

Prüfbericht-Nr.: <i>Test report no.:</i>	CN23KLHV (P15C-BLE) 001	Auftrags-Nr.: <i>Order no.:</i>	48215145	Seite 1 von 28 Page 1 of 28
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	2023-02-02	
Auftraggeber: <i>Client:</i>	BEHAVIOR TECH COMPUTER CORP. 20F-B, No.98, Sec.1, Xintai 5th Rd., Xizhi Dist., New Taipei City 221411, Taiwan (R.O.C.)			
Prüfgegenstand: <i>Test item:</i>	AP-12			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	AP-12SC			
Auftrags-Inhalt: <i>Order content:</i>	FCC Part 15C Test report (BLE)			
Prüfgrundlage: <i>Test specification:</i>	FCC 47CFR Part 15: Subpart C Section 15.247			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2023-02-03			
Prüfmuster-Nr.: <i>Test sample no.:</i>	A003409438-002 A003409438-005			
Prüfzeitraum: <i>Testing period:</i>	2023-02-14 - 2023-02-22			
Ort der Prüfung: <i>Place of testing:</i>	EMC/RF Taipei Testing Site			
Prüflaboratorium: <i>Testing laboratory:</i>	Taipei Testing Laboratories			
Prüfergebnis*: <i>Test result*:</i>	Pass			
zusammengestellt von: <i>compiled by:</i>	genehmigt von: <i>authorized by:</i>			
Datum: <i>Date:</i>	2023-03-15	Ausstellungsdatum: <i>Issue date:</i>	2023-03-15	
Stellung / Position:	Senior Project Manager	Stellung / Position:	Senior Project Manager	
Sonstiges / Other:				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet * Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

TEST SUMMARY

Report Section	FCC Clause	Test Item	Result
5.1.1	15.247(b) & 15.203	Antenna Requirement	Pass
5.1.2	15.247(b)(3)	Peak Output Power	Pass
5.1.3	15.247(a)(2)	6 dB Bandwidth	Pass
5.1.3	2.1049	99% Occupied Bandwidth	Pass
5.1.4	15.247(e)	Power Spectral Density	Pass
5.1.5	15.247(d)	Conducted Spurious Emissions and Band Edges	Pass
5.1.6	15.247(d) & 15.205 & 15.209	Radiated Spurious Emissions and Band Edges	Pass
5.2.1	15.207	Mains Conducted Emission	Pass

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

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APPENDIX B - TEST RESULT OF RADIATED EMISSIONS & MAINS CONDUCTED EMISSION

APPENDIX SP - PHOTOGRAPHS OF TEST SETUP

APPENDIX EP - PHOTOGRAPHS OF EUT

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HISTORY OF THIS TEST REPORT

Report No.	Description	Date Issued
CN23KLHV (P15C-BLE) 001	Original Release	2023-03-15

1. General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix A - Test Result of Conducted

Appendix B - Test Result of Radiated Emissions & Mains Conducted Emission

Appendix SP - Photographs of Test Setup

Appendix EP - Photographs of EUT

Applied Standard and Test Levels

Radio
FCC 47CFR Part 15: Subpart C Section 15.247
FCC 47CFR Part 2: Subpart J Section 2.1049
ANSI C63.10:2013
KDB 558074 D01 15.247 Meas Guidance v05r02

1.2 Decision Rule of Conformity

The decision rule of conformity of this test report is following the requirements of the requested standard in the quotation, and agreed among testing laboratory and manufacturer (applicant) to exclude the consideration of Measurement Uncertainty, unless it is required by the specific standard.

2. Test Sites

2.1 Test Laboratory

Taipei Testing Laboratories

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

2.2 Test Facility

Taipei Testing Laboratories

No.458-18, Sec. 2, Fenliao Rd., Linkou Dist.,
New Taipei City 244
Taiwan (R.O.C.)
FCC Registration No.: 180491
ISED Registration No.: 25563

2.3 Traceability

All measurement equipment calibrations are traceable to NML(Taiwan)/NIST(USA) or where calibration is performed outside Taiwan, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically in a suitably accredited Calibration Lab. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

All measurement uncertainty values are shown with a coverage factor of $k=2$ to indicate a 95% level of confidence.

Emission Measurement Uncertainty

Parameter	Uncertainty
Radiated Emission (9 kHz ~ 30 MHz)	± 1.15 dB
Radiated Emission (30 MHz ~ 200 MHz)	± 1.30 dB
Radiated Emission (200 MHz ~ 1 GHz)	± 1.30 dB
Radiated Emission (1 GHz ~ 18 GHz)	± 1.54 dB
Radiated Emission (18 GHz ~ 40 GHz)	± 2.52 dB
Mains Conducted Emission	± 1.65 dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a AP-12. It contains a Bluetooth compatible module enabling the user to communicate data through a Wireless interface.

For details refer to the User Guide, Data Sheet and Circuit Diagram.

3.2 System Details and Ratings

Basic Information of EUT

Item	EUT information
Kind of Equipment/Test Item	AP-12
Type Identification	AP-12SC
FCC ID	E5XBMAP12SC

Technical Specification of EUT

Item	EUT information
Operating Frequency	2402 MHz ~ 2480 MHz
Channel Number	40
Data Rate	1Mbps, 2Mbps
Operation Voltage	3.3 Vdc
Modulation	GFSK
Maximum Output Power (mW)	2.84
Antenna Information	Refer to 5.1.1
Accessory Device	Refer to 4.4

3.3 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.4 Submitted Documents

- Circuit Diagram
- Instruction Manual
- Rating Label
- Technical Description

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The test modes were adapted accordingly in reference to the instructions for use.

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output expected by the customer and is going to be fixed on the firmware of the final end product.

Table for Parameters of Test Software Setting

Frequency (MHz)	Power Setting
2402	Default
2440	Default
2480	Default

4.2 Carrier Frequency and Channel

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

4.3 Test Operation and Test Software

Setup for testing: Test samples are provided with UART interface which makes it possible to control them by CMW500.

The samples were used as follows:

A003409438-002

A003409438-005

Full test was applied on all test modes, but only worst case was shown.

EUT Configure Mode	Applicable To				Description
	Antenna Port Conducted Measurement	Radiated Spurious Emissions above 1 GHz	Radiated Spurious Emissions below 1 GHz	Mains Conducted Emission	
-	√	√	√	√	-

Note:

1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when position on **Z-plane**.
2. "-" means no effect.

Antenna Port Conducted Measurement

- ☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Frequency (MHz)	Tested Frequency (MHz)	Date Rate (Mbps)
-	2402 to 2480	2402, 2440, 2480	1
-	2402 to 2480	2402, 2440, 2480	2

Radiated Spurious Emissions (Above 1 GHz)

- ☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Frequency (MHz)	Tested Frequency (MHz)	Date Rate (Mbps)
-	2402 to 2480	2402, 2440, 2480	1
-	2402 to 2480	2402, 2440, 2480	2

Radiated Spurious Emissions (Below 1 GHz)

- ☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Frequency (MHz)	Tested Frequency (MHz)	Date Rate (Mbps)
-	2402 to 2480	2480	2

Mains Conducted Emission

- ☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Frequency (MHz)	Tested Frequency (MHz)	Date Rate (Mbps)
-	2402 to 2480	2480	2

Test Condition

Test Item	Ambient Temperature	Relative Humidity	Tested by
Conducted Measurement	18-21.3 °C	45.7-58 %	Nick Hsu & Andy Chen
Radiated Spurious Emissions above 1 GHz	23.4-24.9 °C	61-63 %	Ray Huang
Radiated Spurious Emissions below 1 GHz	23.4-24.9 °C	61-63 %	Ray Huang
Mains Conducted Emission	20.5-25.8 °C	51.5-56.3 %	Ray Huang

4.4 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

Accessory of EUT

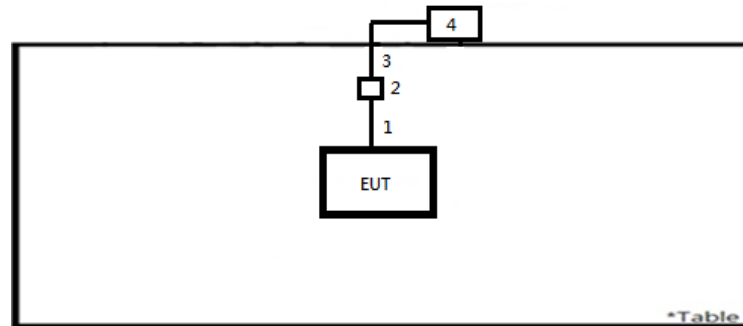
None

Support Unit

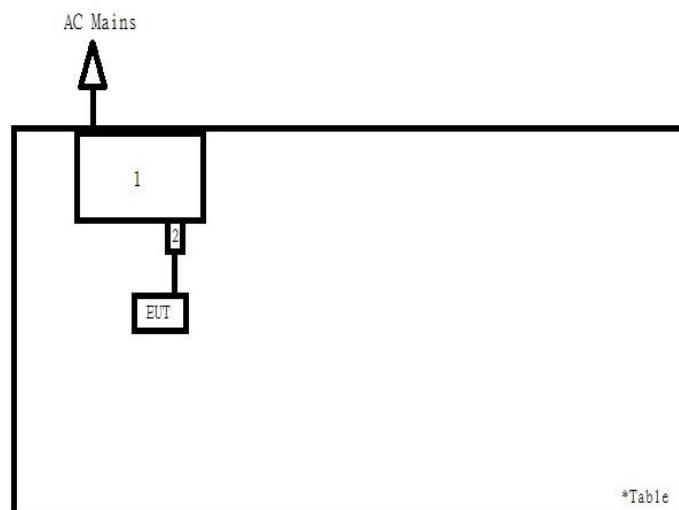
Support Unit								
No	Description	Brand	Model	S/N	Shielded	Ferrite Core (Qty)	Length (cm)	Remark
1	Cable	TUV	TUV-001	N/A	NO	NO	20	Radiated
2	USB TO TTL	TUV	TUV-002	N/A	-	-	-	
3	USB to USB Cable	TUV	TUV-003	N/A	NO	NO	100	
4	Base station	R&S	CMW 500	166923	-	-	-	
1	Base Station	R&S	CMW 500	166923	-	-	-	Mains Conducted
2	Uart	MODULES	CP2102	N/A	-	-	-	

4.5 Test Setup Diagram

<Radiated Spurious Emissions mode>

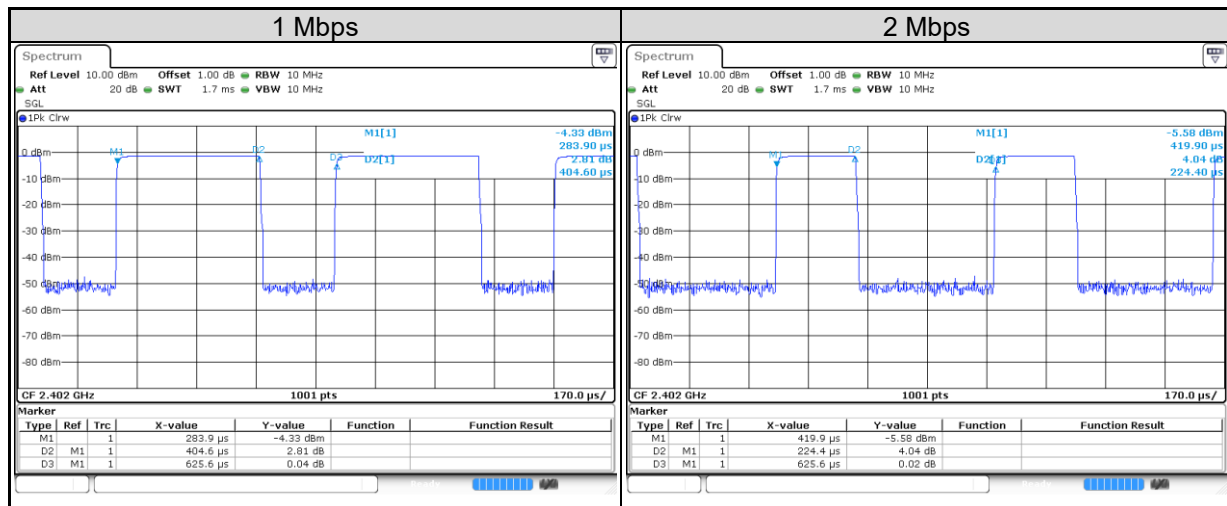


<Mains Conducted Emission mode>



4.6 Duty Cycle of Test Signal

Mode	On + Off Time (ms)	On Time (ms)	Duty Cycle (%)	Duty Factor (dB)
1 Mbps	0.6256	0.4046	64.67	1.89
2 Mbps	0.6256	0.2244	35.87	4.45



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

Requirement Use of approved antennas only

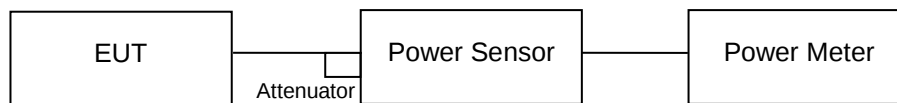
According to the manufacturer declaration, the EUT has an antenna with a directional gain of -3.37 dBi. The antenna is PCB antenna with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision.
Refer to EUT photo for details.

5.1.2 Peak Output Power

Limit 1 watt (30 dBm)

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Power Meter	Anritsu	ML2495A	1901008	2022/3/15	2023/3/14	2023/2/14	2023/2/15
Power Sensor	Anritsu	MA2411B	1725269	2022/3/15	2023/3/14	2023/2/14	2023/2/15

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.

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

Test Result
Peak Output Power
<1Mbps>

Channel	Channel Frequency	Peak Output Power		Limit (dBm)
	(MHz)	(dBm)	(mW)	
Low Channel	2402	1.09	1.29	30
Middle Channel	2440	3.21	2.09	30
High Channel	2480	4.53	2.84	30

<2Mbps>

Channel	Channel Frequency	Peak Output Power		Limit (dBm)
	(MHz)	(dBm)	(mW)	
Low Channel	2402	1.06	1.28	30
Middle Channel	2440	3.21	2.09	30
High Channel	2480	4.53	2.84	30

Average Power
<1Mbps>

Channel	Channel Frequency	Average Power	
	(MHz)	(dBm)	(mW)
Low Channel	2402	0.95	1.24
Middle Channel	2440	3.11	2.05
High Channel	2480	4.46	2.79

<2Mbps>

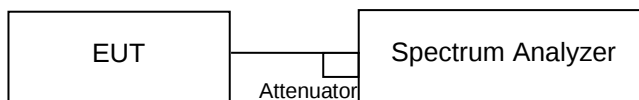
Channel	Channel Frequency	Average Power	
	(MHz)	(dBm)	(mW)
Low Channel	2402	0.94	1.24
Middle Channel	2440	3.09	2.04
High Channel	2480	4.46	2.79

5.1.3 6 dB Bandwidth and 99% Occupied Bandwidth

Limit The minimum 6 dB bandwidth shall be at least 500 kHz.

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2022/2/24	2023/2/23	2023/2/14	2023/2/15

Test Procedure

- Set resolution bandwidth (RBW) = 100 kHz
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.
- For 99% occupied bandwidth measurement, the transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to PEAK. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean power of a given emission.

Test Results

Please refer to Appendix A.

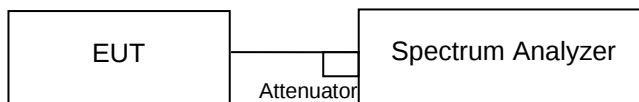
5.1.4 Power Spectral Density

Limit

The power spectral density shall not be greater than 8 dBm in any 3 kHz band.

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2022/2/24	2023/2/23	2023/2/14	2023/2/15

Test Procedure

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- Set the VBW $\geq 3 \times \text{RBW}$.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level within the RBW.

Test Results

Please refer to Appendix A.

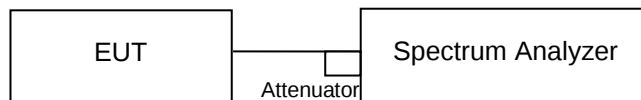
5.1.5 Conducted Spurious Emissions and Frequency Band Edges Measured in 100kHz Bandwidth

Limit

20dB (below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.)

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2022/2/24	2023/2/23	2023/2/14	2023/2/15

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 OOBE

1. Set RBW = 100 kHz.
2. Set VBW $\geq$ 300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

Test Results

Please refer to Appendix A.

5.1.6 Radiated Spurious Emissions and Band Edges

Limit

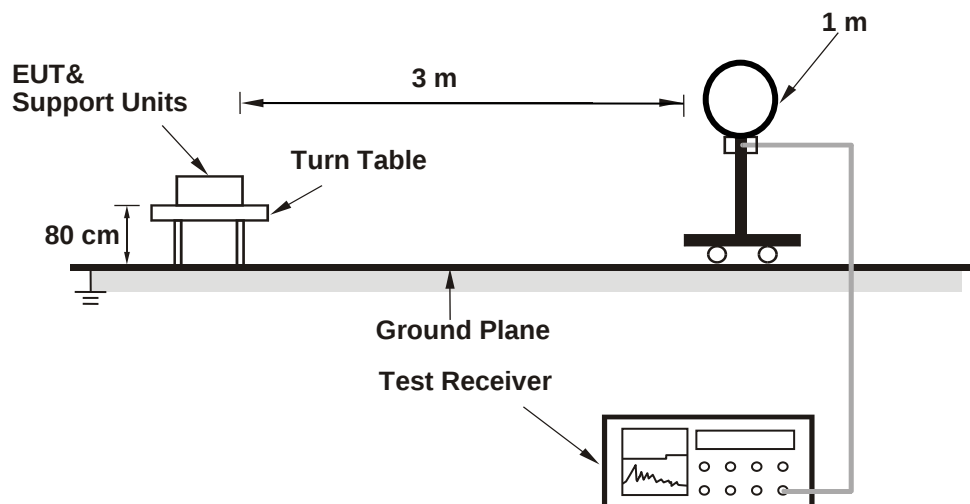
Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a).

Emissions radiated outside the restricted and authorized frequency bands must either comply with the radiated emission limits specified for the restricted bands or in §15.247(d).

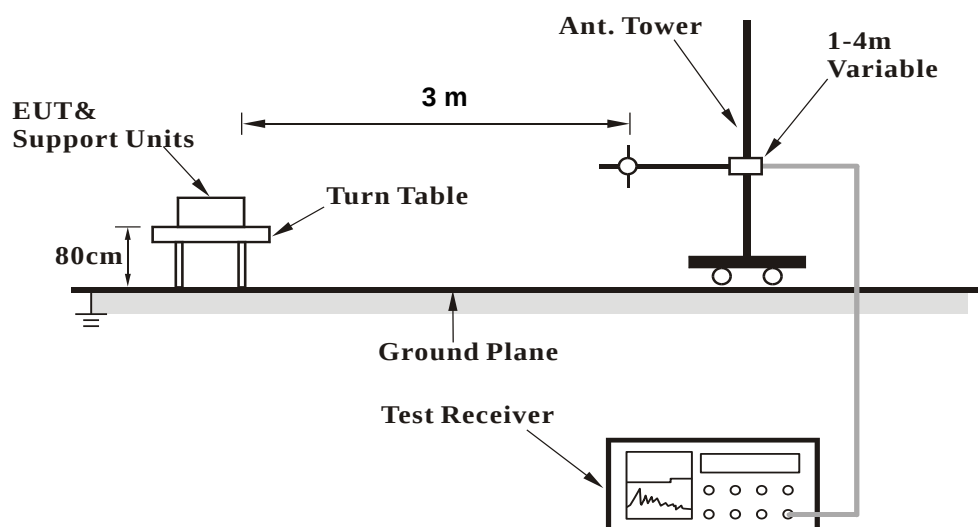
Kind of Test Site 3m Semi-Anechoic Chamber

Test Setup

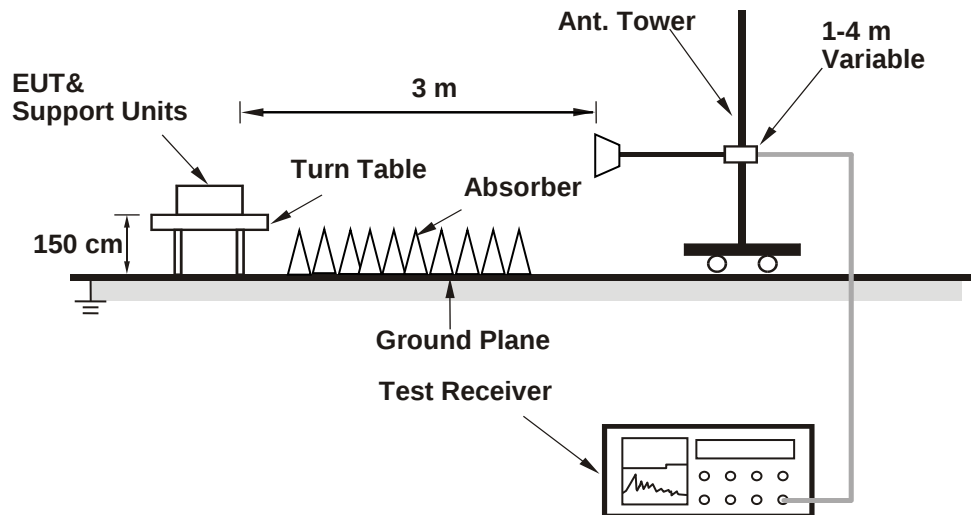
<Radiated Emissions below 30 MHz>



<Radiated Emissions 30 MHz to 1 GHz>



<Radiated Emissions above 1 GHz>



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

Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
Above 1 GHz					
Signal Analyzer	R&S	FSV40	101508	2022/4/13	2023/4/12
Horn Antenna	ETS-Lindgren	3117	00218929	2022/12/8	2023/12/7
HF-AMP + AC source	EMCI	EMC051845SE	980656	2023/1/16	2024/1/15
HF-AMP + AC source	EM	EM01G18GA	060905	2022/11/28	2023/11/27
Horn Antenna	SCHWARZBECK	BBHA 9170	00887	2022/3/29	2023/3/28
Test Software	Audix E3	15914a_20191106 tuv	PK-001087	N/A	N/A
30 MHz ~ 1 GHz					
Receiver	R&S	ESR7	102108	2022/4/28	2023/4/27
Bilog Antenna	SCHWARZBECK	VULB-9168	00950	2022/4/6	2023/4/5
LF-AMP	Agilent	8447D	2944A107722	2022/3/22	2023/3/21
Test Software	Audix E3	15914a_20191106 tuv	PK-001087	N/A	N/A
Receiver	R&S	ESR7	102108	2022/4/28	2023/4/27
Below 30 MHz					
Receiver	R&S	ESR7	102108	2022/4/28	2023/4/27
Loop Antenna	FMZB	1519B	00215	2023/1/4	2024/1/3
Test Software	Audix E3	15914a_20191106 tuv	PK-001087	N/A	N/A

Test Procedures**For Radiated Emissions below 30 MHz**

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. 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. Parallel (OPEN), perpendicular (CLOSE), and ground-parallel (GROUND) orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case 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 Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz at frequency below 30 MHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

For Radiated Emissions above 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1 GHz) / 1.5 meters (for above 1 GHz) 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 height of antenna 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 quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
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 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98 %) or 10 Hz (Duty cycle ≥ 98 %) for Average detection (AV) at frequency above 1 GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.
5. The Radiated Emissions testing was performed in the X(E1), Y(H) and Z(E2) axis orientation. The worst-case Axis orientation is recorded in this test report.

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Test Results

Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB)
Level (dBuV/m) = Reading (dBuV) + Factor (dB/m)

Please refer to Appendix B.

5.2 Mains Emission

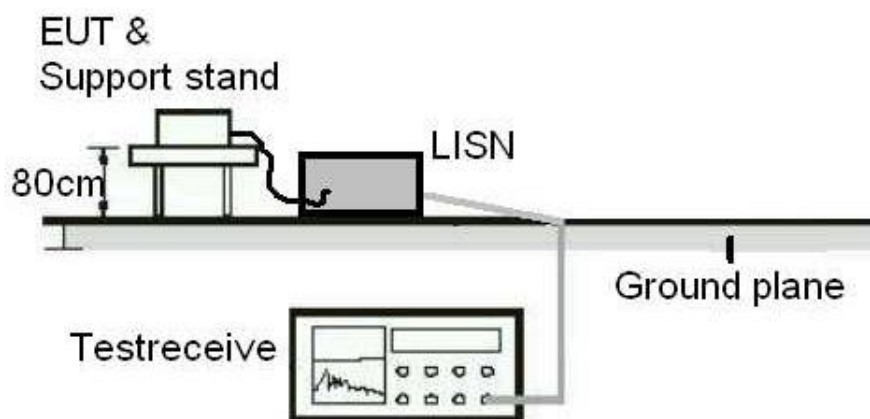
5.2.1 Mains Conducted Emission

Limit

Mains Conducted Emission as defined in §15.207 must comply with the mains conducted emission limits.

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
Two-Line V-Network	Rohde & Schwarz	ENV216	101938	2022/9/22	2023/9/21
EMI Test Receiver	R&S	ESCI	100797	2022/6/19	2023/6/18

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/50 uH 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 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

Note: The resolution bandwidth and video bandwidth of test receiver is 9 kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15 MHz – 30 MHz.

Test Results

Please refer to Appendix B.

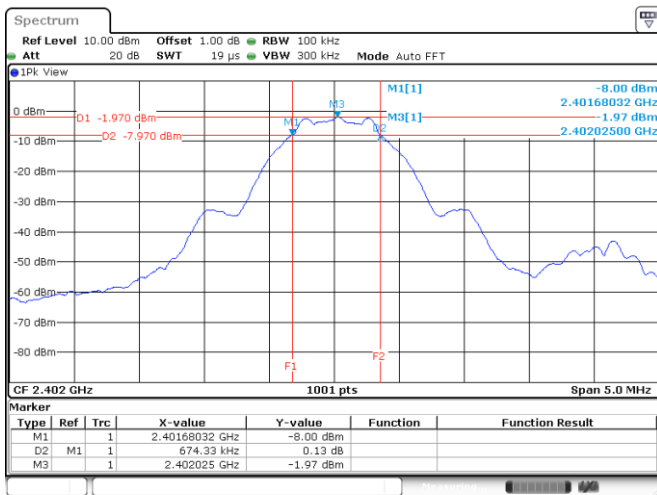
Appendix A: Test Results of Conducted Test

Test Result of 6 dB Bandwidth

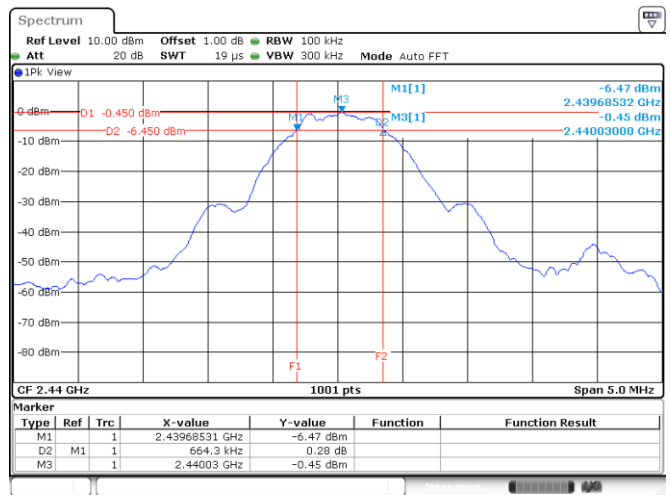
BLE_1M

Channel	Channel Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)	Result
Low Channel	2402	0.67	> 0.5	Pass
Middle Channel	2440	0.66	> 0.5	Pass
High Channel	2480	0.68	> 0.5	Pass

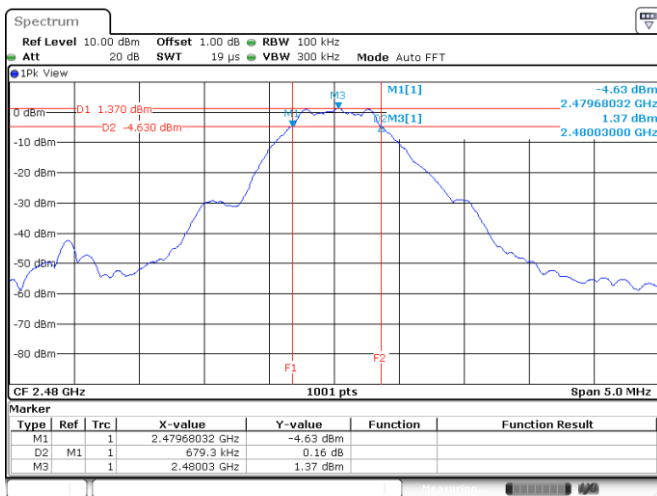
Low Channel



Middle Channel



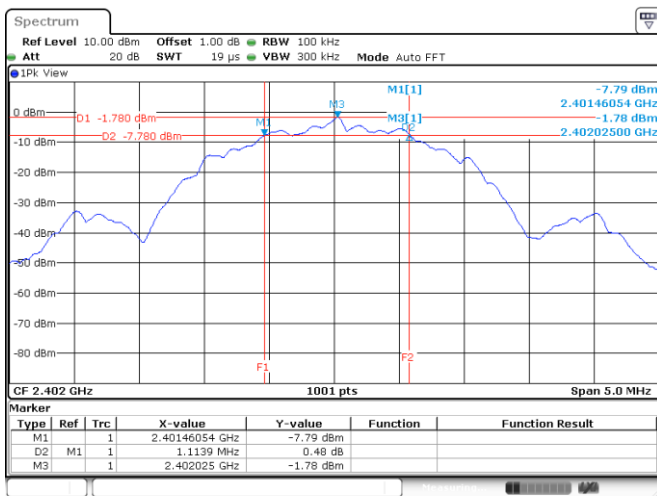
High Channel



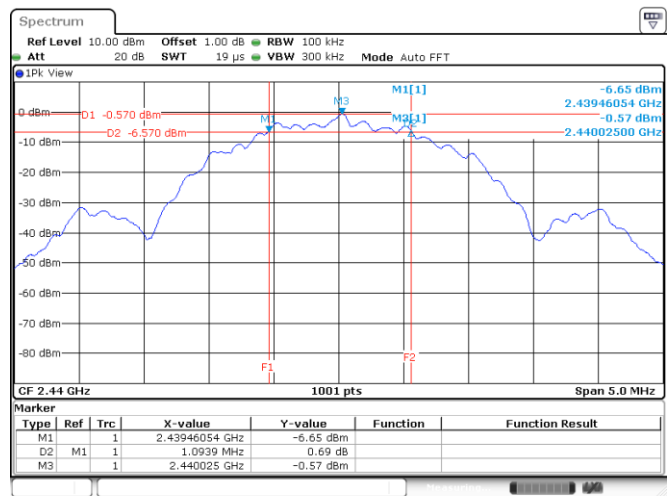
BLE_2M

Channel	Channel Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)	Result
Low Channel	2402	1.11	> 0.5	Pass
Middle Channel	2440	1.09	> 0.5	Pass
High Channel	2480	1.12	> 0.5	Pass

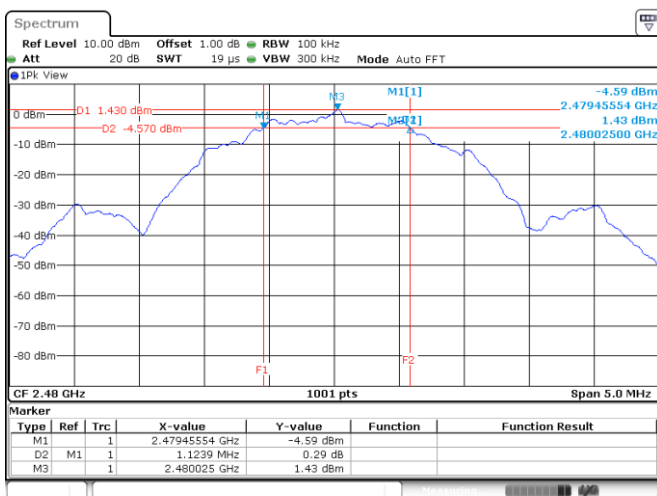
Low Channel



Middle Channel



High Channel

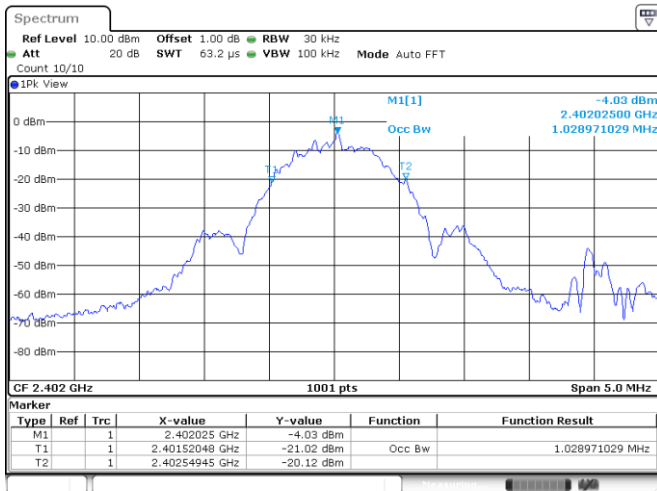


Test Result of 99% Occupied Bandwidth

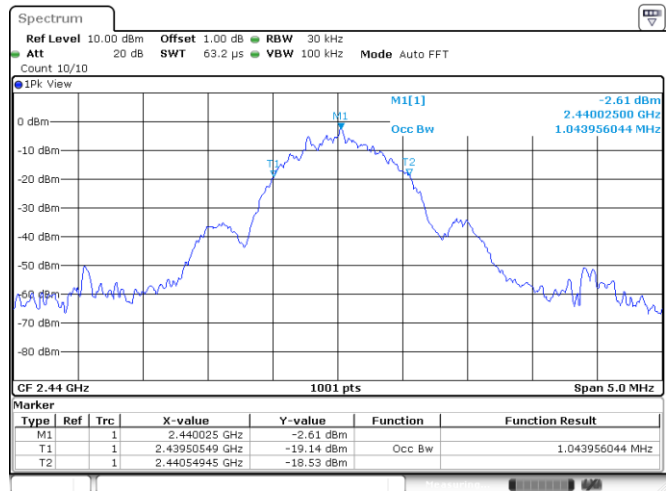
BLE_1M

Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)
Low Channel	2402	1.03
Middle Channel	2440	1.04
High Channel	2480	1.04

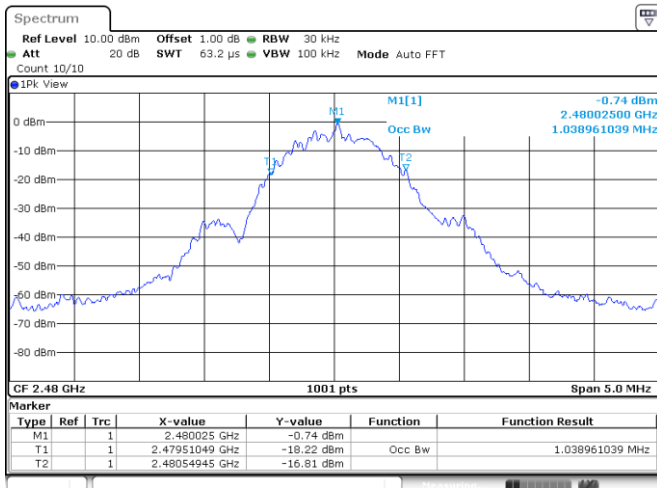
Low Channel



Middle Channel

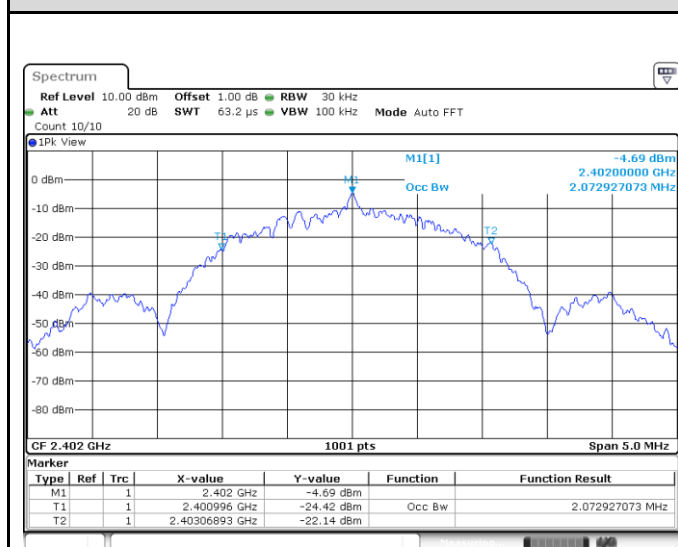
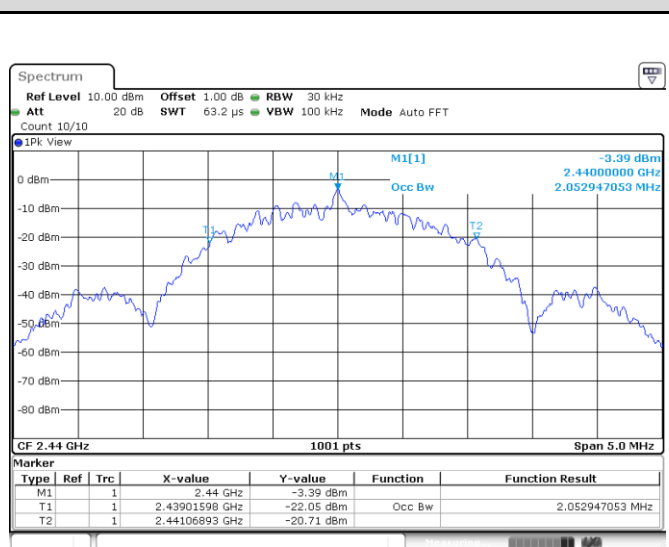
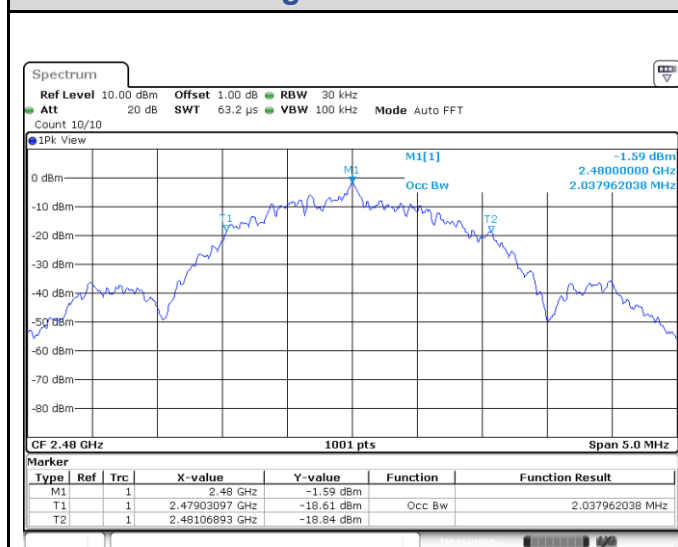


High Channel



BLE_2M

Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)
Low Channel	2402	2.07
Middle Channel	2440	2.05
High Channel	2480	2.04

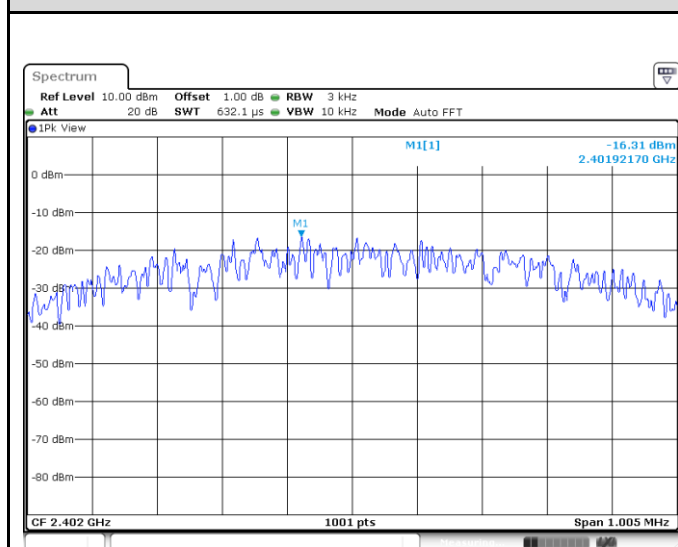
Low Channel

Middle Channel

High Channel


Test Result of Power Spectral Density

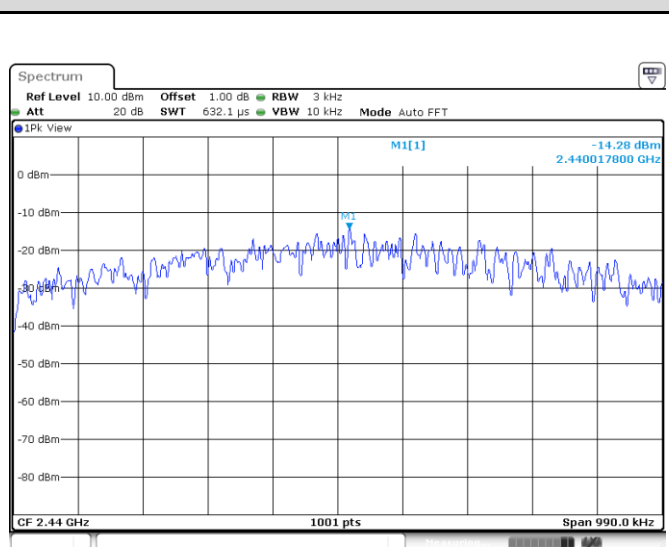
BLE_1M

Channel	Channel Frequency (MHz)	Power Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
Low Channel	2402	-16.31	8	Pass
Middle Channel	2440	-14.28	8	Pass
High Channel	2480	-13.59	8	Pass

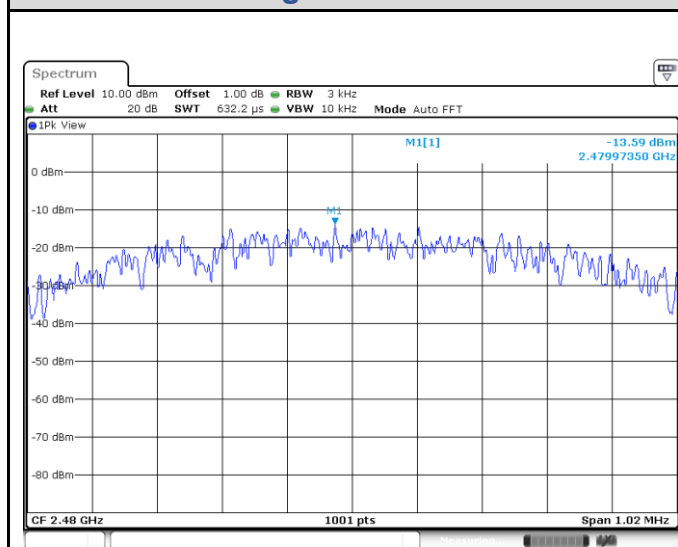
Low Channel



Middle Channel

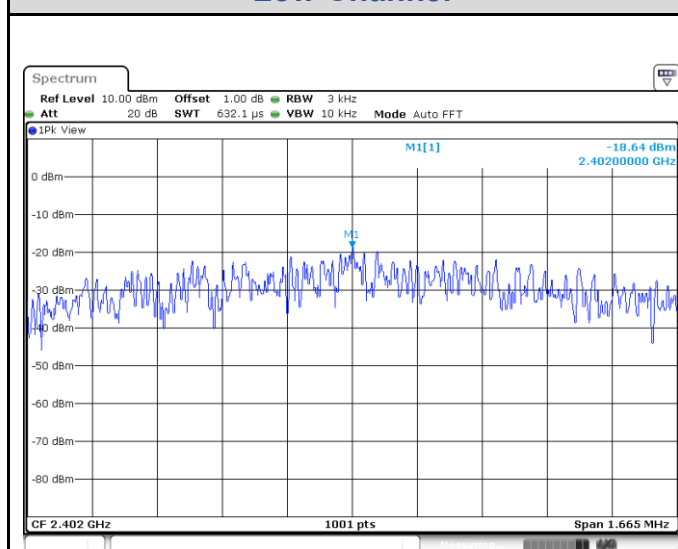
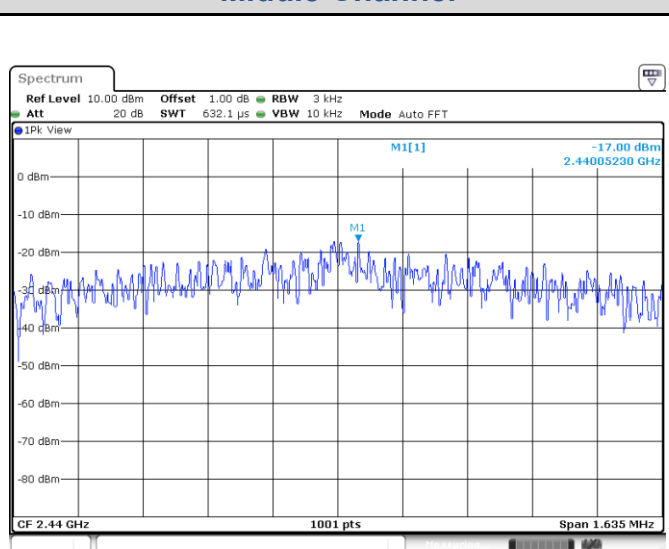
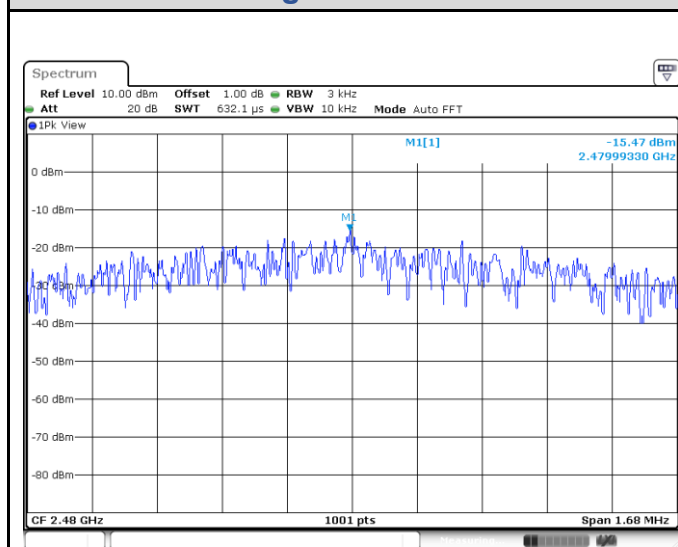


High Channel



BLE_2M

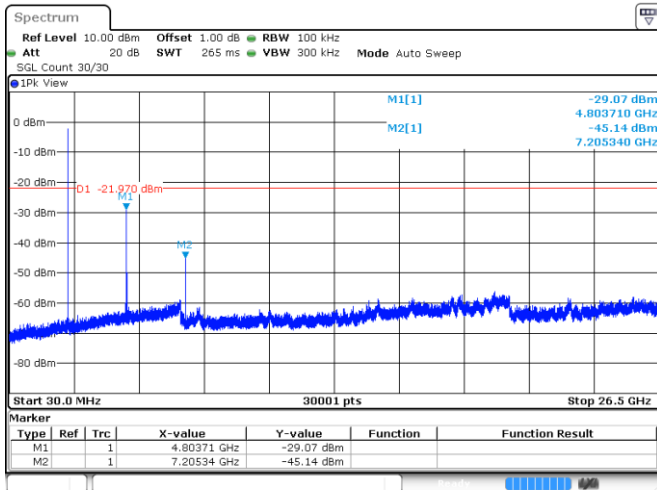
Channel	Channel Frequency (MHz)	Power Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
Low Channel	2402	-18.64	8	Pass
Middle Channel	2440	-17.00	8	Pass
High Channel	2480	-15.47	8	Pass

Low Channel

Middle Channel

High Channel


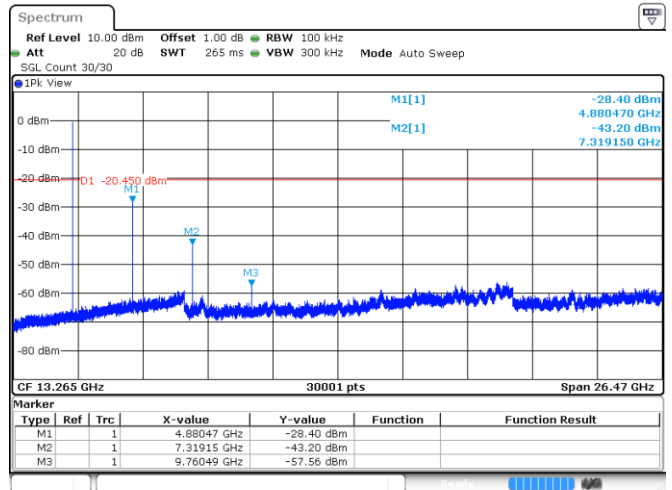
Test Result of Conducted Spurious Emissions, Tx Mode

BLE_1M

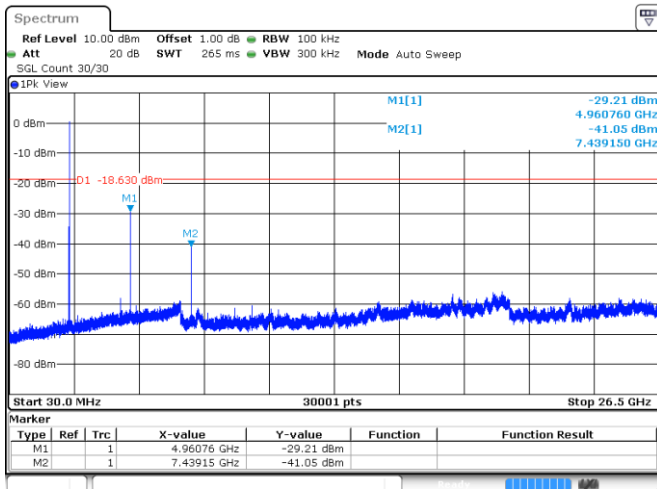
Low Channel

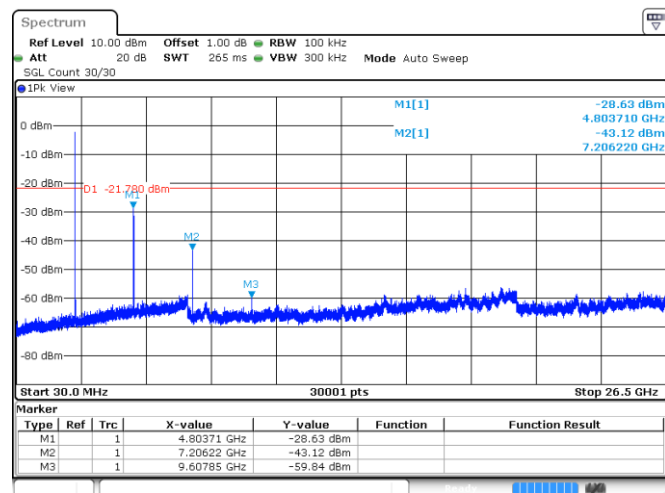
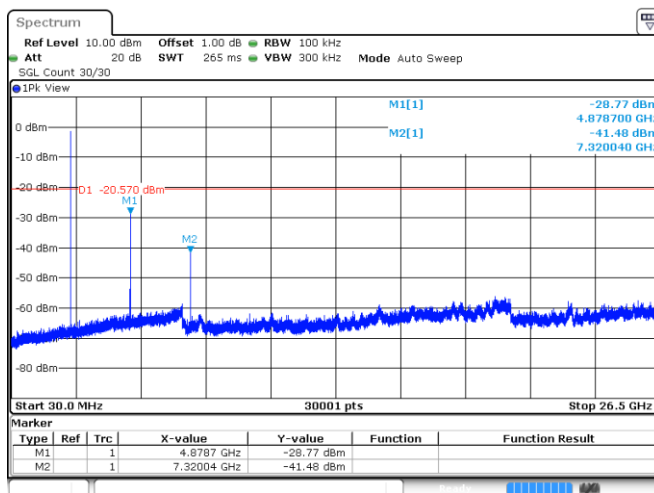
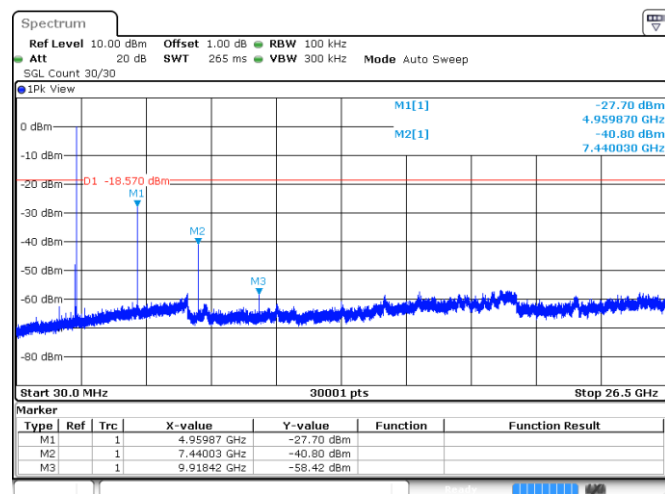


Middle Channel



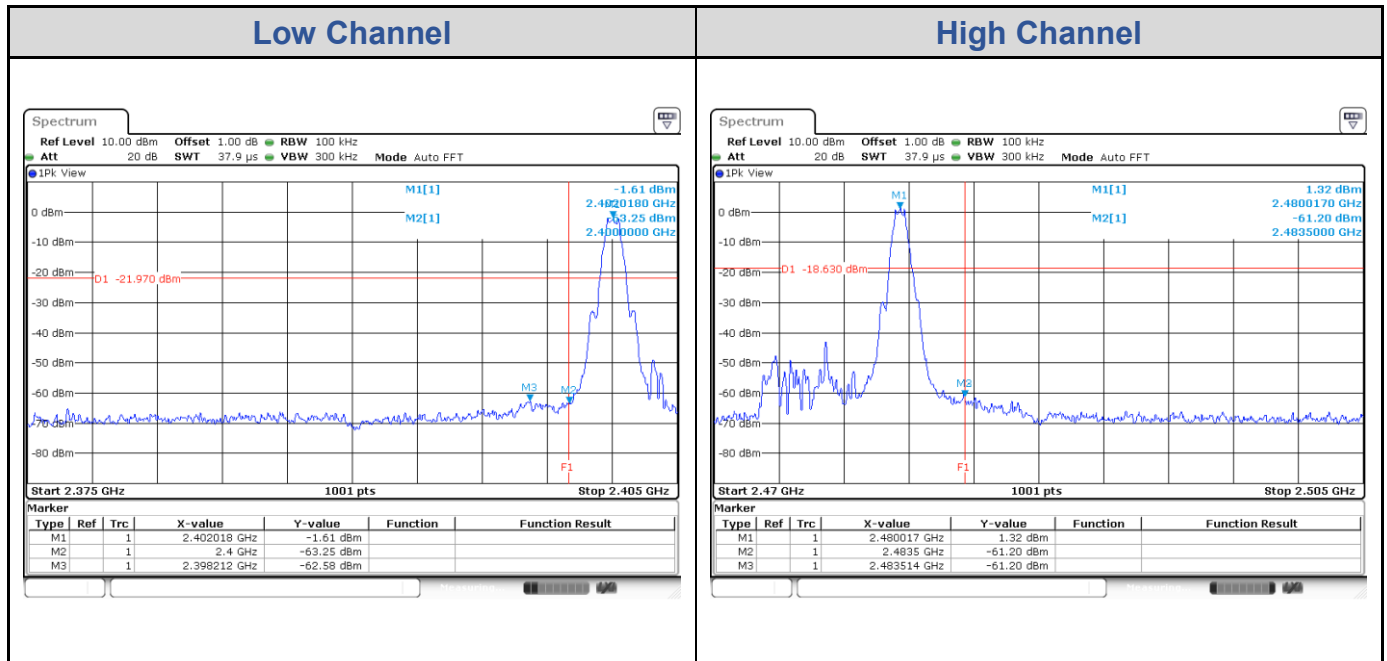
High Channel



BLE_2M
Low Channel

Middle Channel

High Channel


Test Result of Conducted Band Edge, Tx Mode

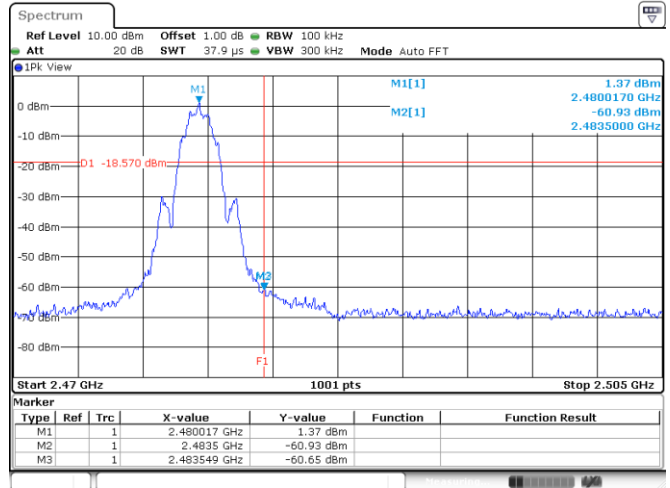
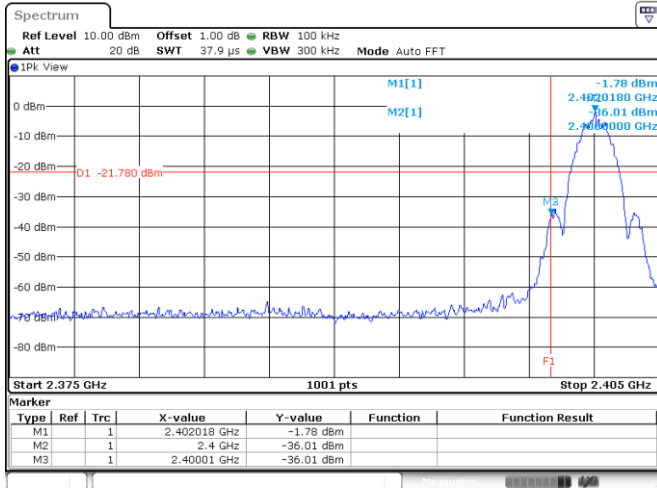
BLE_1M



BLE_2M

Low Channel

High Channel



Appendix B: Test Results of Radiated Spurious Emissions & Mains

Conducted Emission Test

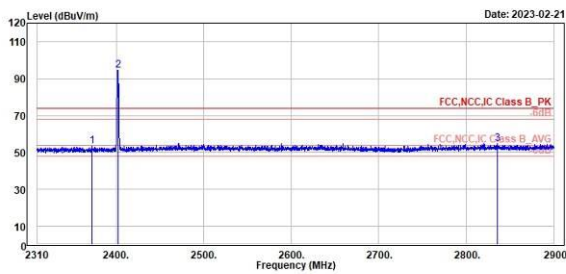
Band Edges, 2.31GHz ~ 2.9GHz

BLE_1M

Low Channel (Horizontal) Peak



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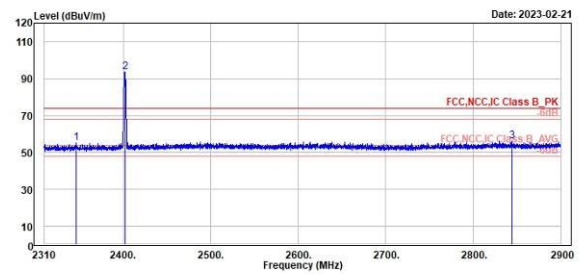


Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	2372.78	53.50	16.42	37.08	74.00	-20.50	133	159	Peak	Horizontal	
2 *	2402.00	94.58	57.46	37.12	74.00	20.58	133	159	Peak	Horizontal	
3	2835.45	54.83	17.24	37.59	74.00	-19.17	133	159	Peak	Horizontal	

Low Channel (Vertical) Peak



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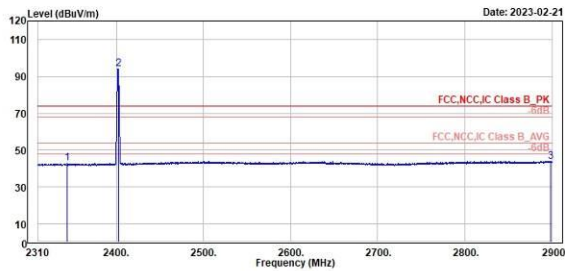
Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	2346.82	55.13	18.09	37.04	74.00	-18.87	306	196	Peak	Vertical	
2 *	2402.00	93.66	56.54	37.12	74.00	19.66	306	196	Peak	Vertical	
3	2843.95	56.23	18.56	37.67	74.00	-17.77	306	196	Peak	Vertical	

BLE_1M

Low Channel (Horizontal) Average



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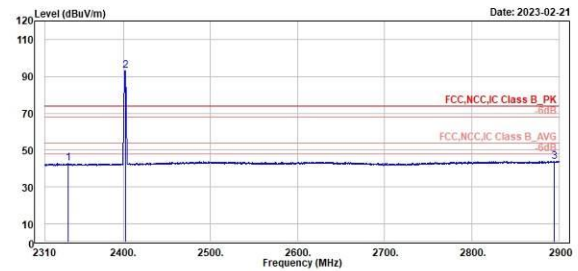


	Freq	Level	Read	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1	2343.28	42.83	5.81	37.02	54.00	-11.17	133	159	Average	Horizontal	
2 *	2402.00	94.14	57.02	37.12	54.00	40.14	133	159	Average	Horizontal	
3	2897.88	43.99	6.03	37.96	54.00	-10.01	133	159	Average	Horizontal	

Low Channel (Vertical) Average



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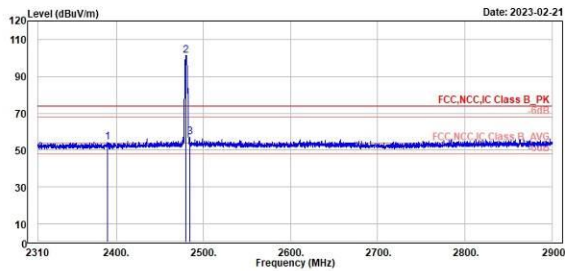
	Freq	Level	Read	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1	2336.90	42.74	5.77	36.97	54.00	-11.26	306	196	Average	Vertical	
2 *	2402.00	93.19	56.07	37.12	54.00	39.19	306	196	Average	Vertical	
3	2894.22	43.96	6.02	37.94	54.00	-10.04	306	196	Average	Vertical	

BLE_1M

High Channel (Horizontal) Peak



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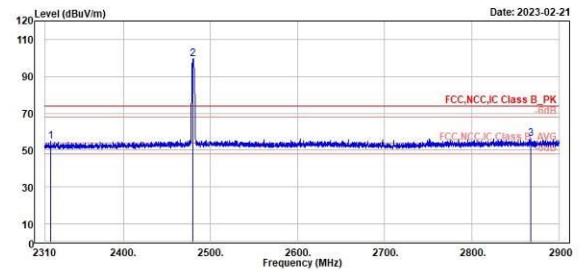


	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	2389.41	54.34	17.24	37.10	74.00	-19.66	221	163 Peak		Horizontal		
2 *	2489.00	101.18	63.79	37.48	74.00	27.18	221	163 Peak		Horizontal		
3	2484.05	57.06	19.57	37.49	74.00	-16.94	221	163 Peak		Horizontal		

High Channel (Vertical) Peak



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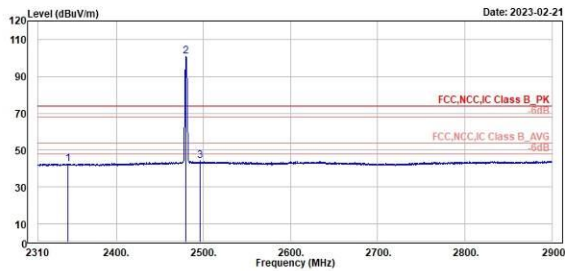
	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	2316.37	54.58	17.75	36.83	74.00	-19.42	260	189 Peak		Vertical		
2 *	2489.00	99.59	62.11	37.48	74.00	25.59	260	189 Peak		Vertical		
3	2867.79	56.23	18.42	37.81	74.00	-17.77	260	189 Peak		Vertical		

BLE_1M

High Channel (Horizontal) Average



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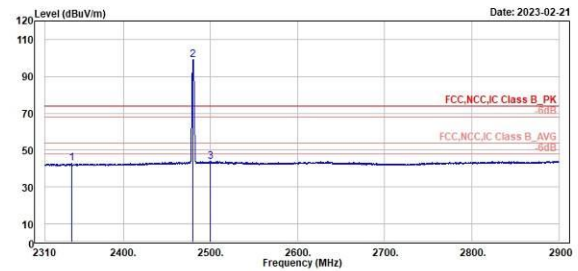


	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	2344.57	42.58	5.55	37.03	54.00	-11.42	221	163	Average	Horizontal		
2 *	2489.00	100.70	63.22	37.48	54.00	46.70	221	163	Average	Horizontal		
3	2495.97	44.05	6.55	37.50	54.00	-9.95	221	163	Average	Horizontal		

High Channel (Vertical) Average



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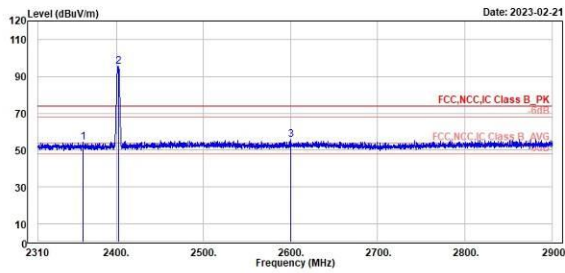
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	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	2340.56	42.96	5.97	36.99	54.00	-11.04	260	189	Average	Vertical		
2 *	2489.00	99.10	61.62	37.48	54.00	45.10	260	189	Average	Vertical		
3	2499.74	43.92	6.42	37.50	54.00	-10.08	260	189	Average	Vertical		

BLE_2M

Low Channel (Horizontal) Peak



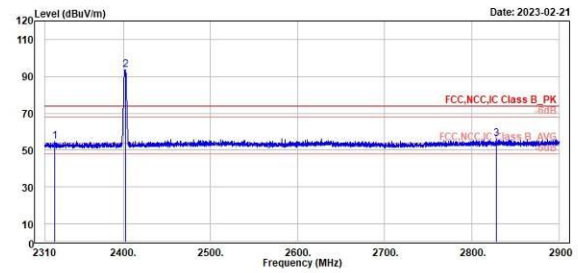
TÜV Rheinland Taiwan Ltd.
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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	2361.00	54.00	17.01	37.07	74.00	-19.92	211	160	Peak	Horizontal		
2 *	2402.00	95.46	58.34	37.12	74.00	21.46	211	160	Peak	Horizontal		
3	2600.40	55.83	18.34	37.49	74.00	-18.17	211	160	Peak	Horizontal		



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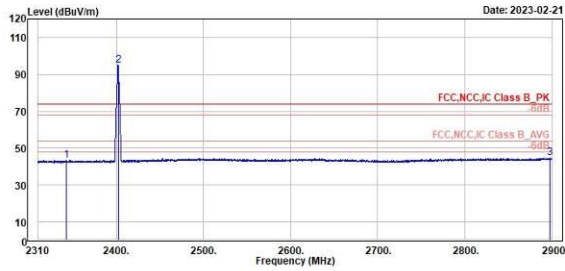
	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	2321.00	54.97	18.10	36.87	74.00	-19.03	308	198	Peak	Vertical		
2 *	2402.00	93.64	56.52	37.12	74.00	19.64	308	198	Peak	Vertical		
3	2828.14	56.00	18.47	37.53	74.00	-18.00	308	198	Peak	Vertical		

BLE_2M

Low Channel (Horizontal) Average



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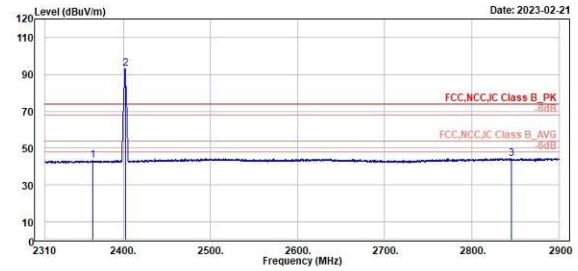


	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	2342.33	43.35	6.35	37.00	54.00	-10.65	211	160	Average	Horizontal		
2 *	2402.00	95.02	57.90	37.12	54.00	41.02	211	160	Average	Horizontal		
3	2897.64	44.55	6.59	37.96	54.00	-9.45	211	160	Average	Horizontal		

Low Channel (Vertical) Average



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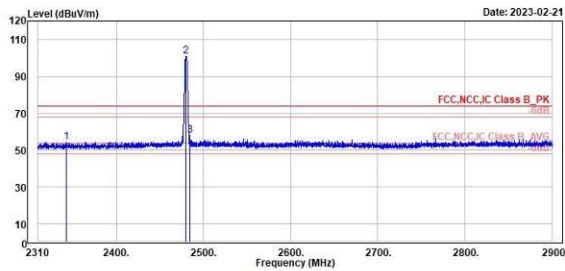
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	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	2365.22	43.32	6.24	37.08	54.00	-10.68	308	198	Average	Vertical		
2 *	2402.00	95.12	56.00	37.12	54.00	39.12	308	198	Average	Vertical		
3	2844.89	44.47	6.79	37.68	54.00	-9.53	308	198	Average	Vertical		

BLE_2M

High Channel (Horizontal) Peak



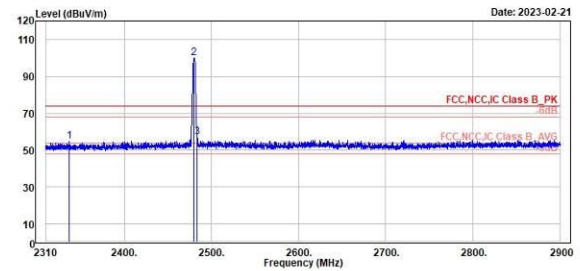
TÜV Rheinland Taiwan Ltd.
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High Channel (Vertical) Peak



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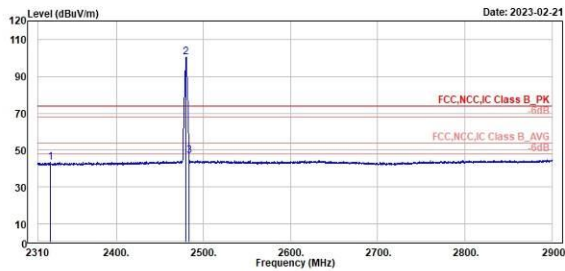


BLE_2M

High Channel (Horizontal) Average



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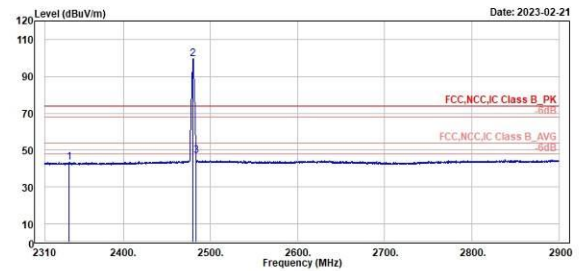


	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	2324.04	43.25	6.37	36.88	54.00	-10.75	220	164	Average	Horizontal		
2 *	2480.00	100.42	62.94	37.48	54.00	46.42	220	164	Average	Horizontal		
3	2483.46	47.12	9.64	37.48	54.00	-6.88	220	164	Average	Horizontal		

High Channel (Vertical) Average



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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	2337.61	43.56	6.58	36.98	54.00	-10.44	260	194	Average	Vertical		
2 *	2480.00	99.46	61.98	37.48	54.00	45.46	260	194	Average	Vertical		
3	2483.46	46.82	9.34	37.48	54.00	-7.18	260	194	Average	Vertical		

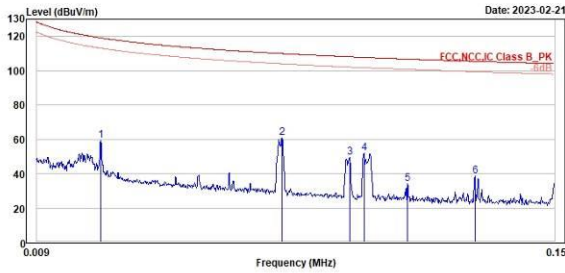
Spurious Emissions, Tx Mode, 9kHz ~ 30MHz

BLE_2M

High Channel (Open) 9kHz~150kHz



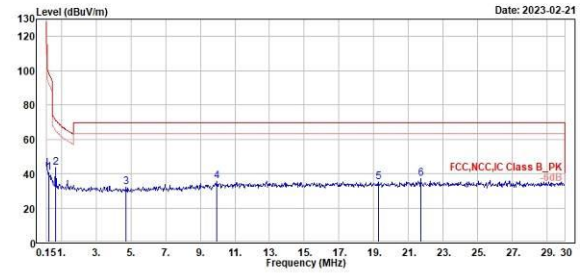
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Peak	Freq	Level	Read	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1	0.03	59.24	40.29	18.95	119.13	-59.89	100		59 Peak	Open	
2	0.08	60.60	42.11	18.49	118.00	-49.40	100		85 Peak	Open	
3	0.09	49.46	31.41	18.05	108.12	-58.66	100		115 Peak	Open	
4	0.10	51.71	33.74	17.97	107.76	-56.05	100		196 Peak	Open	
5	0.11	33.87	15.91	17.96	106.77	-72.90	100		223 Peak	Open	
6	0.13	38.40	20.37	18.03	105.43	-67.03	100		179 Peak	Open	



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Peak	Freq	Level	Read	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1	0.27	40.54	21.93	18.61	98.99	-58.45	100		151 Peak	Open	
2	0.66	43.56	24.65	18.91	71.25	-27.69	100		154 Peak	Open	
3	4.72	31.93	12.44	19.49	69.50	-37.57	100		255 Peak	Open	
4	9.97	35.48	13.89	21.59	69.50	-34.02	100		349 Peak	Open	
5	19.25	34.92	12.67	22.25	69.50	-34.58	100		5 Peak	Open	
6	21.70	36.96	14.63	22.33	69.50	-32.54	100		33 Peak	Open	

Spurious Emissions, Tx Mode, 30MHz ~ 1GHz

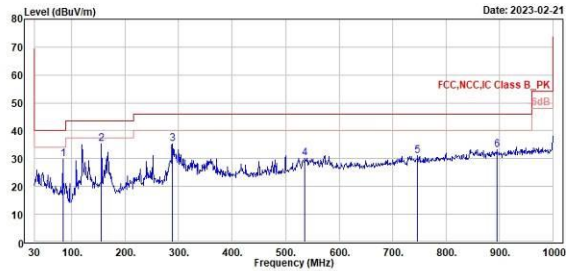
BLE_2M

High Channel (Horizontal)

High Channel (Vertical)



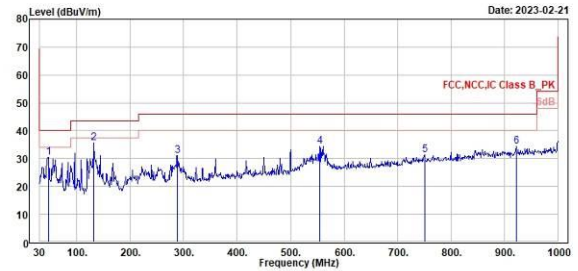
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	Freq	Level	Read	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	83.35	29.78	42.38	-12.60	40.00	-10.22	200	51 Peak	Horizontal	
2	155.13	35.33	42.80	-7.47	43.50	-8.17	300	268 Peak	Horizontal	
3	288.02	35.16	41.74	-6.58	46.00	-10.84	100	276 Peak	Horizontal	
4	536.34	30.27	32.67	-2.40	46.00	-15.73	100	74 Peak	Horizontal	
5	746.83	31.16	29.67	1.49	46.00	-14.84	360	360 Peak	Horizontal	
6	895.24	33.23	29.21	4.02	46.00	-12.77	400	294 Peak	Horizontal	



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	Freq	Level	Read	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	46.49	30.48	37.70	-7.22	40.00	-9.52	100	172 Peak	Vertical	
2	131.85	35.58	44.05	-8.47	43.50	-7.92	100	71 Peak	Vertical	
3	288.02	31.09	37.67	-6.58	46.00	-14.91	100	82 Peak	Vertical	
4	554.77	34.35	36.38	-2.03	46.00	-11.65	100	67 Peak	Vertical	
5	750.71	31.34	29.78	1.56	46.00	-14.66	100	360 Peak	Vertical	
6	922.40	34.23	29.86	4.37	46.00	-11.77	300	294 Peak	Vertical	

Spurious Emissions, Tx Mode, 1GHz ~ 26.5GHz

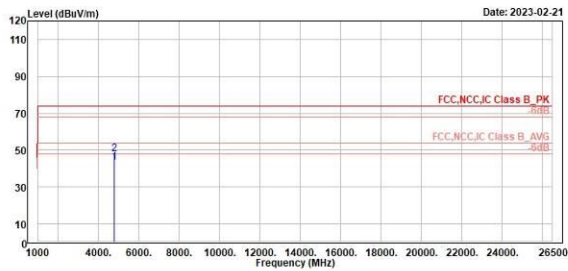
BLE_1M

Low Channel (Horizontal)

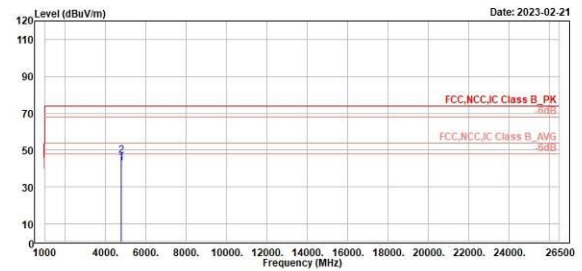
Low Channel (Vertical)



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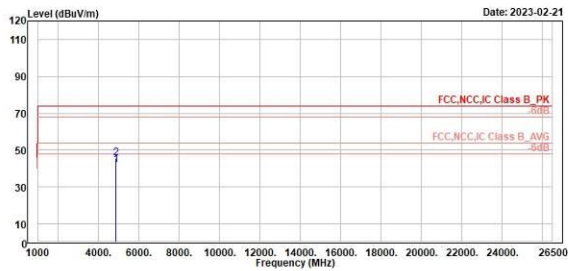


BLE_1M

Middle Channel (Horizontal)



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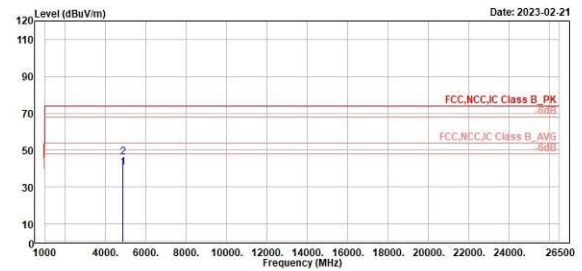


	Freq	Level	Read	Level	Factor	Limit	Over	Line	Limit	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg						
1	4880.00	41.96	33.56	8.40	54.00	-12.04	100	64	Average	Horizontal				
2	4880.00	45.83	37.43	8.40	74.00	-28.17	100	64	Peak	Horizontal				

Middle Channel (Vertical)



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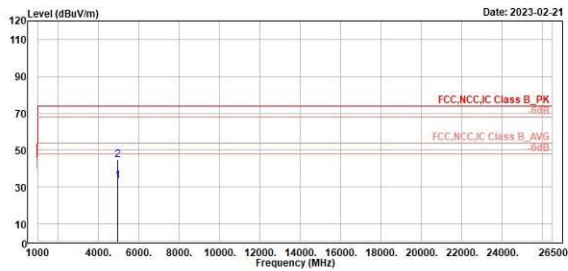
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	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg						
1	4880.00	40.48	32.08	8.40	54.00	-13.52	100	177	Average	Vertical				
2	4880.00	46.23	37.83	8.40	74.00	-27.77	100	177	Peak	Vertical				

BLE_1M

High Channel (Horizontal)



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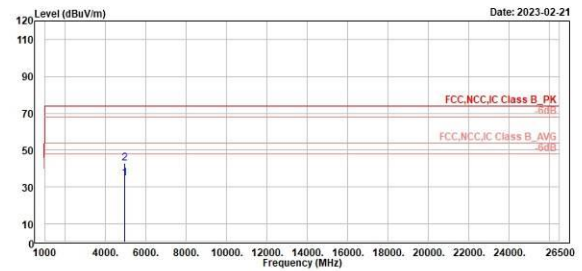


	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	4960.00	33.49	25.00	8.49	54.00	-20.51	100	249	Average	Horizontal		
2	4960.00	44.70	36.21	8.49	74.00	-29.30	100	249	Peak	Horizontal		

High Channel (Vertical)



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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	4960.00	34.47	25.98	8.49	54.00	-19.53	200	298	Average	Vertical		
2	4960.00	42.99	34.50	8.49	74.00	-31.01	200	298	Peak	Vertical		

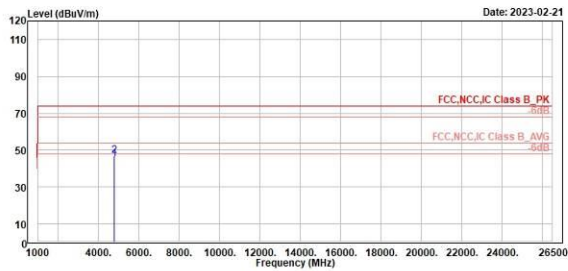
BLE_2M

Low Channel (Horizontal)

Low Channel (Vertical)



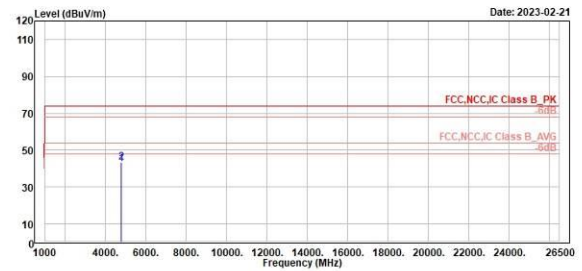
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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	dB	cm	deg			
1	4804.00	45.14	36.78	8.36	54.00	-8.86	300	206	Average	Horizontal		
2	4804.00	47.00	38.64	8.36	74.00	-27.00	300	206	Peak	Horizontal		



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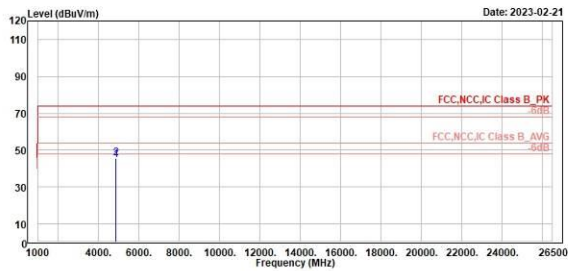
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	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	dB	cm	deg			
1	4804.00	42.22	33.86	8.36	54.00	-11.78	111	142	Average	Vertical		
2	4804.00	43.46	35.10	8.36	74.00	-30.54	111	142	Peak	Vertical		

BLE_2M

Middle Channel (Horizontal)



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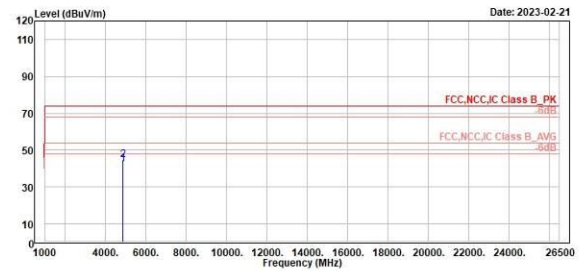


	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	dB	cm	deg			
1	4889.00	44.32	36.42	8.40	54.00	-9.18	200	172	Average	Horizontal		
2	4889.00	45.40	37.00	8.40	74.00	-28.60	200	172	Peak	Horizontal		

Middle Channel (Vertical)



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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	dB	cm	deg			
1	4889.00	42.49	34.09	8.40	54.00	-11.51	100	178	Average	Vertical		
2	4889.00	44.52	36.12	8.40	74.00	-29.48	100	178	Peak	Vertical		

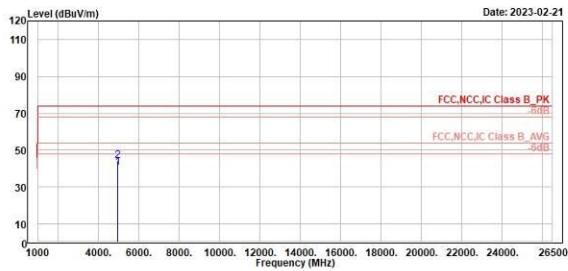
BLE_2M

High Channel (Horizontal)

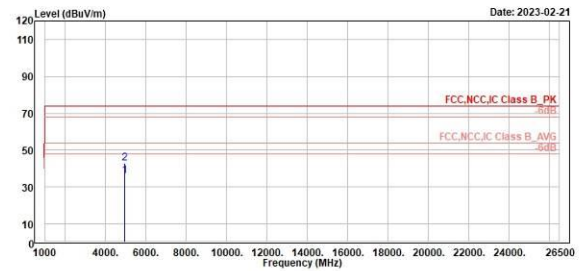
High Channel (Vertical)



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Mains Conducted Emission, Tx Mode 150kHz ~ 30MHz

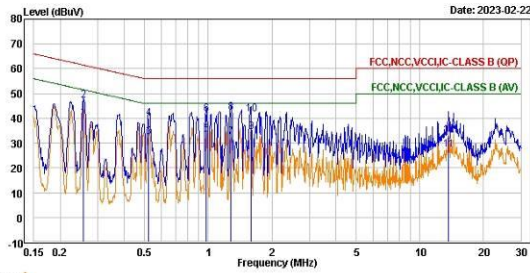
Worst Band

(Line)

(Neutral)



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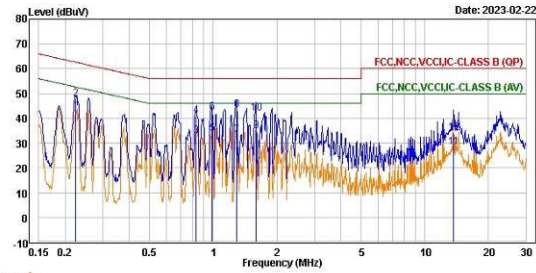


Trace: 1

Freq	Level	Read	Limit	Over	Remark	Pol/Phase	Note
MHz	dBuV	Level Factor	Line	Limit			
1	0.26	40.19	30.51	9.68	51.49 -11.30 Average	line1	
2	0.26	47.11	37.43	9.68	61.49 -14.38 QP	line1	
3	0.52	32.33	22.65	9.68	46.00 -13.67 Average	line1	
4	0.52	39.86	30.18	9.68	56.00 -16.14 QP	line1	
5	0.98	33.47	23.78	9.69	46.00 -12.53 Average	line1	
6	0.98	41.68	31.99	9.69	56.00 -14.32 QP	line1	
7	1.28	32.46	22.76	9.70	46.00 -13.54 Average	line1	
8	1.28	42.36	32.66	9.70	56.00 -13.64 QP	line1	
9	1.59	34.52	24.81	9.71	46.00 -11.48 Average	line1	
10	1.59	41.59	31.88	9.71	56.00 -14.41 QP	line1	
11	13.65	27.18	17.37	9.81	50.00 -22.82 Average	line1	
12	13.65	33.26	23.45	9.81	60.00 -26.74 QP	line1	



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Trace: 1

Freq	Level	Read	Limit	Over	Remark	Pol/Phase	Note
MHz	dBuV	Level Factor	Line	Limit			
1	0.22	42.87	33.21	9.66	52.69 -9.82 Average	neutral	
2	0.22	47.70	38.04	9.66	62.69 -14.99 QP	neutral	
3	0.83	32.64	22.96	9.66	46.00 -13.36 Average	neutral	
4	0.83	41.00	31.34	9.66	56.00 -15.00 QP	neutral	
5	0.99	33.84	24.18	9.66	46.00 -12.16 Average	neutral	
6	0.99	42.49	32.83	9.66	56.00 -13.51 QP	neutral	
7	1.29	33.04	23.37	9.67	46.00 -12.96 Average	neutral	
8	1.29	43.36	33.69	9.67	56.00 -12.64 QP	neutral	
9	1.59	34.98	25.30	9.68	46.00 -11.02 Average	neutral	
10	1.59	41.95	32.27	9.68	56.00 -14.05 QP	neutral	
11	13.65	28.31	18.48	9.83	50.00 -21.69 Average	neutral	
12	13.65	34.25	24.42	9.83	60.00 -25.75 QP	neutral	