ 25GHz | | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | | | |
|---|-------------------------|-------------------|----------------|-------------|------------------------|-----------------|--------------------|---------------------|----------------------|---------|
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB /m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 2390 | 50.62 | 58.66 | 74 | -23.38 | 31.75 | 6.18 | 45.97 | 168 | 245 | Peak |
| 2390 | 42.45 | 50.49 | 54 | -11.55 | 31.75 | 6.18 | 45.97 | 168 | 245 | Average |
| 2440 | 103.58 | 111.37 | / | / | 31.91 | 6.25 | 45.95 | 168 | 245 | Peak |
| 2440 | 103.41 | 111.2 | / | / | 31.91 | 6.25 | 45.95 | 168 | 245 | Average |
| 2483.5 | 49.65 | 57.22 | 74 | -24.35 | 32.05 | 6.31 | 45.93 | 168 | 245 | Peak |
| 2483.5 | 43.52 | 51.09 | 54 | -10.48 | 32.05 | 6.31 | 45.93 | 168 | 245 | Average |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M | | | | | | | | | | |
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB /m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 2390 | 50.66 | 58.31 | 74 | -23.34 | 32.14 | 6.18 | 45.97 | 100 | 195 | Peak |
| 2390 | 43.02 | 50.67 | 54 | -10.98 | 32.14 | 6.18 | 45.97 | 100 | 195 | Average |
| 2440 | 98.35 | 105.79 | / | / | 32.26 | 6.25 | 45.95 | 100 | 195 | Peak |
| 2440 | 98.25 | 105.69 | / | / | 32.26 | 6.25 | 45.95 | 100 | 195 | Average |
| 2483.5 | 50.4 | 57.66 | 74 | -23.6 | 32.36 | 6.31 | 45.93 | 100 | 195 | Peak |
| 2483.5 | 43.13 | 50.39 | 54 | -10.87 | 32.36 | 6.31 | 45.93 | 100 | 195 | Average |

REMARKS:

- Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
Margin value = Emission level – Limit value.
- 2440MHz: Fundamental frequency.



| | | | |
|------------------------|---------------|------------------------------|--------------|
| CHANNEL | TX Channel 39 | DETECTOR FUNCTION | Peak (PK) |
| FREQUENCY RANGE | 1GHz ~ 25GHz | | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | | | |
|---|-------------------------------|-------------------------|-------------------|----------------|------------------------------|-----------------------|--------------------------|---------------------------|----------------------------|---------|
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB /m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 2390 | 49.69 | 57.73 | 74 | -24.31 | 31.75 | 6.18 | 45.97 | 165 | 240 | Peak |
| 2390 | 42.2 | 50.24 | 54 | -11.8 | 31.75 | 6.18 | 45.97 | 165 | 240 | Average |
| 2480 | 101.9 | 109.49 | / | / | 32.04 | 6.3 | 45.93 | 165 | 240 | Peak |
| 2480 | 101.77 | 109.36 | / | / | 32.04 | 6.3 | 45.93 | 165 | 240 | Average |
| 2483.5 | 50.97 | 58.54 | 74 | -23.03 | 32.05 | 6.31 | 45.93 | 165 | 240 | Peak |
| 2483.5 | 43.23 | 50.8 | 54 | -10.77 | 32.05 | 6.31 | 45.93 | 165 | 240 | Average |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M | | | | | | | | | | |
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB /m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 2390 | 51.49 | 59.14 | 74 | -22.51 | 32.14 | 6.18 | 45.97 | 123 | 180 | Peak |
| 2390 | 42.69 | 50.34 | 54 | -11.31 | 32.14 | 6.18 | 45.97 | 123 | 180 | Average |
| 2480 | 96.53 | 103.81 | / | / | 32.35 | 6.3 | 45.93 | 123 | 180 | Peak |
| 2480 | 96.4 | 103.68 | / | / | 32.35 | 6.3 | 45.93 | 123 | 180 | Average |
| 2483.5 | 51.16 | 58.42 | 74 | -22.84 | 32.36 | 6.31 | 45.93 | 123 | 180 | Peak |
| 2483.5 | 42.88 | 50.14 | 54 | -11.12 | 32.36 | 6.31 | 45.93 | 123 | 180 | Average |

REMARKS:

- Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
Margin value = Emission level – Limit value.
- 2480MHz: Fundamental frequency.

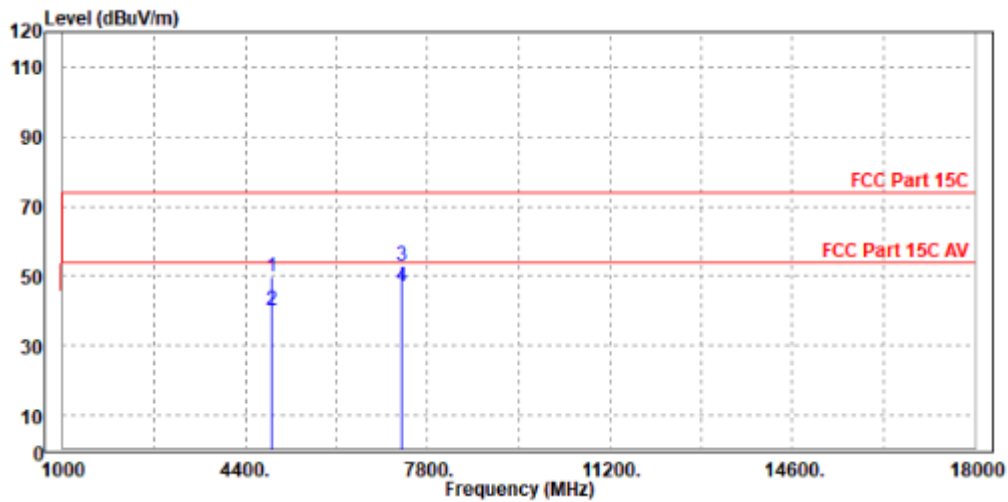


Worst case harmonic:

| | | | |
|------------------------|---------------|--------------------------|--------------|
| CHANNEL | TX Channel 19 | DETECTOR FUNCTION | Peak (PK) |
| FREQUENCY RANGE | 1GHz ~ 25GHz | | Average (AV) |

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

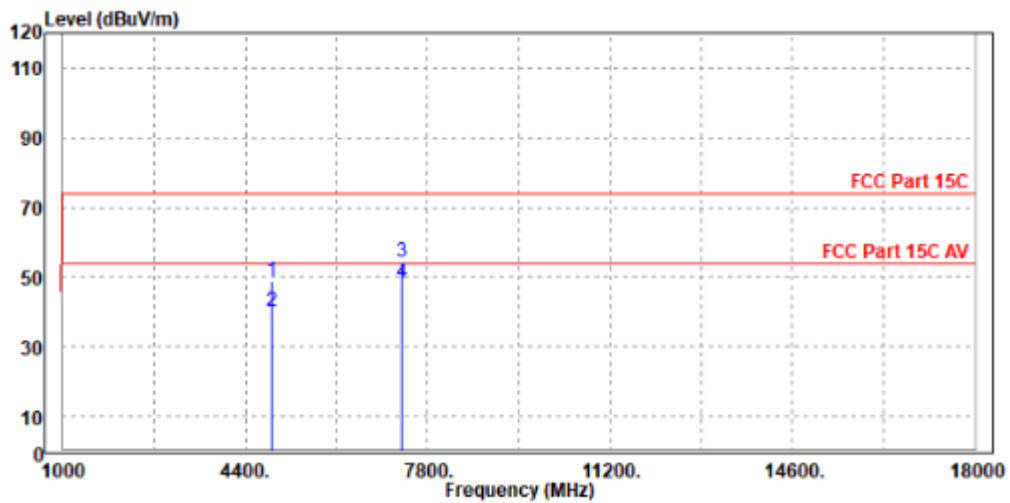
| | Freq | Level | Read Level | Limit Line | Over Limit | Factor | Remark | Pol/Phase |
|------|----------|--------|------------|------------|------------|--------|---------|------------|
| | MHz | dBuV/m | dBuV | dBuV/m | dB | dB/m | | |
| 1 | 4876.000 | 49.86 | 51.19 | 74.00 | -24.14 | -1.33 | Peak | Horizontal |
| 2 | 4876.000 | 40.26 | 41.59 | 54.00 | -13.74 | -1.33 | Average | Horizontal |
| 3 PK | 7320.000 | 53.11 | 51.25 | 74.00 | -20.89 | 1.86 | Peak | Horizontal |
| 4 PP | 7320.000 | 46.78 | 44.92 | 54.00 | -7.22 | 1.86 | Average | Horizontal |





ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

| | Freq | Level | Read Level | Limit Line | Over Limit | Factor | Remark | Pol/Phase |
|---|-------------|--------|------------|------------|------------|--------|---------|-----------|
| | MHz | dBuV/m | dBuV | dBuV/m | dB | dB/m | | |
| 1 | 4880.000 | 48.78 | 49.90 | 74.00 | -25.22 | -1.12 | Peak | Vertical |
| 2 | 4880.000 | 40.13 | 41.25 | 54.00 | -13.87 | -1.12 | Average | Vertical |
| 3 | PK 7324.000 | 54.24 | 52.31 | 74.00 | -19.76 | 1.93 | Peak | Vertical |
| 4 | PP 7324.000 | 48.25 | 46.32 | 54.00 | -5.75 | 1.93 | Average | Vertical |



REMARKS:

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
Margin value = Emission level – Limit value.
2. 2440MHz: Fundamental frequency.
3. For frequency above 18GHz, the emission was tested 20db below the limit so the data not recorded in the sheet



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Test Report No.: W7L-P23040024RF01

BT-LE_2M

| | | | |
|------------------------|--------------|------------------------------|--------------|
| CHANNEL | TX Channel 1 | DETECTOR FUNCTION | Peak (PK) |
| FREQUENCY RANGE | 1GHz ~ 25GHz | | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | | | |
|--|-------------------------------|-------------------------|-------------------|----------------|------------------------------|-----------------------|--------------------------|---------------------------|----------------------------|---------|
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB /m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 2390 | 49.2 | 57.24 | 74 | -24.8 | 31.75 | 6.18 | 45.97 | 318 | 188 | Peak |
| 2390 | 42.1 | 50.14 | 54 | -11.9 | 31.75 | 6.18 | 45.97 | 318 | 188 | Average |
| 2404 | 104 | 111.98 | / | / | 31.79 | 6.2 | 45.97 | 318 | 188 | Peak |
| 2404 | 102.8 | 110.78 | / | / | 31.79 | 6.2 | 45.97 | 318 | 188 | Average |
| 2483.5 | 49.77 | 57.34 | 74 | -24.23 | 32.05 | 6.31 | 45.93 | 318 | 188 | Peak |
| 2483.5 | 42.48 | 50.05 | 54 | -11.52 | 32.05 | 6.31 | 45.93 | 318 | 188 | Average |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M | | | | | | | | | | |
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB /m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 2390 | 49.53 | 57.18 | 74 | -24.47 | 32.14 | 6.18 | 45.97 | 100 | 180 | Peak |
| 2390 | 43.07 | 50.72 | 54 | -10.93 | 32.14 | 6.18 | 45.97 | 100 | 180 | Average |
| 2404 | 101.14 | 108.74 | / | / | 32.17 | 6.2 | 45.97 | 100 | 180 | Peak |
| 2404 | 99.87 | 107.47 | / | / | 32.17 | 6.2 | 45.97 | 100 | 180 | Average |
| 2483.5 | 51.33 | 58.59 | 74 | -22.67 | 32.36 | 6.31 | 45.93 | 100 | 180 | Peak |
| 2483.5 | 43.24 | 50.5 | 54 | -10.76 | 32.36 | 6.31 | 45.93 | 100 | 180 | Average |

REMARKS:

- Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
Margin value = Emission level – Limit value.
- 2404MHz: Fundamental frequency.



| | | | |
|-----------------|---------------|-------------------|--------------|
| CHANNEL | TX Channel 19 | DETECTOR FUNCTION | Peak (PK) |
| FREQUENCY RANGE | 1GHz ~ 25GHz | | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | | | |
|---|-------------------------|-------------------|----------------|-------------|------------------------|-----------------|--------------------|---------------------|----------------------|---------|
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB /m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 2390 | 49.82 | 57.86 | 74 | -24.18 | 31.75 | 6.18 | 45.97 | 168 | 245 | Peak |
| 2390 | 42.14 | 50.18 | 54 | -11.86 | 31.75 | 6.18 | 45.97 | 168 | 245 | Average |
| 2440 | 103.38 | 111.17 | / | / | 31.91 | 6.25 | 45.95 | 168 | 245 | Peak |
| 2440 | 102.09 | 109.88 | / | / | 31.91 | 6.25 | 45.95 | 168 | 245 | Average |
| 2483.5 | 49.52 | 57.09 | 74 | -24.48 | 32.05 | 6.31 | 45.93 | 168 | 245 | Peak |
| 2483.5 | 42.51 | 50.08 | 54 | -11.49 | 32.05 | 6.31 | 45.93 | 168 | 245 | Average |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M | | | | | | | | | | |
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB /m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 2390 | 49.45 | 57.1 | 74 | -24.55 | 32.14 | 6.18 | 45.97 | 100 | 195 | Peak |
| 2390 | 43.04 | 50.69 | 54 | -10.96 | 32.14 | 6.18 | 45.97 | 100 | 195 | Average |
| 2440 | 98.21 | 105.65 | / | / | 32.26 | 6.25 | 45.95 | 100 | 195 | Peak |
| 2440 | 96.93 | 104.37 | / | / | 32.26 | 6.25 | 45.95 | 100 | 195 | Average |
| 2483.5 | 50.46 | 57.72 | 74 | -23.54 | 32.36 | 6.31 | 45.93 | 100 | 195 | Peak |
| 2483.5 | 42.97 | 50.23 | 54 | -11.03 | 32.36 | 6.31 | 45.93 | 100 | 195 | Average |

REMARKS:

- Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
Margin value = Emission level – Limit value.
- 2440MHz: Fundamental frequency.



| | | | |
|------------------------|---------------|------------------------------|--------------|
| CHANNEL | TX Channel 38 | DETECTOR FUNCTION | Peak (PK) |
| FREQUENCY RANGE | 1GHz ~ 25GHz | | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | | | |
|---|-------------------------------|-------------------------|-------------------|----------------|------------------------------|-----------------------|--------------------------|---------------------------|----------------------------|---------|
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB /m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 2390 | 49.06 | 57.1 | 74 | -24.94 | 31.75 | 6.18 | 45.97 | 165 | 240 | Peak |
| 2390 | 42.22 | 50.26 | 54 | -11.78 | 31.75 | 6.18 | 45.97 | 165 | 240 | Average |
| 2478 | 102.25 | 109.85 | / | / | 32.03 | 6.3 | 45.93 | 165 | 240 | Peak |
| 2478 | 100.91 | 108.51 | / | / | 32.03 | 6.3 | 45.93 | 165 | 240 | Average |
| 2483.5 | 50.67 | 58.24 | 74 | -23.33 | 32.05 | 6.31 | 45.93 | 165 | 240 | Peak |
| 2483.5 | 42.59 | 50.16 | 54 | -11.41 | 32.05 | 6.31 | 45.93 | 165 | 240 | Average |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M | | | | | | | | | | |
| FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | READ LEVEL (dBuV) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA FACTOR (dB /m) | CABLE LOSS (dB) | PREAMP FACTOR (dB) | ANTENNA HEIGHT (cm) | TABLE ANGLE (Degree) | REMARK |
| 2390 | 49.66 | 57.31 | 74 | -24.34 | 32.14 | 6.18 | 45.97 | 127 | 180 | Peak |
| 2390 | 43.41 | 51.06 | 54 | -10.59 | 32.14 | 6.18 | 45.97 | 127 | 180 | Average |
| 2478 | 97.37 | 104.65 | / | / | 32.35 | 6.3 | 45.93 | 127 | 180 | Peak |
| 2478 | 95.86 | 103.14 | / | / | 32.35 | 6.3 | 45.93 | 127 | 180 | Average |
| 2483.5 | 50.05 | 57.31 | 74 | -23.95 | 32.36 | 6.31 | 45.93 | 127 | 180 | Peak |
| 2483.5 | 43.63 | 50.89 | 54 | -10.37 | 32.36 | 6.31 | 45.93 | 127 | 180 | Average |

REMARKS:

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
Margin value = Emission level – Limit value.
2. 2478MHz: Fundamental frequency.



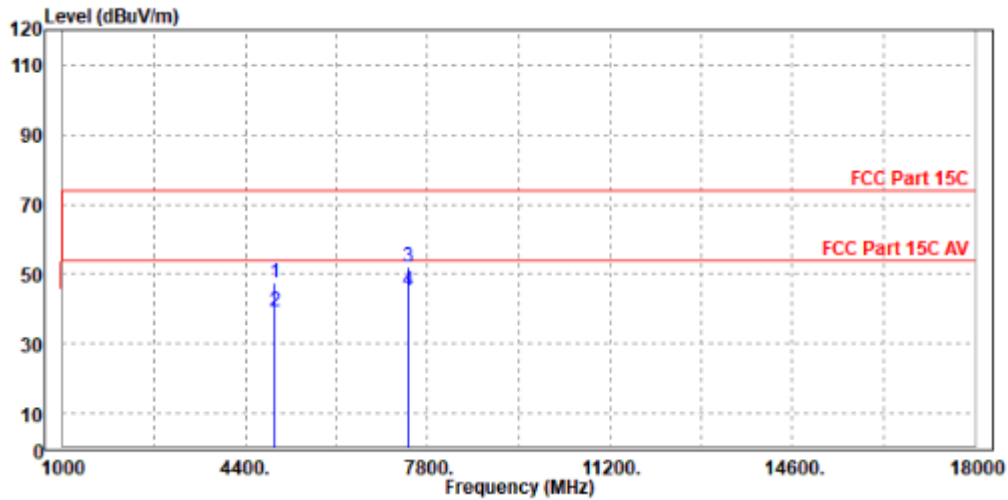
BUREAU VERITAS Test Report No.: W7L-P23040024RF01

Worst case harmonic:

| | | | |
|------------------------|---------------|--------------------------|--------------|
| CHANNEL | TX Channel 38 | DETECTOR FUNCTION | Peak (PK) |
| FREQUENCY RANGE | 1GHz ~ 25GHz | | Average (AV) |

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

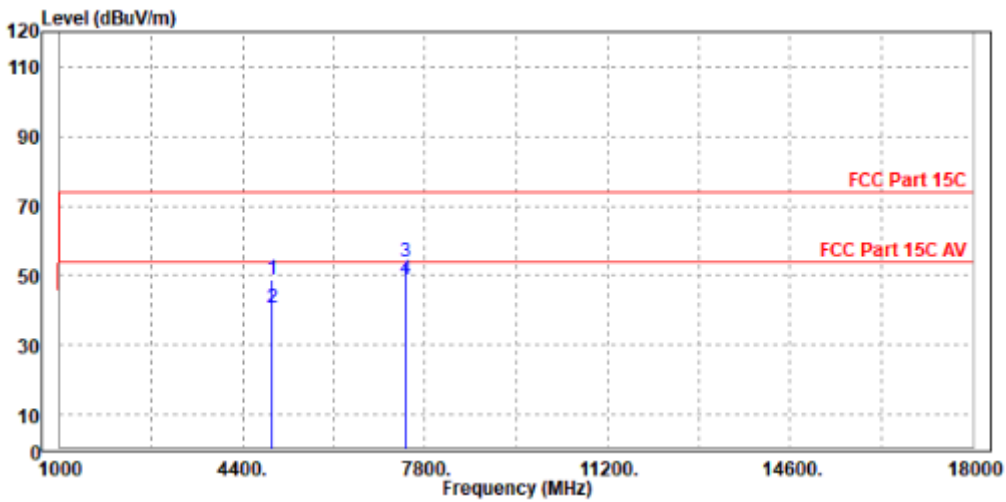
| | Freq | Level | Read Level | Limit Line | Over Limit | Factor | Remark | Pol/Phase |
|---|-------------|--------|------------|------------|------------|--------|---------|------------|
| | MHz | dBuV/m | dBuV | dBuV/m | dB | dB/m | | |
| 1 | 4956.000 | 47.61 | 48.81 | 74.00 | -26.39 | -1.20 | Peak | Horizontal |
| 2 | 4956.000 | 39.35 | 40.55 | 54.00 | -14.65 | -1.20 | Average | Horizontal |
| 3 | PK 7426.000 | 52.20 | 50.23 | 74.00 | -21.80 | 1.97 | Peak | Horizontal |
| 4 | PP 7426.000 | 45.21 | 43.24 | 54.00 | -8.79 | 1.97 | Average | Horizontal |





ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

| | Freq | Level | Read Level | Limit Line | Over Limit | Factor | Remark | Pol/Phase |
|---|-------------|--------|------------|------------|------------|--------|---------|-----------|
| | MHz | dBuV/m | dBuV | dBuV/m | dB | dB/m | | |
| 1 | 4961.000 | 48.74 | 49.73 | 74.00 | -25.26 | -0.99 | Peak | Vertical |
| 2 | 4961.000 | 40.64 | 41.63 | 54.00 | -13.36 | -0.99 | Average | Vertical |
| 3 | PK 7434.000 | 53.63 | 51.63 | 74.00 | -20.37 | 2.00 | Peak | Vertical |
| 4 | PP 7434.000 | 48.94 | 46.94 | 54.00 | -5.06 | 2.00 | Average | Vertical |



REMARKS:

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
Margin value = Emission level – Limit value.
2. 2478MHz: Fundamental frequency.
3. For frequency above 18GHz, the emission was tested 20db below the limit so the data not recorded in the sheet



3.3 6 dB BANDWIDTH MEASUREMENT

3.3.1 LIMITS OF 6dB BANDWIDTH MEASUREMENT

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

3.3.2 TEST INSTRUMENTS

| Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Next Cal. |
|---------------------|--------------|------------|------------|------------|------------|
| Power Meter | ANRITSU | ML2495A | 1506002 | Feb. 14,23 | Feb. 13,24 |
| EXA Signal Analyzer | KEYSIGHT | N9010A-526 | MY54510322 | Feb. 17,23 | Feb. 16,24 |
| EXA Signal Analyzer | KEYSIGHT | N9010A-544 | MY54510355 | May.14,22 | May.13,23 |
| EXA Signal Analyzer | KEYSIGHT | N9010A-544 | MY54510355 | May.13,23 | May.12,24 |
| Power Sensor | ANRITSU | MA2411B | 1339352 | Feb. 14,23 | Feb. 13,24 |

NOTE:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
2. The test was performed in RF Oven room.
3. The FCC Site Registration No. is 525120; The Designation No. is CN1171.

3.3.3 TEST PROCEDURE

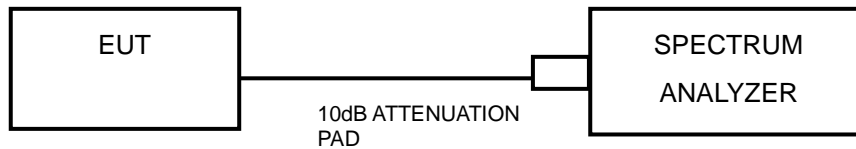
1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.



3.3.4 DEVIATION FROM TEST STANDARD

No deviation.

3.3.5 TEST SETUP



3.3.6 EUT OPERATING CONDITIONS

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.



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3.3.7 TEST RESULTS

Please Refer to Appendix Of this test report.

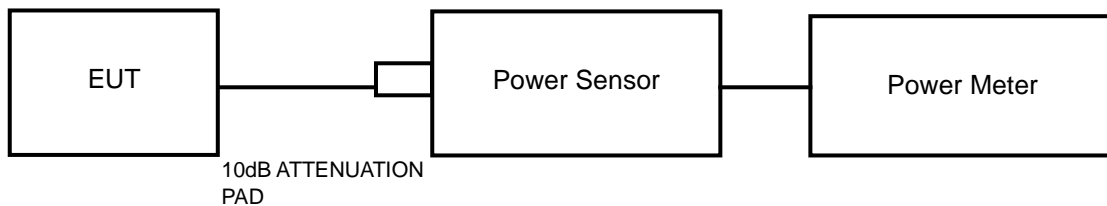


3.4 CONDUCTED OUTPUT POWER

3.4.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT

For systems using digital modulation in the 2400–2483.5 MHz band: 1 Watt (30dBm)

3.4.2 TEST SETUP



3.4.3 TEST INSTRUMENTS

Refer to section 3.3.2 to get information of above instrument.

3.4.4 TEST PROCEDURES

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

3.4.5 DEVIATION FROM TEST STANDARD

No deviation.

3.4.6 EUT OPERATING CONDITIONS

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.



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3.4.7 TEST RESULTS

3.4.7.1 MAXIMUM PEAK OUTPUT POWER

Please Refer to Appendix Of this test report.



3.4.7.2 AVERAGE OUTPUT POWER (FOR REFERENCE)

The average power sensor was used on the output port of the EUT. A power meter was used to read the response of the power sensor. Record the power level.

Please Refer to Appendix Of this test report.

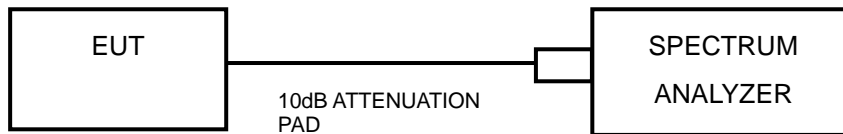


3.5 POWER SPECTRAL DENSITY MEASUREMENT

3.5.1 LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT

The Maximum of Power Spectral Density Measurement is 8dBm/3KHz.

3.5.2 TEST SETUP



3.5.3 TEST INSTRUMENTS

Refer to section 3.3.2 to get information of above instrument.

3.5.4 TEST PROCEDURE

1. Set the span to 1.5 times the DTS bandwidth
2. Set the RBW = 3 kHz, VBW \geq 3 x RBW, Detector = peak.
3. Sweep time = auto couple, Trace mode = max hold, allow trace to fully stabilize.
4. Use the peak marker function to determine the maximum amplitude level.

3.5.5 DEVIATION FROM TEST STANDARD

No deviation.

3.5.6 EUT OPERATING CONDITION

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.



3.5.7 TEST RESULTS

Please Refer to Appendix Of this test report.

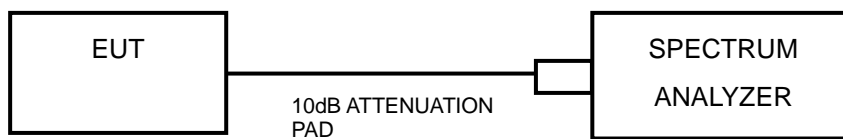


3.6 OUT OF BAND EMISSION MEASUREMENT

3.6.1 LIMITS OF OUT OF BAND EMISSION MEASUREMENT

Below -20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

3.6.2 TEST SETUP



3.6.3 TEST INSTRUMENTS

Refer to section 3.3.2 to get information of above instrument.

3.6.4 TEST PROCEDURE

MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW \geq 300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.



MEASUREMENT PROCEDURE OOB

1. Set RBW = 100 kHz.
2. Set VBW \geq 300 kHz.
3. Set span to encompass the spectrum to be examined
4. Detector = peak.
5. Trace Mode = max hold.
6. Sweep = auto couple.

3.6.5 DEVIATION FROM TEST STANDARD

No deviation.

3.6.6 EUT OPERATING CONDITION

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

3.6.7 TEST RESULTS

The spectrum plots are attached on the following images. D1 line indicates the highest level. D2 line indicates the 20dB offset below D1. It shows compliance to the requirement.

Please Refer to Appendix Of this test report.



3.7 ANTENNA REQUIREMENTS

3.7.1 STANDARD APPLICABLE

If transmitting antenna directional gain is greater than 6 dBi, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.7.2 ANTENNA CONNECTED CONSTRUCTION

An embedded-in antenna design is used.

3.7.3 ANTENNA GAIN

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit and PSD limit



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4 PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the attached file (Test Setup Photo).



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5 MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications are made to the EUT by the lab during the test.



6 APPENDIX

DTS BANDWIDTH

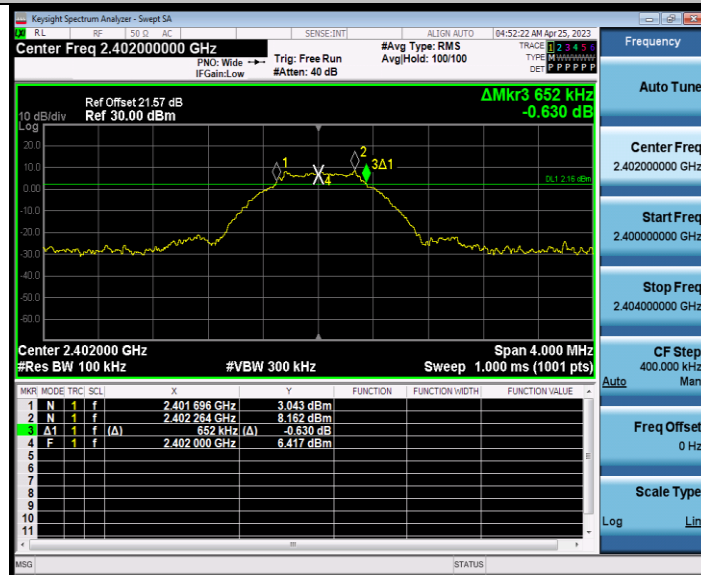
TEST RESULT

| TestMode | Antenna | Frequency[MHz] | DTS BW [MHz] | FL[MHz] | FH[MHz] | Limit[MHz] | Verdict |
|----------|---------|----------------|--------------|----------|----------|------------|---------|
| BLE_1M | Ant1 | 2402 | 0.652 | 2401.696 | 2402.348 | 0.5 | PASS |
| | | 2440 | 0.704 | 2439.664 | 2440.368 | 0.5 | PASS |
| | | 2480 | 0.660 | 2479.688 | 2480.348 | 0.5 | PASS |
| BLE_2M | Ant1 | 2404 | 1.380 | 2403.344 | 2404.724 | 0.5 | PASS |
| | | 2440 | 1.296 | 2439.360 | 2440.656 | 0.5 | PASS |
| | | 2478 | 1.408 | 2477.332 | 2478.740 | 0.5 | PASS |



TEST GRAPHS

BLE_1M_Ant1_2402



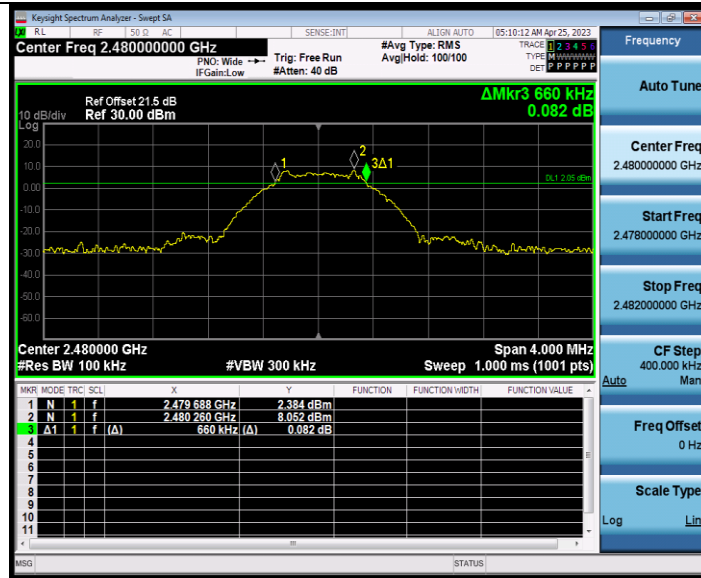
BLE_1M_Ant1_2440



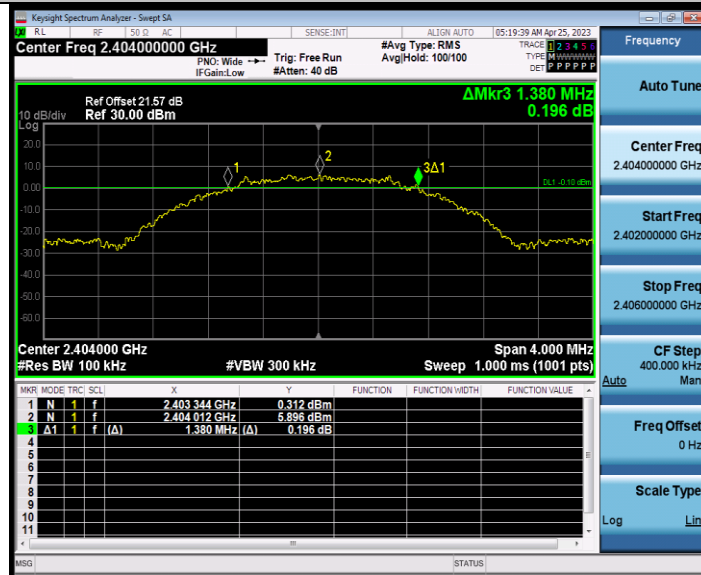
BLE_1M_Ant1_2480



BUREAU VERITAS Test Report No.: W7L-P23040024RF01



BLE_2M_Ant1_2404

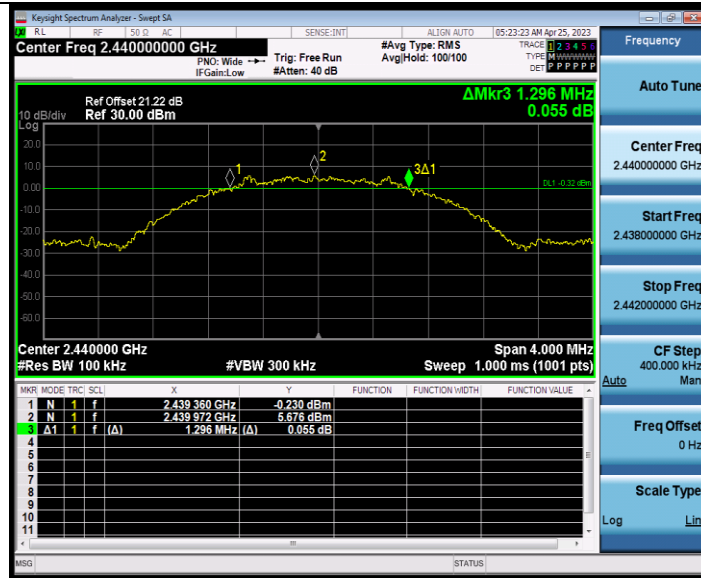


BLE_2M_Ant1_2440



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Test Report No.: W7L-P23040024RF01



BLE_2M_Ant1_2478





OCCUPIED CHANNEL BANDWIDTH TEST RESULT

| TestMode | Antenna | Frequency[MHz] | OCB [MHz] | FL[MHz] | FH[MHz] | Limit[MHz] | Verdict |
|----------|---------|----------------|-----------|-----------|-----------|------------|---------|
| BLE_1M | Ant1 | 2402 | 1.0258 | 2401.4987 | 2402.5245 | --- | --- |
| | | 2440 | 1.0451 | 2439.4920 | 2440.5371 | --- | --- |
| | | 2480 | 1.0523 | 2479.4927 | 2480.5450 | --- | --- |
| BLE_2M | Ant1 | 2404 | 2.0458 | 2402.9933 | 2405.0391 | --- | --- |
| | | 2440 | 2.0730 | 2438.9745 | 2441.0475 | --- | --- |
| | | 2478 | 2.0448 | 2476.9923 | 2479.0371 | --- | --- |



TEST GRAPHS





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Test Report No.: W7L-P23040024RF01



BLE_2M_Ant1_2404



BLE_2M_Ant1_2440



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Test Report No.: W7L-P23040024RF01



BLE_2M_Ant1_2478





MAXIMUM CONDUCTED OUTPUT POWER

TEST GRAPHS

| TestMode | Antenna | Channel | Average power [dBm] | Peak power [dBm] | Peak power [mw] | Conducted Limit [dBm] | EIRP [dBm] | EIRP [mw] | EIRP Limit [dBm] | Verdict | Power Setting |
|----------|---------|---------|---------------------|------------------|-----------------|-----------------------|------------|-----------|------------------|---------|---------------|
| BLE_1M | Ant1 | 2402 | 7.02 | 7.16 | 5.20 | ≤30 | 9.46 | 8.83 | ≤36 | PASS | 22 |
| | | 2440 | 7.14 | 7.25 | 5.31 | ≤30 | 9.55 | 9.02 | ≤36 | PASS | 21 |
| | | 2480 | 7.11 | 7.24 | 5.30 | ≤30 | 9.54 | 8.99 | ≤36 | PASS | 21 |
| BLE_2M | Ant1 | 2404 | 7.01 | 7.17 | 5.21 | ≤30 | 9.47 | 8.85 | ≤36 | PASS | 21 |
| | | 2440 | 7.16 | 7.28 | 5.35 | ≤30 | 9.58 | 9.08 | ≤36 | PASS | 21 |
| | | 2478 | 7.13 | 7.25 | 5.31 | ≤30 | 9.55 | 9.02 | ≤36 | PASS | 21 |

Note:EIRP=Peak Power+Gain



MAXIMUM POWER SPECTRAL DENSITY TEST RESULT

| TestMode | Antenna | Frequency[MHz] | Result[dBm/3kHz] | Limit[dBm/3kHz] | Verdict |
|----------|---------|----------------|------------------|-----------------|---------|
| BLE_1M | Ant1 | 2402 | -4.26 | ≤8.00 | PASS |
| | | 2440 | -4.96 | ≤8.00 | PASS |
| | | 2480 | -4.61 | ≤8.00 | PASS |
| BLE_2M | Ant1 | 2404 | -7.35 | ≤8.00 | PASS |
| | | 2440 | -7.55 | ≤8.00 | PASS |
| | | 2478 | -7.27 | ≤8.00 | PASS |

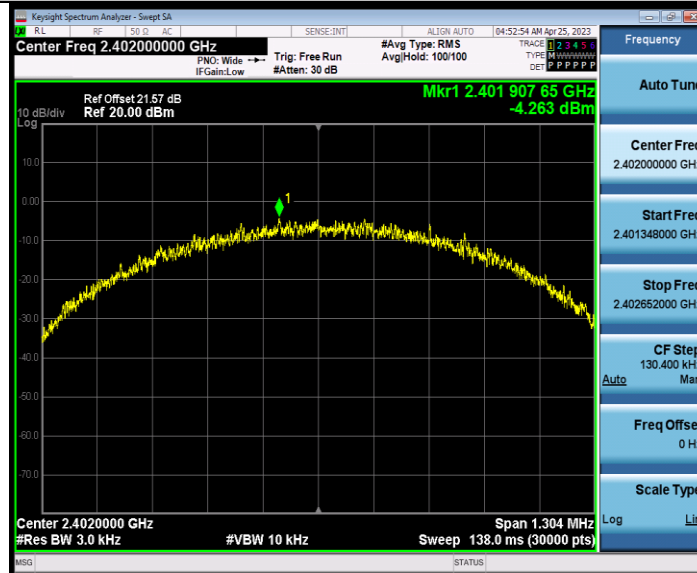


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Test Report No.: W7L-P23040024RF01

TEST GRAPHS

BLE_1M_Ant1_2402



BLE_1M_Ant1_2440

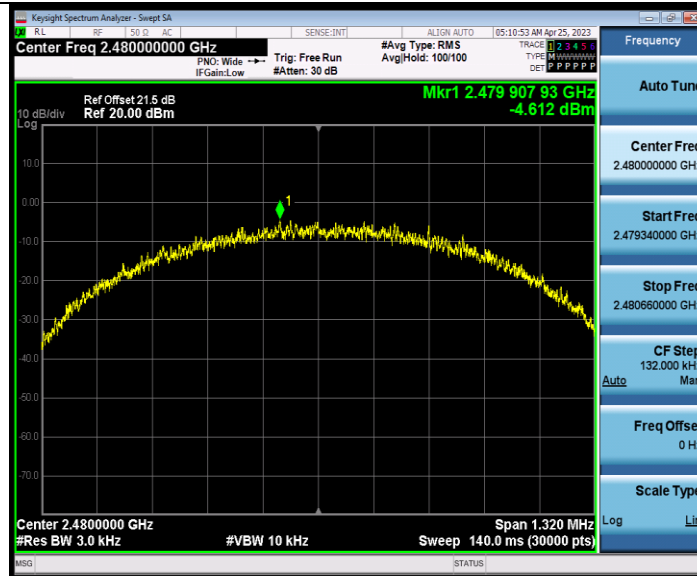


BLE_1M_Ant1_2480

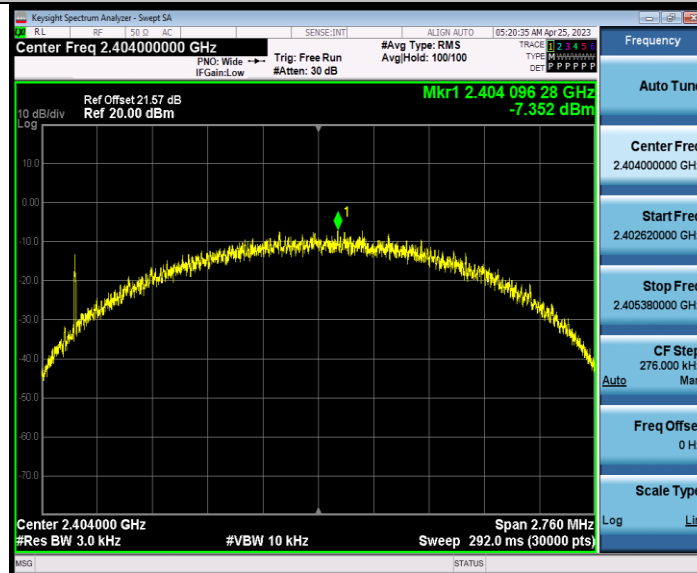


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Test Report No.: W7L-P23040024RF01



BLE_2M_Ant1_2404

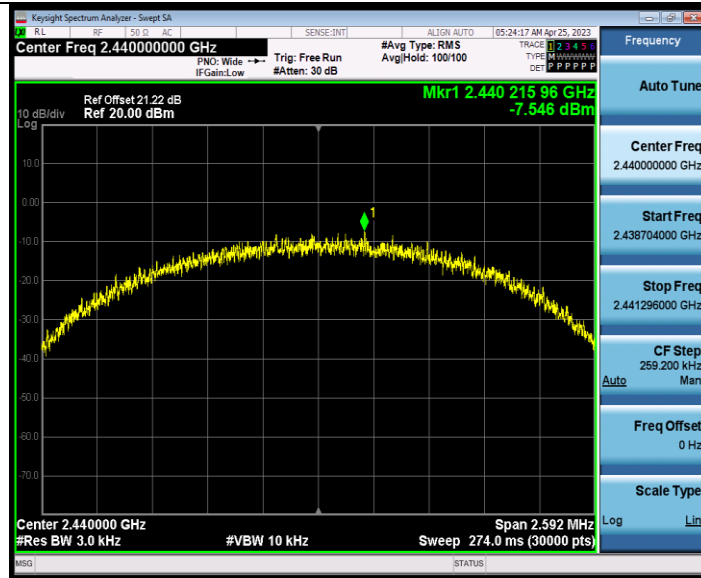


BLE_2M_Ant1_2440

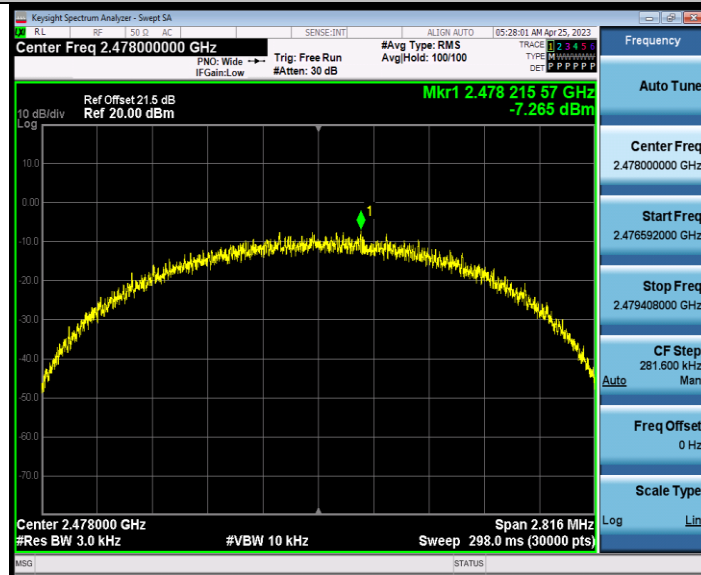


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Test Report No.: W7L-P23040024RF01



BLE_2M_Ant1_2478





BAND EDGE MEASUREMENTS

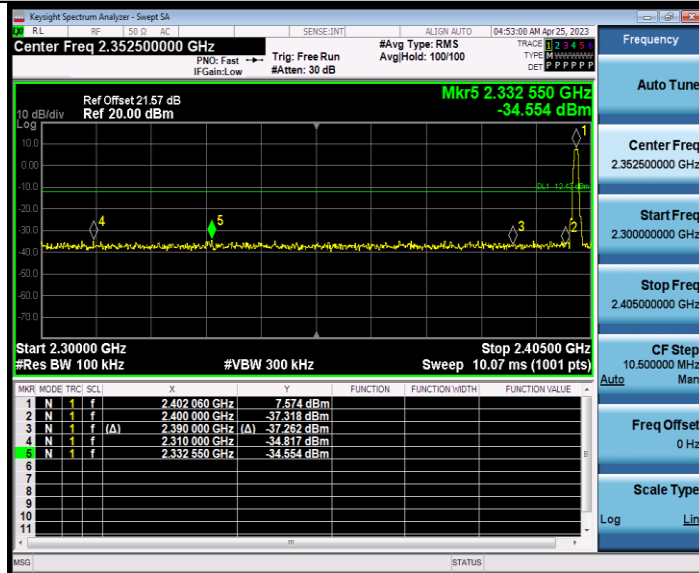
TEST RESULT

| TestMode | Antenna | ChName | Frequency[MHz] | RefLevel[dBm] | Result[dBm] | Limit[dBm] | Verdict |
|----------|---------|--------|----------------|---------------|-------------|------------|---------|
| BLE_1M | Ant1 | Low | 2402 | 7.57 | -34.55 | ≤-12.43 | PASS |
| | | High | 2480 | 7.26 | -34.42 | ≤-12.74 | PASS |
| BLE_2M | Ant1 | Low | 2404 | 6.52 | -34.18 | ≤-13.48 | PASS |
| | | High | 2478 | 5.73 | -34.05 | ≤-14.27 | PASS |

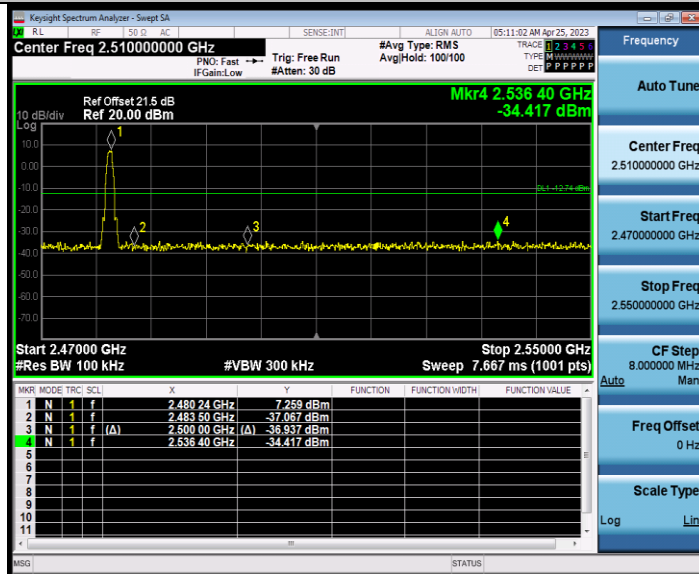


TEST GRAPHS

BLE_1M_Ant1_Low_2402



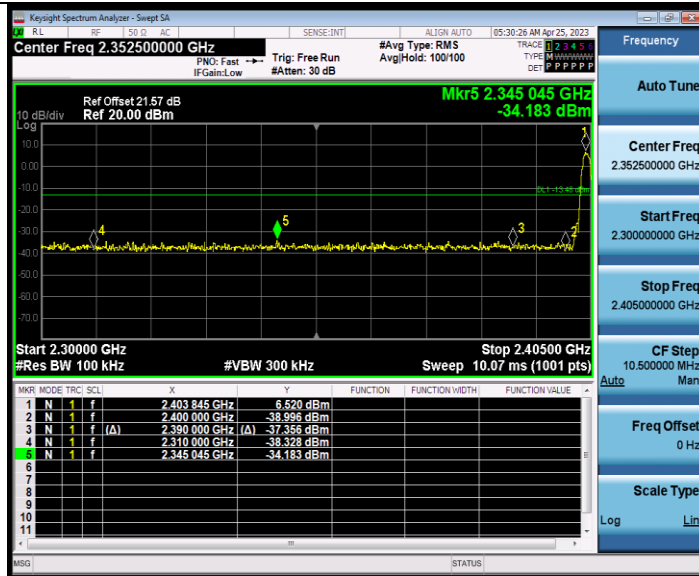
BLE_1M_Ant1_High_2480



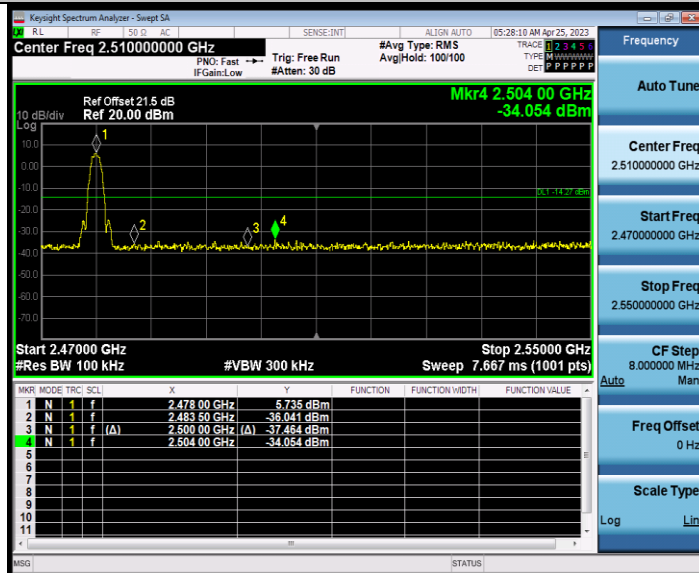
BLE_2M_Ant1_Low_2404



BUREAU VERITAS Test Report No.: W7L-P23040024RF01



BLE_2M_Ant1_High_2478





CONDUCTED SPURIOUS EMISSION TEST RESULT

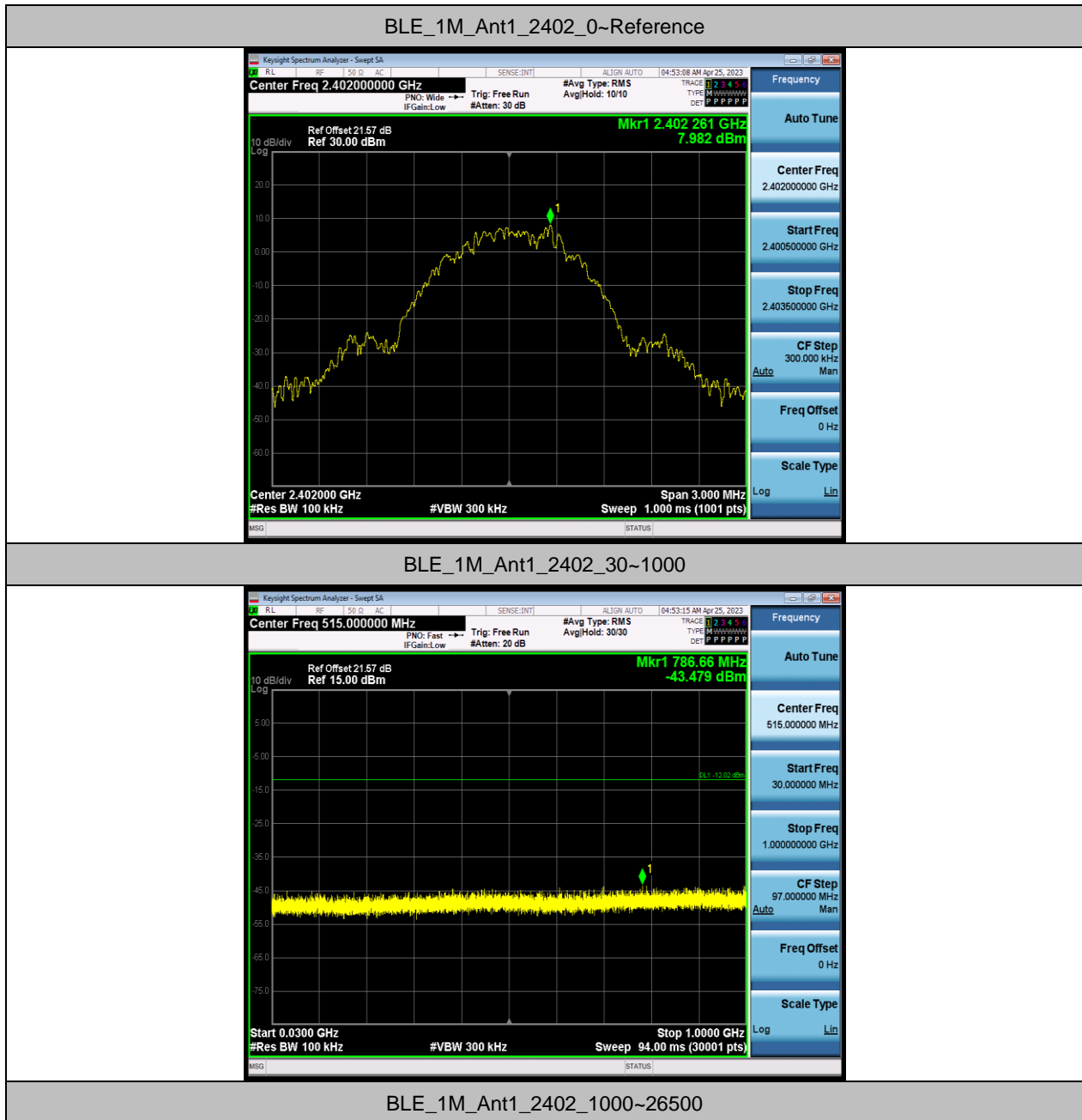
| TestMode | Antenna | Frequency[MHz] | FreqRange [MHz] | RefLevel [dBm] | Result[dBm] | Limit[dBm] | Verdict |
|----------|---------|----------------|-----------------|----------------|-------------|------------|---------|
| BLE_1M | Ant1 | 2402 | Reference | 7.98 | 7.98 | --- | PASS |
| | | | 30~1000 | 7.98 | -43.48 | ≤-12.02 | PASS |
| | | | 1000~26500 | 7.98 | -23.53 | ≤-12.02 | PASS |
| | | 2440 | Reference | 7.17 | 7.17 | --- | PASS |
| | | | 30~1000 | 7.17 | -43.06 | ≤-12.83 | PASS |
| | | | 1000~26500 | 7.17 | -24 | ≤-12.83 | PASS |
| | | 2480 | Reference | 7.17 | 7.17 | --- | PASS |
| | | | 30~1000 | 7.17 | -43.18 | ≤-12.83 | PASS |
| | | | 1000~26500 | 7.17 | -24.17 | ≤-12.83 | PASS |
| BLE_2M | Ant1 | 2404 | Reference | 5.16 | 5.16 | --- | PASS |
| | | | 30~1000 | 5.16 | -42.34 | ≤-14.84 | PASS |
| | | | 1000~26500 | 5.16 | -23.94 | ≤-14.84 | PASS |
| | | 2440 | Reference | 4.59 | 4.59 | --- | PASS |
| | | | 30~1000 | 4.59 | -43.58 | ≤-15.41 | PASS |
| | | | 1000~26500 | 4.59 | -24.21 | ≤-15.41 | PASS |
| | | 2478 | Reference | 5.19 | 5.19 | --- | PASS |
| | | | 30~1000 | 5.19 | -42.83 | ≤-14.81 | PASS |
| | | | 1000~26500 | 5.19 | -23.72 | ≤-14.81 | PASS |



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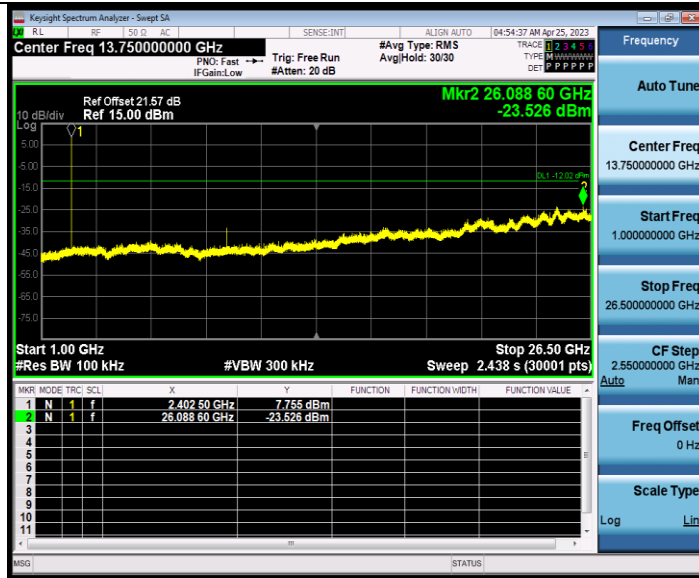
TEST GRAPHS





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Test Report No.: W7L-P23040024RF01



BLE_1M_Ant1_2440_0-Reference

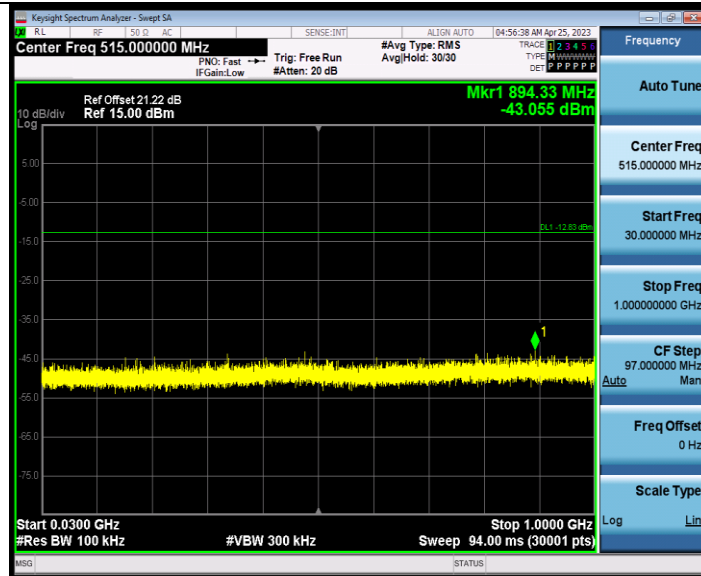


BLE_1M_Ant1_2440_30~1000



BUREAU VERITAS

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BLE_1M_Ant1_2440_1000~26500



BLE_1M_Ant1_2480_0~Reference

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Tel: +86 755 8869 6566
Fax: +86 755 8869 6577
Email: customerservice.sw@bureauveritas.com

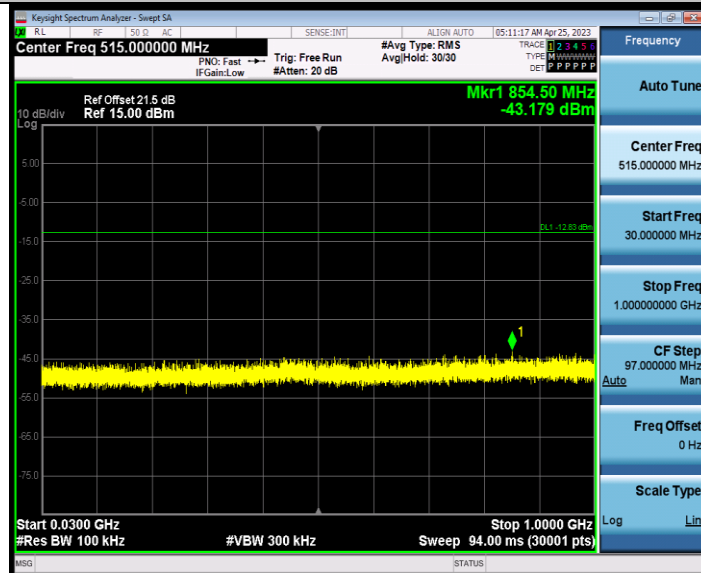


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Test Report No.: W7L-P23040024RF01



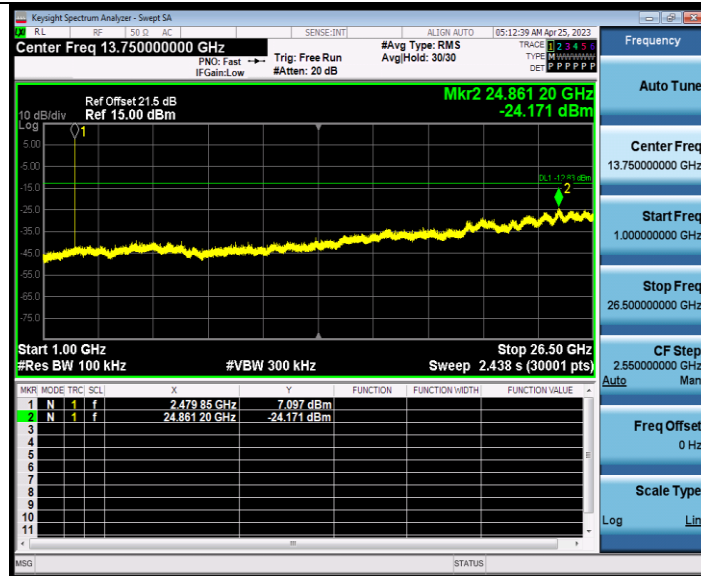
BLE_1M_Ant1_2480_30~1000



BLE_1M_Ant1_2480_1000~26500



BUREAU VERITAS Test Report No.: W7L-P23040024RF01



BLE_2M_Ant1_2404_0-Reference

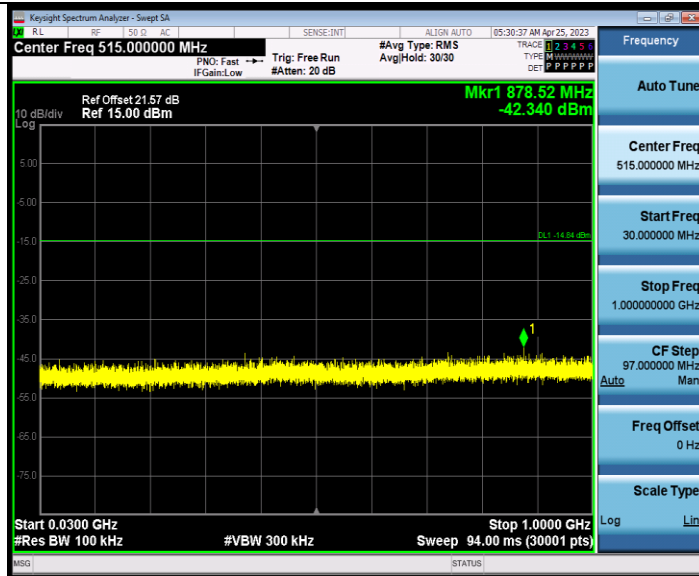


BLE_2M_Ant1_2404_30~1000



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Test Report No.: W7L-P23040024RF01



BLE_2M_Ant1_2404_1000~26500



BLE_2M_Ant1_2440_0~Reference

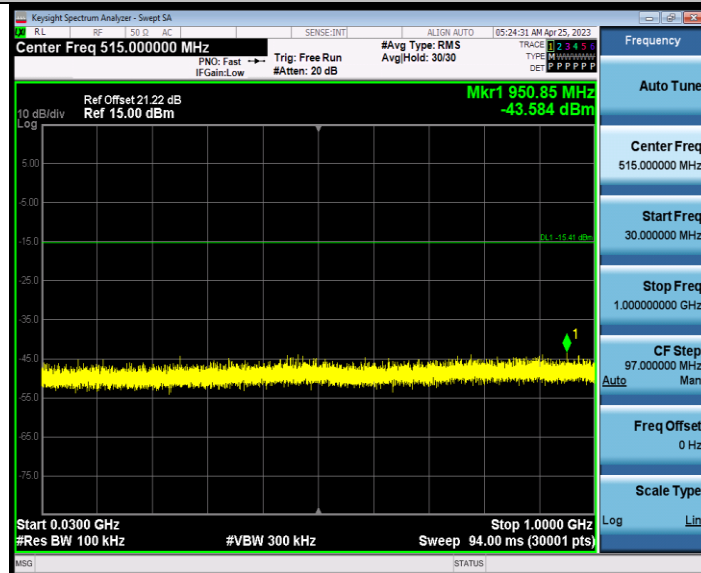


BUREAU VERITAS

Test Report No.: W7L-P23040024RF01



BLE_2M_Ant1_2440_30~1000



BLE_2M_Ant1_2440_1000~26500



**BUREAU
VERITAS**

Test Report No.: W7L-P23040024RF01



BLE_2M_Ant1_2478_0-Reference



BLE_2M_Ant1_2478_30~1000



**BUREAU
VERITAS**

Test Report No.: W7L-P23040024RF01



BLE_2M_Ant1_2478_1000~26500





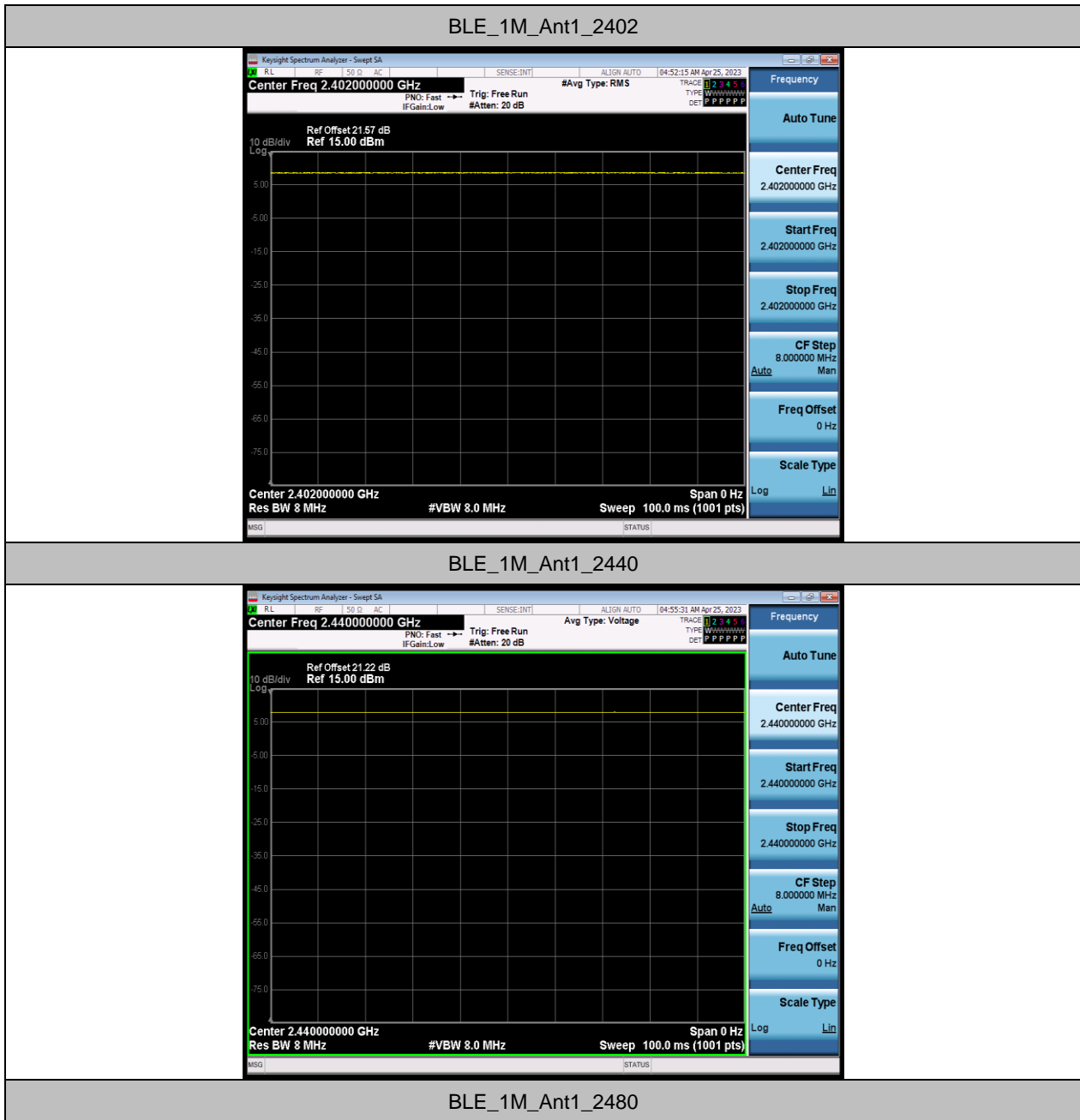
DUTY CYCLE

TEST RESULT

| TestMode | Antenna | Frequency[MHz] | ON Time [ms] | Period [ms] | Duty Cycle [%] | Duty Cycle Factor[dB] |
|----------|---------|----------------|-----------------|----------------|-------------------|--------------------------|
| BLE_1M | Ant1 | 2402 | 100.00 | 100.00 | 100.00 | 0.00 |
| | | 2440 | 100.00 | 100.00 | 100.00 | 0.00 |
| | | 2480 | 100.00 | 100.00 | 100.00 | 0.00 |
| BLE_2M | Ant1 | 2404 | 100.00 | 100.00 | 100.00 | 0.00 |
| | | 2440 | 100.00 | 100.00 | 100.00 | 0.00 |
| | | 2478 | 100.00 | 100.00 | 100.00 | 0.00 |



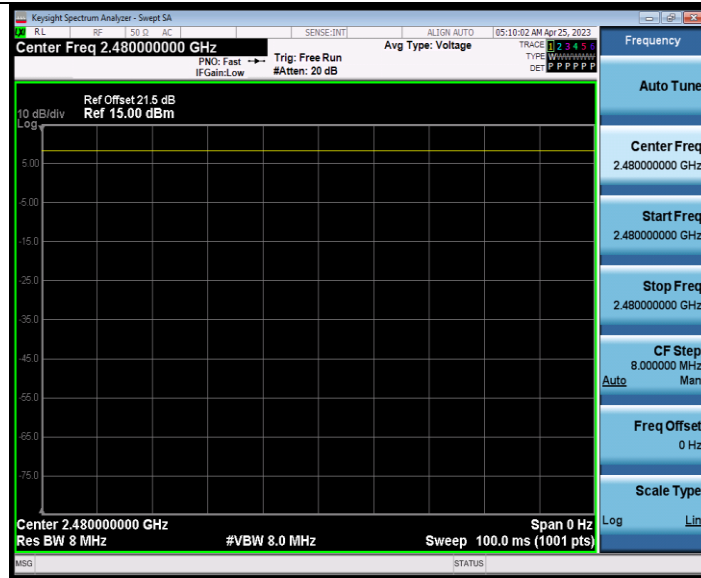
TEST GRAPHS



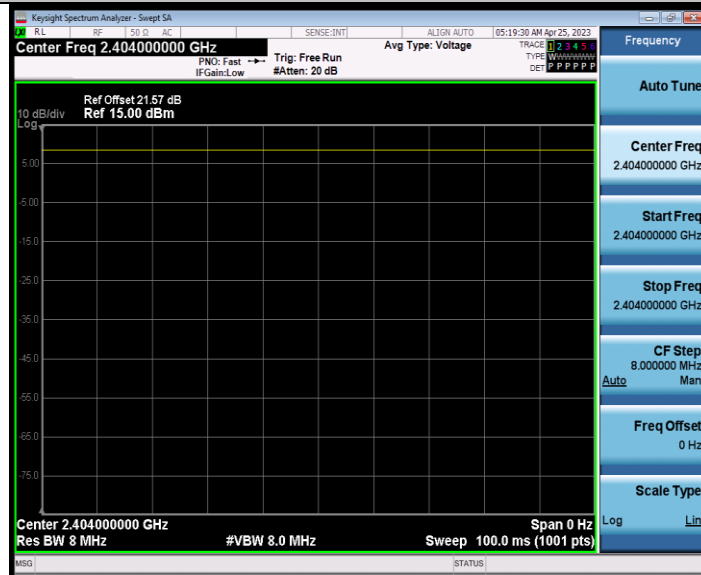


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BLE_2M_Ant1_2404

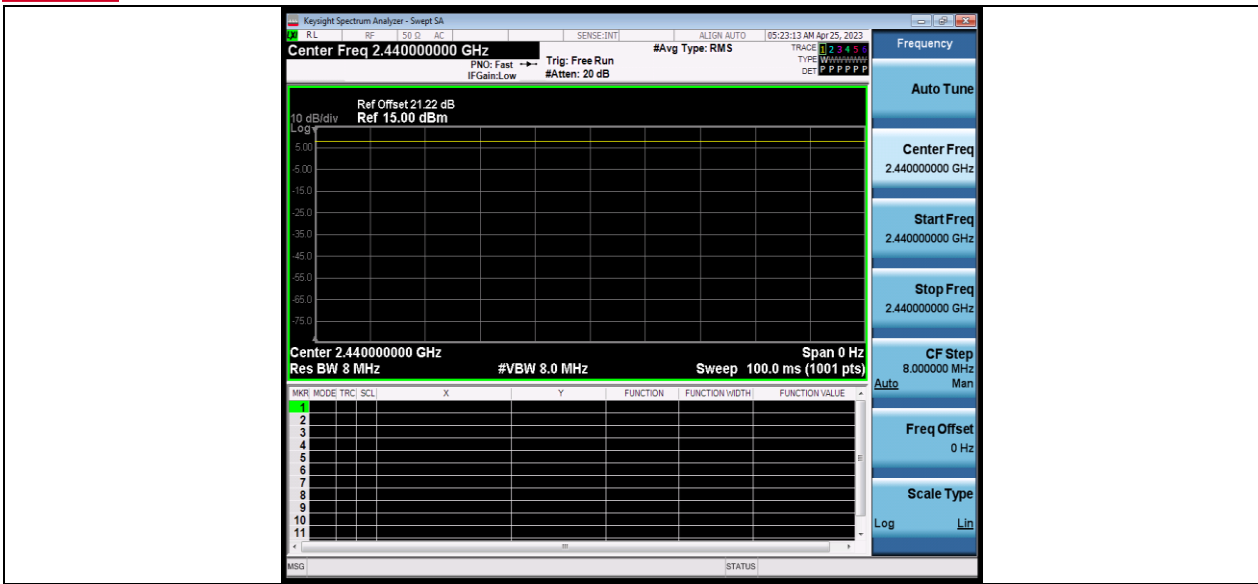


BLE_2M_Ant1_2440

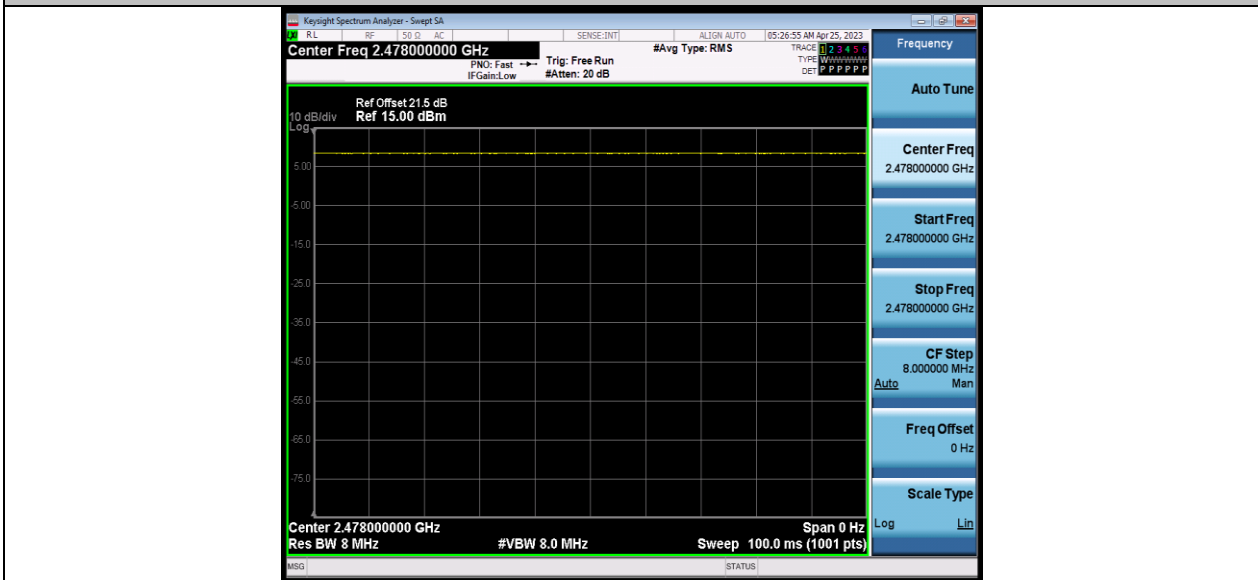


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VERITAS**

Test Report No.: W7L-P23040024RF01



BLE_2M_Ant1_2478



---END---