Prüfbericht-Nr.: *Test report no.:*	CN21H2XW(P15.247-BLE) 001	**Auftrags-Nr.:** *Order no.:*	238486434	
Kunden-Referenz-Nr.: *Client reference no.:*	N/A	**Auftragsdatum:** *Order date:*	2020-05-12	
Auftraggeber: *Client:*	iSenseTek Technology Inc. 4F-1, No.15, Ln. 360, Sec. 1,Neihu Rd., Neihu Dist., Taipei, Taiwan			
Prüfgegenstand: *Test item:*	Bluetooth 5.0 BLE + ANT+ module			
Bezeichnung / Typ-Nr.: *Identification / Type no.:*	ISBLE1506-X52			
Auftrags-Inhalt: *Order content:*	FCC Part 15C Test report (BLE)			
Prüfgrundlage: *Test specification:*	FCC 47CFR Part 15: Subpart C Section 15.247			
Wareneingangsdatum: *Date of sample receipt:*	2020-05-08			
Prüfmuster-Nr.: *Test sample no:*	A002822714-001 A002822714-005			
Prüfzeitraum: *Testing period:*	2020-07-01 - 2021-06-23			
Ort der Prüfung: *Place of testing:*	EMC/RF Taipei Testing Site			
Prüflaboratorium: *Testing laboratory:*	Taipei Testing Laboratories			
Prüfergebnis*: *Test result*:*	Pass			

zusammengestellt von: *compiled by:*		**genehmigt von:** authorized by:	
Datum: *Date:* 2021-06-30	Ryan Chen	**Ausstellungsdatum:** *Issue date:* 2021-06-30	Brenda Chen
Stellung / *Position:*	Senior Project Manager	**Stellung** / *Position:*	Senior Project Manager

Sonstiges / *Other:*

Zustand des Prüfgegenstandes bei Anlieferung: Prüfmuster vollständig und unbeschädigt
Condition of the test item at delivery: *Test item complete and undamaged*

* 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.
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.
V05

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 A - TEST RESULT OF CONDUCTED

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

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APPENDIX EP - PHOTOGRAPHS OF EUT

HISTORY OF THIS TEST REPORT

Report No.	Description	Date Issued
CN21H2XW(P15.247-BLE) 001	Original Release	2021-06-30

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.: 226631
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 basics 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 Bluetooth 5.0 BLE + ANT+ module. It contains a Bluetooth compatible module enabling t he 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	Bluetooth 5.0 BLE + ANT+ module
Type Identification	ISBLE1506-X52
FCC ID	2AI2V-ISBLE1506X52

Technical Specification of EUT

Item	EUT information
Operating Frequency	2402 MHz ~ 2480 MHz
Channel Spacing	2 MHz
Channel Number	40
Data Rate	1Mbps
Operation Voltage	5Vdc
Modulation	GFSK
Maximum Output Power (mW)	1.02
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: The module is mounted on an Evaluation Board provided by the manufacturer.
The EVB is provided with an USB interface which makes it possible to control the module through the Bluetooth simulator by DTM.

Test Software	None.

The samples were used as follows:
A002822714-001 for radiated
A002822714-005 for conducted
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

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

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	1

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	1

Test Condition

Test Item	Ambient Temperature	Relative Humidity	Tested by
Conducted Measurement	24.8 °C	53.5 %	Stanislas Charles
Radiated Spurious Emissions above 1 GHz	26 °C	59.5 %	Simon Tsai
Radiated Spurious Emissions below 1 GHz	26 °C	59.5 %	Simon Tsai
Mains Conducted Emission	20 °C	54 %	Nick Hsu

4.4 Special Accessories and Auxiliary Equipment

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

Accessory of EUT

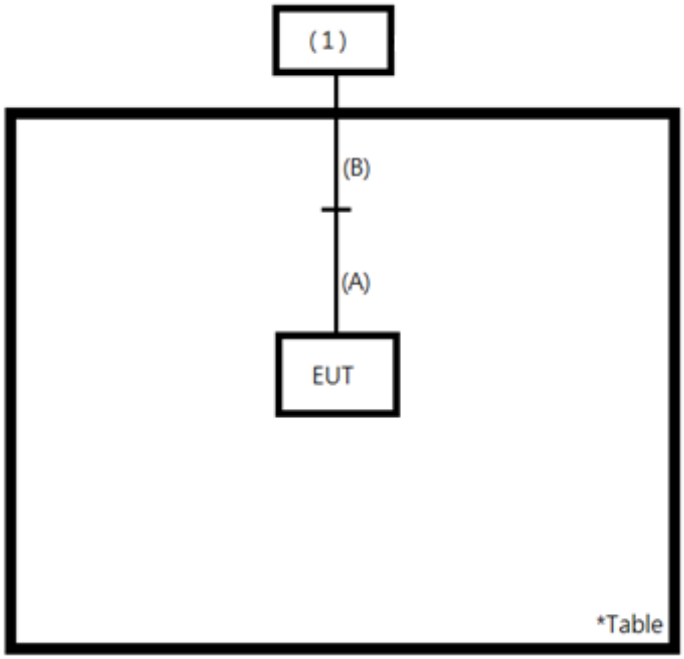
None.

Support Unit

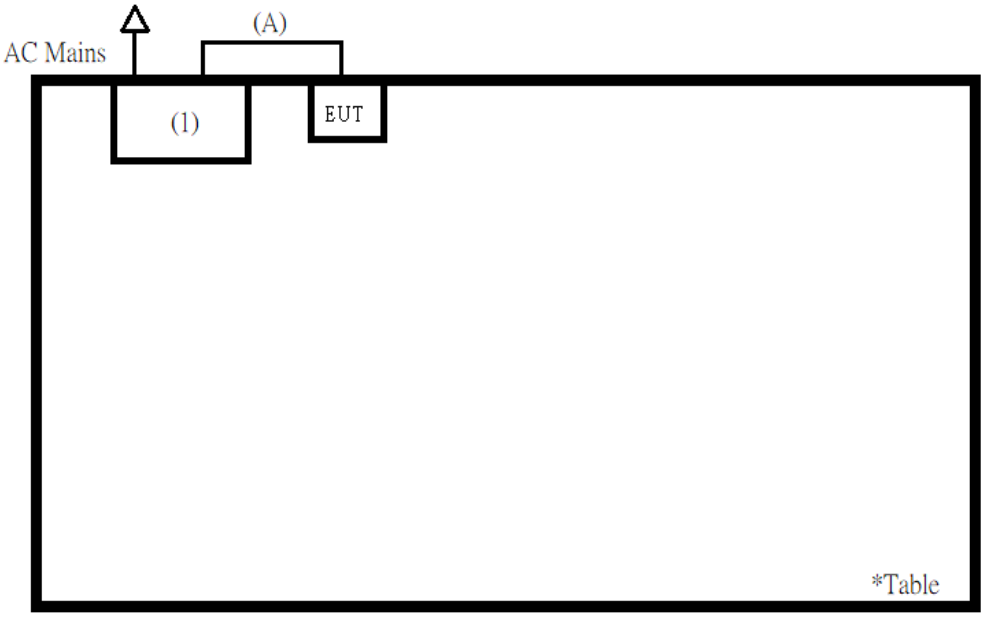
No.	Description	Brand	Model	S/N	Remark
Radiated Test					
A	Mirco USB Cable	isenseTek	isenseTek-001	-	100 cm shielded cable with core
B	USB Cable	Pro-Best	MK-USBMF-3M	-	300 cm shielded cable with core
1	NoteBook	HP	15s-du0007TX	CND93662VF	-
Mains Conducted Test					
A	Mirco USB Cable	isenseTek	isenseTek-001	-	100 cm shielded cable with core
1	Wireless Tester	R&S	CMW500	495677	-

4.5 Test Setup Diagram

<Radiated Spurious Emissions mode>



<Mains Conducted Emission mode>



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

Requirement Use of approved antennas only

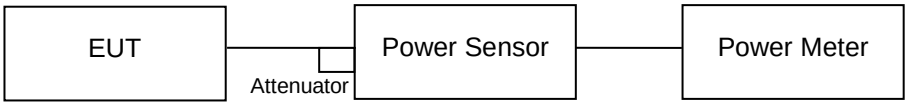
According to the manufacturer declaration, the EUT has an antenna with a directional gain of -1.19 dBi. The antenna is a PCB antenna with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision.
Refer to EUT photo for details.

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	2020/3/25	2021/3/24	2020/07/01	2020/07/01
Power Sensor	Anritsu	MA2411B	1725269	2020/3/25	2021/3/24	2020/07/01	2020/07/01

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	0.03	1.01	30
Middle Channel	2440	0.06	1.01	30
High Channel	2480	0.08	1.02	30

Average Power

<1Mbps>

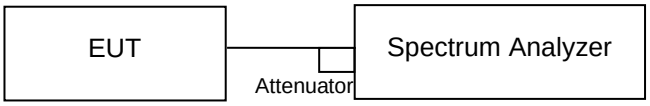
Channel	Channel Frequency	Average Power	
	(MHz)	(dBm)	(mW)
Low Channel	2402	-0.05	0.99
Middle Channel	2440	-0.02	1.00
High Channel	2480	0.00	1.00

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	2020/1/30	2021/1/28	2020/07/01	2020/07/01

Test Procedure

a. Set resolution bandwidth (RBW) = 100 kHz
b. Set the video bandwidth (VBW) ≥ 3 x RBW, Detector = Peak.
c. Trace mode = max hold.
d. Sweep = auto couple.
e. 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.
f. 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.

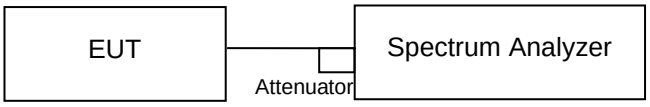
5.1.4 Power Spectral Density

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	2020/1/30	2021/1/28	2020/07/01	2020/07/01

Test Procedure

a. Set analyzer center frequency to DTS channel center frequency.
b. Set the span to 1.5 times the DTS bandwidth.
c. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d. Set the VBW ≥ 3 × RBW.
e. Detector = peak.
f. Sweep time = auto couple.
g. Trace mode = max hold.
h. Allow trace to fully stabilize.
i. Use the peak marker function to determine the maximum amplitude level within the RBW.

Test Results

Please refer to Appendix A.

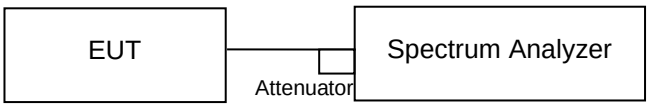
5.1.5 Conducted Spurious Emissions and Frequency Band Edges Measured in 100kHz Bandwidth

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	2020/1/30	2021/1/28	2020/07/01	2020/07/01

Test Procedure

Measurement procedure REF
1. Set the RBW = 100 kHz.
2. Set the VBW ≥ 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 ≥ 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

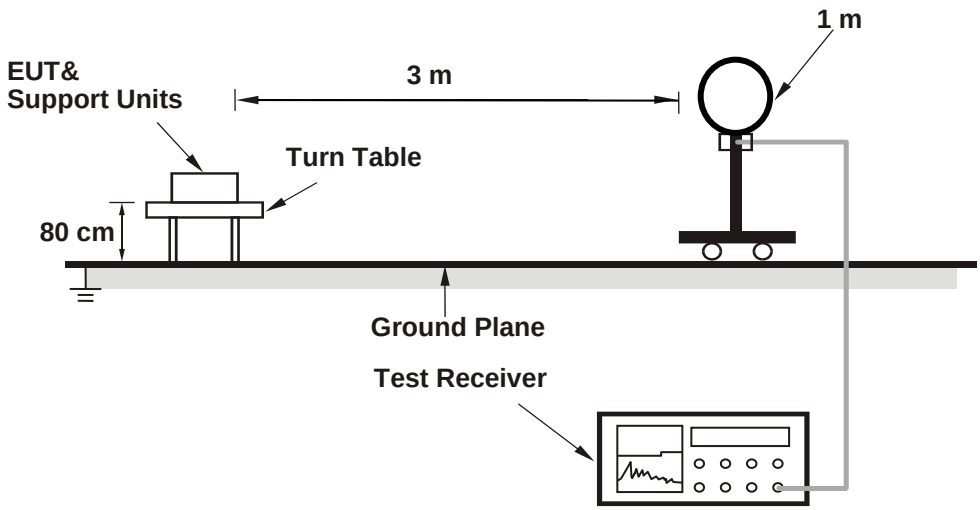
Limit

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).

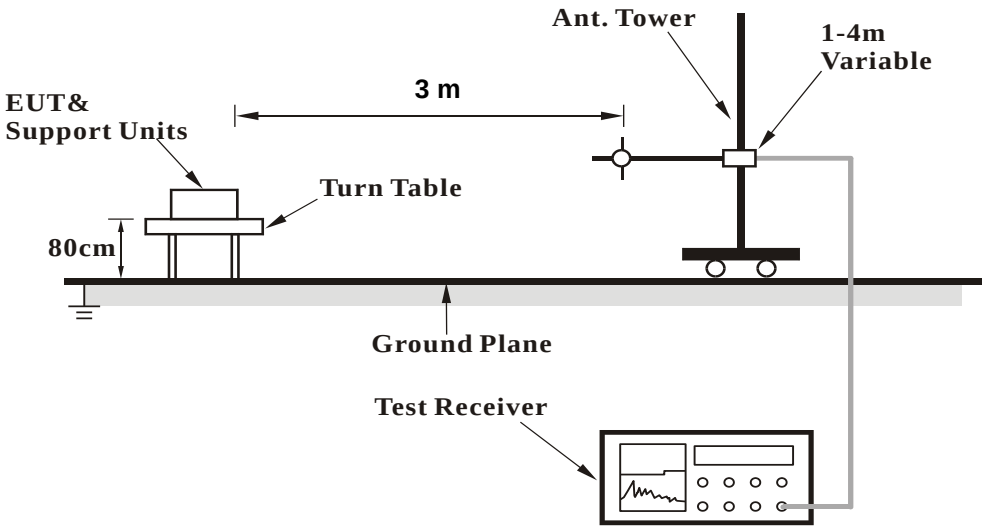
Kind of Test Site 3m Semi-Anechoic Chamber

Test Setup

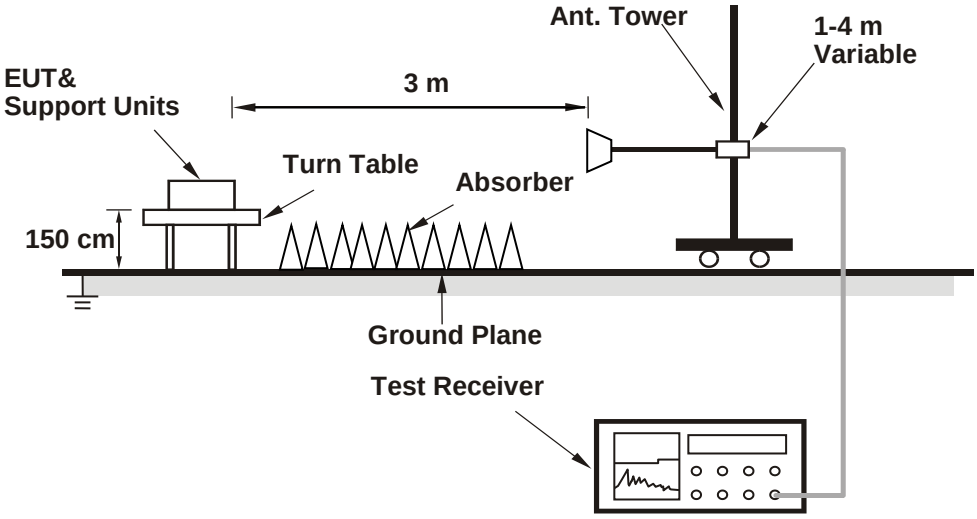
<Radiated Emissions below 30 MHz>



<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

Test Period: 2020/07/02-2020/07/03

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
Signal Analyzer	R&S	FSV40	101508	2020/3/17	2021/3/16
Receiver	R&S	ESR7	102109	2020/3/17	2021/3/16
Bilog Antenna	SCHWARZBECK	VULB-9168	00951	2020/2/19	2021/2/18
Horn Antenna	ETS-Lindgren	3117	00218930	2019/12/3	2020/12/1
LF-AMP	Agilent	8447D	2944A10772	2020/2/19	2021/2/17
HF-AMP + AC source	EMCI	EMC051845SE	980633	2020/2/10	2021/2/8
HF-AMP + AC source	EMCI	EMC184045SE	980657	2020/2/2	2021/1/31
Horn Antenna	SCHWARZBECK	BBHA 9170	00887	2020/4/9	2021/4/8
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104EA	800056/4EA	2020/3/18	2021/3/17
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104	804680/4	2020/3/18	2021/3/17
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104	MY37202/4	2020/3/18	2021/3/17
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	800898/2EA	2020/4/17	2021/4/16
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	800901/2EA	2020/4/17	2021/4/16
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	801027/2EA	2020/4/17	2021/4/16
Loop Antenna	Chance Most	EMCILPA600 +calibration	287	2020/1/16	2021/1/14

Test Period: 2021/06/23

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
Signal Analyzer	R&S	FSV40	101508	2021/3/16	2022/3/15
Receiver	R&S	ESR7	102109	2021/3/16	2022/3/15
Bilog Antenna	SCHWARZBECK	VULB-9168	00951	2021/2/18	2022/2/17
Horn Antenna	ETS-Lindgren	3117	00218930	2020/12/1	2021/11/30
LF-AMP	Agilent	8447D	2944A10772	2021/2/18	2022/2/17
HF-AMP + AC source	EMCI	EMC051845SE	980633	2021/2/9	2022/2/8
HF-AMP + AC source	EMCI	EMC184045SE	980657	2021/2/1	2022/1/31
Horn Antenna	SCHWARZBECK	BBHA 9170	00887	2021/4/8	2022/4/7
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104EA	800056/4EA	2021/3/17	2022/3/16
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104	804680/4	2021/3/17	2022/3/16
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104	MY37202/4	2021/3/17	2022/3/16
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	800898/2EA	2021/4/16	2022/4/15
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	800901/2EA	2021/4/16	2022/4/15
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	801027/2EA	2021/4/16	2022/4/15
Loop Antenna	Chance Most	EMCILPA600 +calibration	287	2021/1/15	2022/1/14

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 ≥ 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.

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

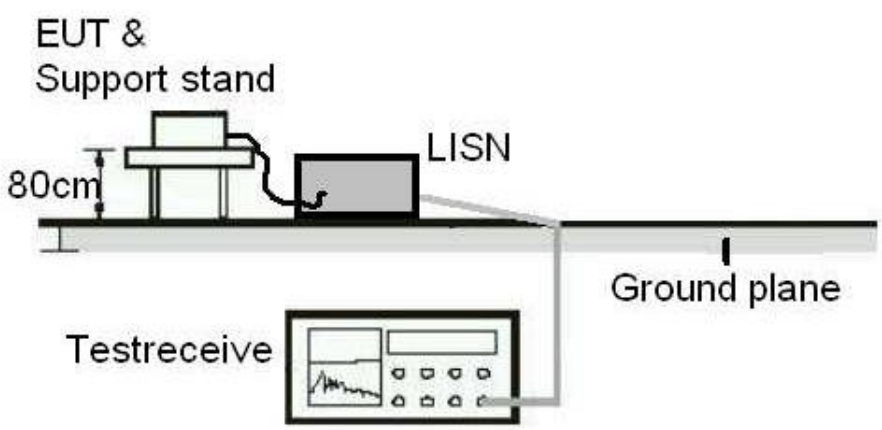
5.2.1 Mains Conducted Emission

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

Test Date: 2020/07/27

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
TWO-LINE V-NETWORK	R&S	ENV216	1816064	2019/9/11	2020/9/10
EMI Test Receiver	R&S	ESCI	1816063	2019/11/18	2020/11/17
RF Cable	N/A	N/A	EMC-003	2019/11/16	2020/11/15

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.

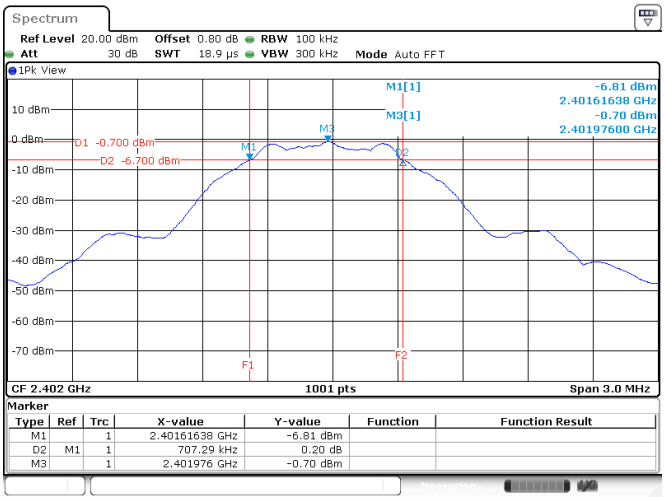
Appendix A: Test Results of Conducted Test

Test Result of 6 dB Bandwidth

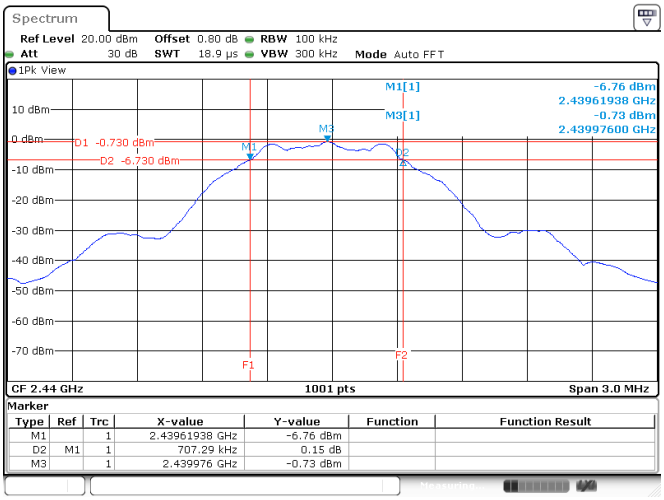
BLE_1M

Channel	Channel Frequency (MHz)	6 dB Bandwidth (kHz)	Limit (kHz)	Result
Low Channel	2402	707.290	> 500	Pass
Middle Channel	2442	707.290	> 500	Pass
High Channel	2480	716.280	> 500	Pass

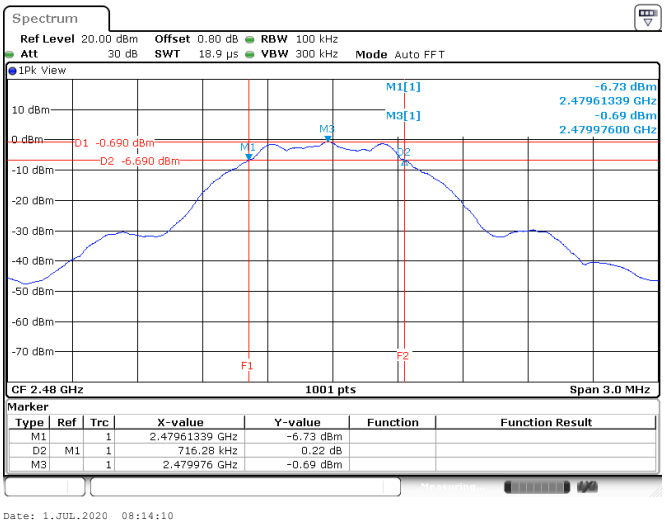
Low Channel



Middle Channel



High Channel

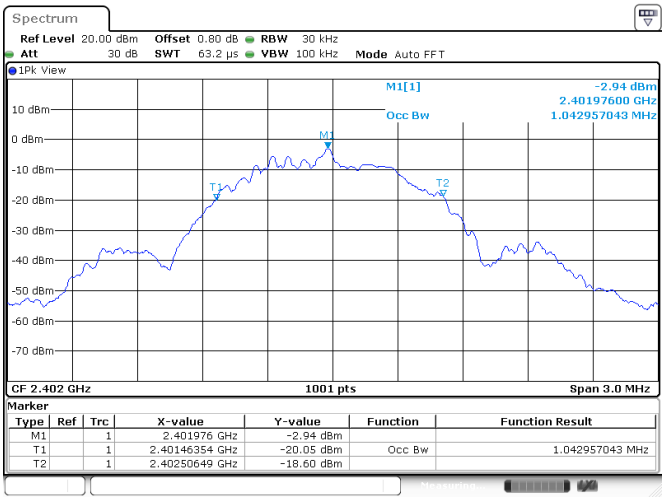


Test Result of 99% Occupied Bandwidth

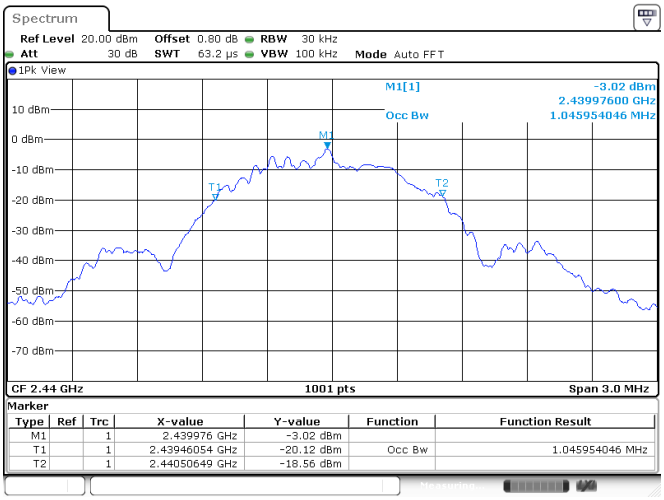
BLE_1M

Channel	Channel Frequency (MHz)	99% Bandwidth (kHz)
Low Channel	2402	1042.96
Middle Channel	2442	1045.95
High Channel	2480	1045.95

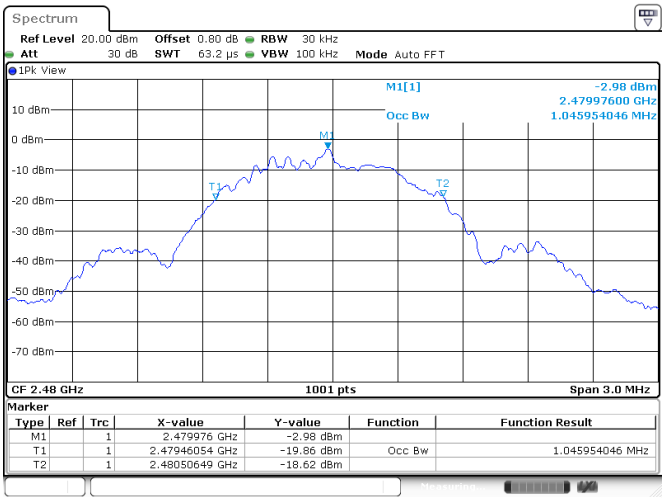
Low Channel



Middle Channel



High Channel

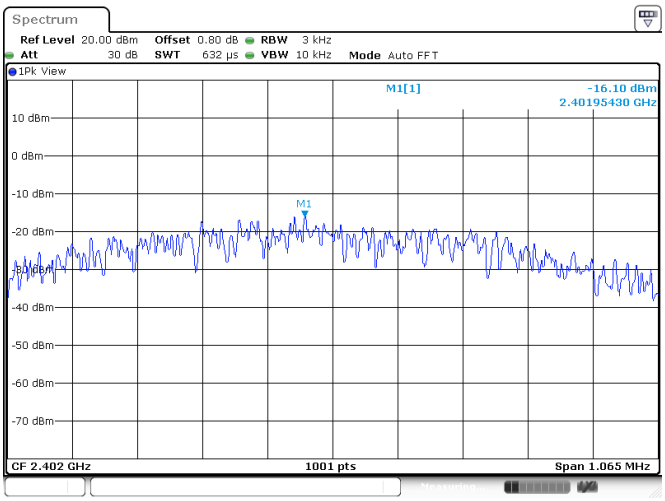


Test Result of Power Spectral Density

BLE_1M

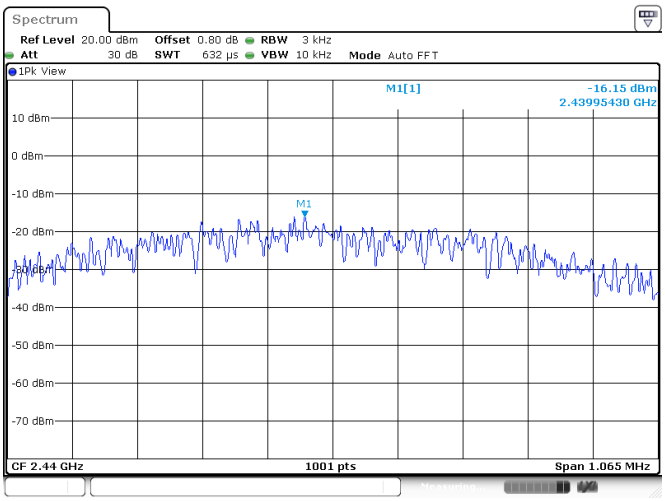
Channel	Channel Frequency (MHz)	Power Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
Low Channel	2402	-16.10	8	Pass
Middle Channel	2442	-16.15	8	Pass
High Channel	2480	-16.09	8	Pass

Low Channel



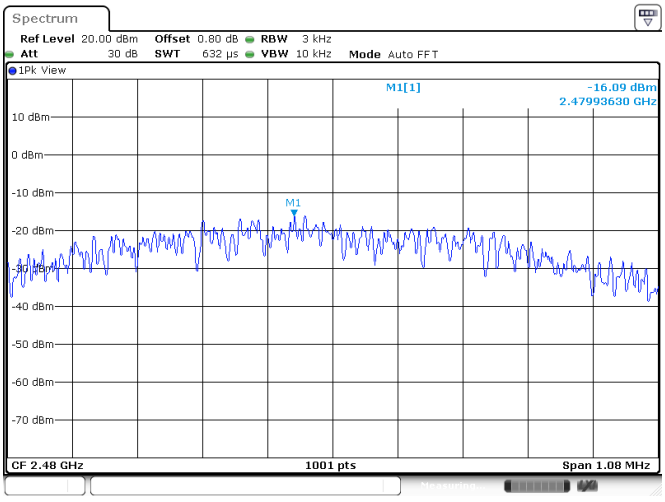
Date: 1.JUL.2020 08:11:05

Middle Channel



Date: 1.JUL.2020 08:13:14

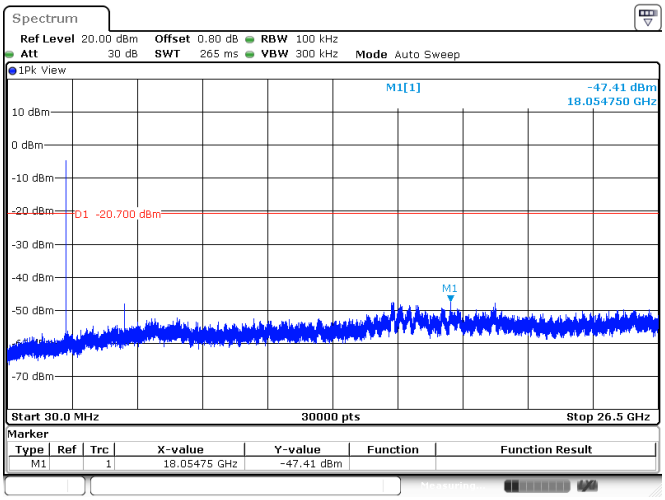
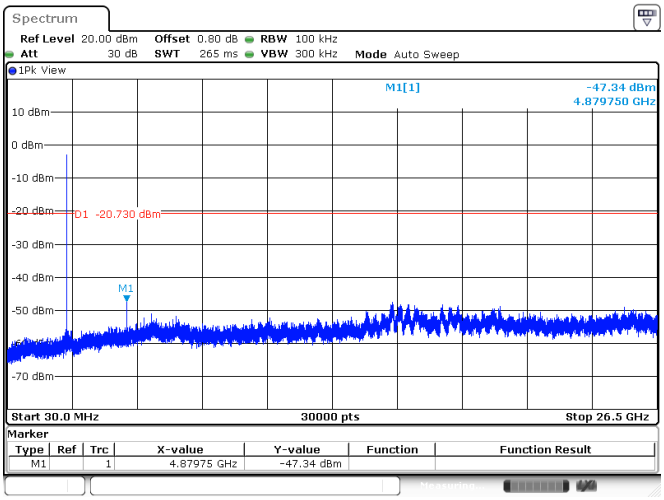
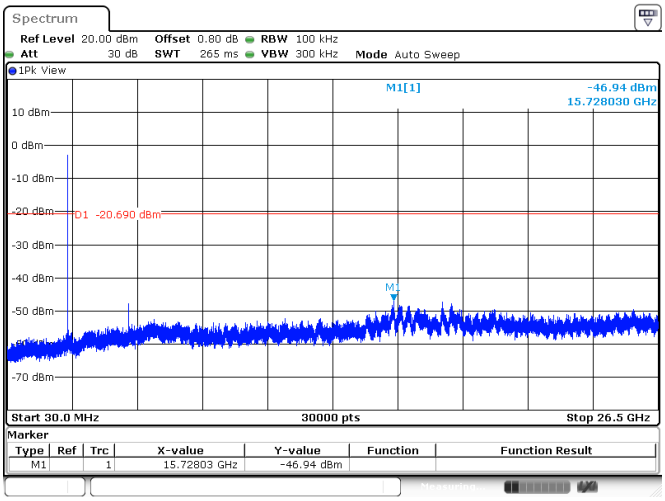
High Channel



Date: 1.JUL.2020 08:15:03

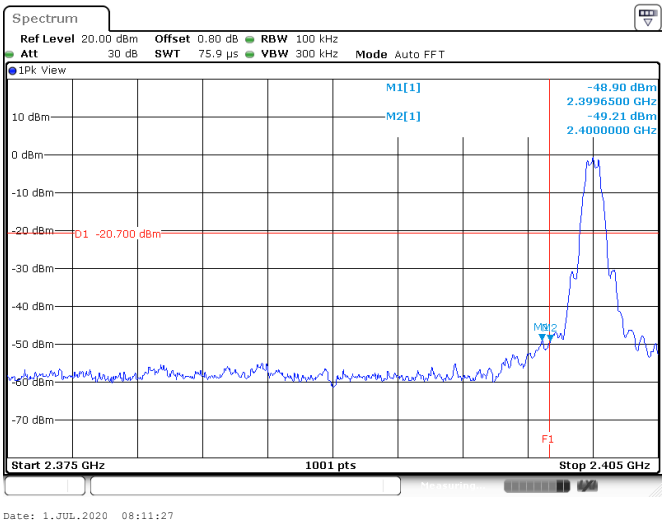
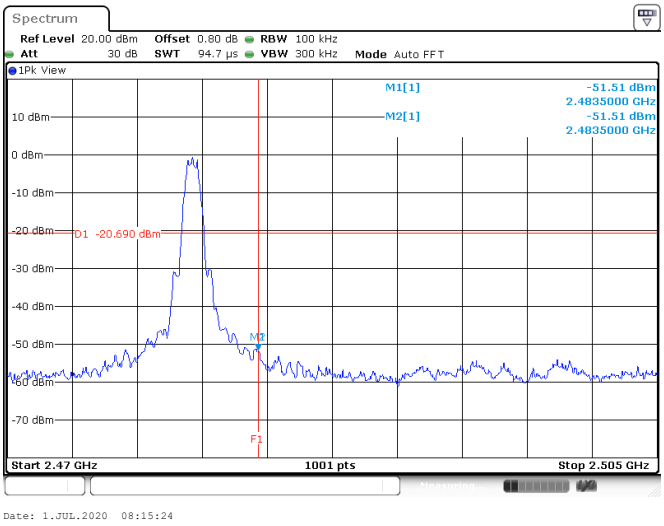
Test Result of Conducted Spurious Emissions, Tx Mode

BLE_1M

Low Channel	Middle Channel
	
High Channel	
	

Test Result of Conducted Band Edge, Tx Mode

BLE_1M

Low Channel	High Channel
	

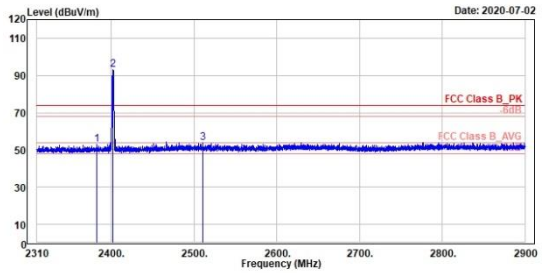
Appendix B: Test Results of Radiated Emissions & Mains Conducted Emission Test

Band Edges, 2.31GHz ~ 2.9GHz

BLE_1M

Low Channel (Horizontal) Peak

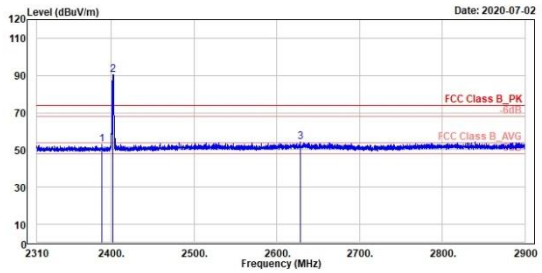
TÜV Rheinland Taiwan Ltd.
No. 458-18,Sec 2,Fenliao.,Linkou Dist.,New Taipei City 244, Taiwan(R.O.C.)
Tel:+886-2172-1000 Fax:+886-2172-1322



	Freq	Level	Read Level	Factor	Limit Line	Over Limit	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1	2382.82	52.93	15.62	37.31	74.00	-21.07	319	341	Peak	Horizontal	
2 *	2402.00	92.96	55.59	37.37	74.00	18.96	319	341	Peak	Horizontal	
3	2510.94	54.01	16.38	37.63	74.00	-19.99	319	341	Peak	Horizontal	

Low Channel (Vertical) Peak

TÜV Rheinland Taiwan Ltd.
No. 458-18,Sec 2,Fenliao.,Linkou Dist.,New Taipei City 244, Taiwan(R.O.C.)
Tel:+886-2172-1000 Fax:+886-2172-1322



	Freq	Level	Read Level	Factor	Limit Line	Over Limit	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1	2388.13	52.78	15.45	37.33	74.00	-21.22	397	218	Peak	Vertical	
2 *	2402.00	90.32	52.95	37.37	74.00	16.32	397	218	Peak	Vertical	
3	2628.68	54.36	16.45	37.91	74.00	-19.64	397	218	Peak	Vertical	

BLE_1M

Low Channel (Horizontal) Average

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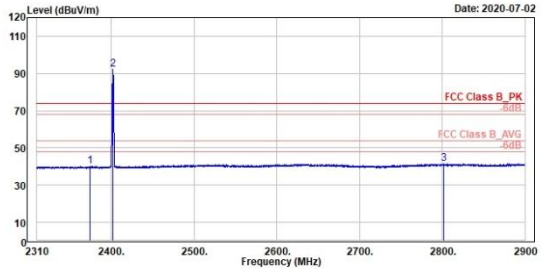
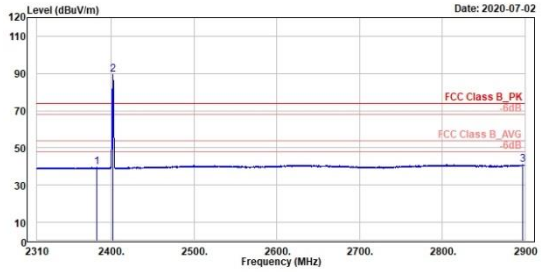
No. 458-18, Sec 2, Fenliao., Linkou Dist., New Taipei City 244, Taiwan(R.O.C.)
Tel:+886-2172-1000 Fax:+886-2172-1322



	Freq	Level	Read Level	Factor	Limit Line	Over Limit	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1	2373.97	40.11	2.83	37.28	54.00	-13.89	319	341	Average	Horizontal	
2 *	2402.00	92.02	54.65	37.37	54.00	38.02	319	341	Average	Horizontal	
3	2802.48	41.61	3.70	37.91	54.00	-12.39	319	341	Average	Horizontal	

Low Channel (Vertical) Average

TÜV Rheinland Taiwan Ltd.
No. 458-18, Sec 2, Fenliao., Linkou Dist., New Taipei City 244, Taiwan(R.O.C.)
Tel:+886-2172-1000 Fax:+886-2172-1322



	Freq	Level	Read Level	Factor	Limit Line	Over Limit	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1	2381.90	39.57	2.27	37.30	54.00	-14.43	397	218	Average	Vertical	
2 *	2402.00	89.28	51.91	37.37	54.00	35.28	397	218	Average	Vertical	
3	2897.89	40.93	2.62	38.31	54.00	-13.07	397	218	Average	Vertical	

BLE_1M

High Channel (Horizontal) Peak

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No. 458-18, Sec 2, Fenliao., Linkou Dist., New Taipei City 244, Taiwan(R.O.C.)
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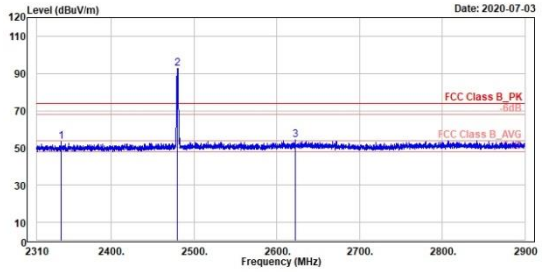
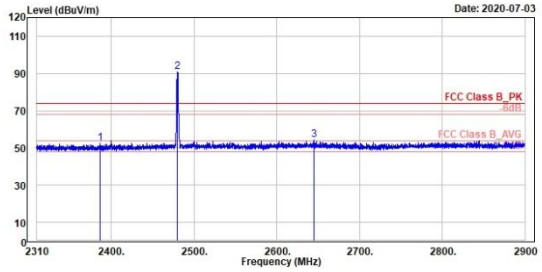


	Freq	Level	Read Level	Factor	Limit Line	Over Limit	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1	2338.79	53.23	16.06	37.17	74.00	-20.77	198	211	Peak	Horizontal	
2 *	2480.00	92.78	55.22	37.56	74.00	18.78	198	211	Peak	Horizontal	
3	2622.70	54.22	16.30	37.92	74.00	-19.78	198	211	Peak	Horizontal	

High Channel (Vertical) Peak

TUV Rheinland Taiwan Ltd.
No. 458-18, Sec 2, Fenliao., Linkou Dist., New Taipei City 244, Taiwan(R.O.C.)
Tel:+886-2172-1000 Fax:+886-2172-1322

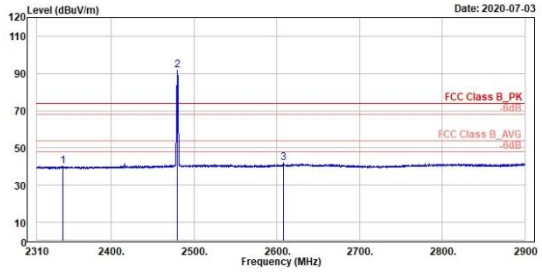


	Freq	Level	Read Level	Factor	Limit Line	Over Limit	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1	2386.94	52.40	15.08	37.32	74.00	-21.60	282	168	Peak	Vertical	
2 *	2480.00	90.59	53.03	37.56	74.00	16.59	282	168	Peak	Vertical	
3	2645.00	54.13	16.27	37.86	74.00	-19.87	282	168	Peak	Vertical	

BLE_1M

High Channel (Horizontal) Average

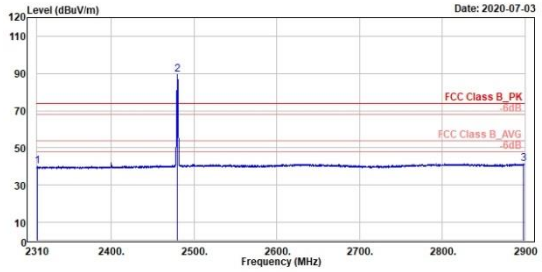
TUV Rheinland Taiwan Ltd.
No. 458-18, Sec 2, Fenliao., Linkou Dist., New Taipei City 244, Taiwan(R.O.C.)
Tel:+886-2172-1000 Fax:+886-2172-1322



	Freq	Level	Read Level	Factor	Limit Line	Over Limit	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1	2341.62	40.16	2.98	37.18	54.00	-13.84	198	211	Average	Horizontal	
2 *	2480.00	91.78	54.22	37.56	54.00	37.78	198	211	Average	Horizontal	
3	2608.07	41.86	3.89	37.97	54.00	-12.14	198	211	Average	Horizontal	

High Channel (Vertical) Average

TUV Rheinland Taiwan Ltd.
No. 458-18, Sec 2, Fenliao., Linkou Dist., New Taipei City 244, Taiwan(R.O.C.)
Tel:+886-2172-1000 Fax:+886-2172-1322



	Freq	Level	Read Level	Factor	Limit Line	Over Limit	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1	2310.24	40.01	2.93	37.08	54.00	-13.99	282	168	Average	Vertical	
2 *	2480.00	89.60	52.04	37.56	54.00	35.60	282	168	Average	Vertical	
3	2898.23	41.69	3.38	38.31	54.00	-12.31	282	168	Average	Vertical	

Spurious Emissions, Tx Mode, 9kHz ~ 30MHz

BLE_1M/2M

High Channel (Open) 9kHz~150kHz

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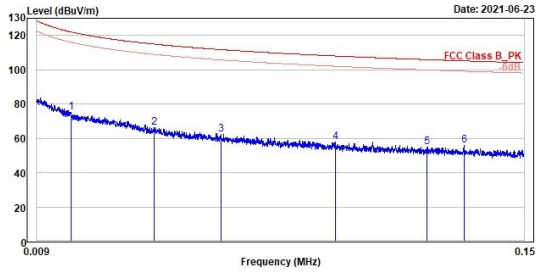
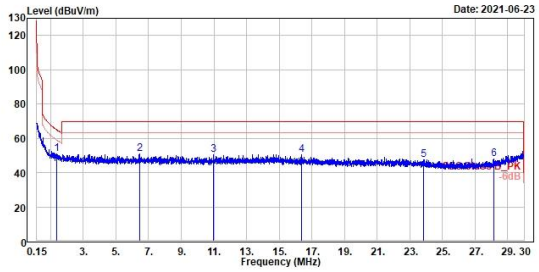
No. 458-18, Sec 2, Fenliao, , Linkou Dist., New Taipei City 244, Taiwan(R.O.C.)
Tel:+886-2172-1000 Fax:+886-2172-1322



	Freq	Level	Read Level	Factor	Limit Line	Over Limit	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1	0.02	75.36	2.12	73.24	122.07	-46.71	100	82	QP	Open	
2	0.04	66.14	-0.64	66.78	114.91	-48.77	100	351	QP	Open	
3	0.06	62.12	-1.23	63.35	111.70	-49.58	100	137	QP	Open	
4	0.10	57.73	-2.08	59.81	108.01	-50.28	100	250	QP	Open	
5	0.12	54.95	-3.02	57.97	105.87	-50.92	100	29	QP	Open	
6	0.13	55.69	-1.67	57.36	105.14	-49.45	100	243	QP	Open	

High Channel (Open) 150kHz~30MHz

TUV Rheinland Taiwan Ltd.
No. 458-18, Sec 2, Fenliao, , Linkou Dist., New Taipei City 244, Taiwan(R.O.C.)
Tel:+886-2172-1000 Fax:+886-2172-1322

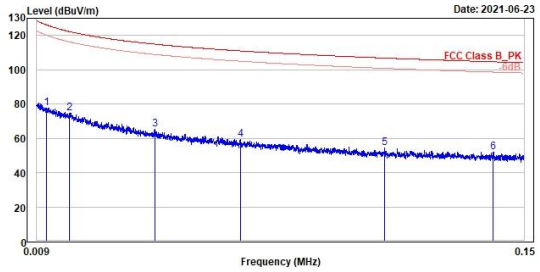


	Freq	Level	Read Level	Factor	Limit Line	Over Limit	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1	1.39	50.89	11.40	39.49	64.77	-13.88	100	252	QP	Open	
2	6.45	50.77	12.42	38.35	69.50	-18.73	100	56	QP	Open	
3	10.98	50.47	13.26	37.21	69.50	-19.03	100	196	QP	Open	
4	16.37	50.24	12.86	37.38	69.50	-19.26	100	286	QP	Open	
5	23.86	47.61	12.63	34.98	69.50	-21.89	100	317	QP	Open	
6	28.16	48.17	12.72	35.45	69.50	-21.33	100	123	QP	Open	

BLE_1M

High Channel (Close) 9kHz~150kHz

TUV Rheinland Taiwan Ltd.
No. 458-18, Sec 2, Fenliao, , Linkou Dist., New Taipei City 244, Taiwan(R.O.C.)
Tel:+886-2172-1000 Fax:+886-2172-1322



	Freq	Level	Read Level	Factor	Limit Line	Over Limit	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1	0.01	77.79	1.81	75.98	126.12	-48.33	100	128	QP	Close	
2	0.02	74.57	1.28	73.29	122.22	-47.65	100	74	QP	Close	
3	0.04	65.15	-0.35	65.50	114.90	-49.75	100	265	QP	Close	
4	0.07	59.51	-1.94	61.45	110.96	-51.45	100	154	QP	Close	
5	0.11	54.61	-2.20	56.81	106.80	-52.19	100	91	QP	Close	
6	0.14	52.14	-3.31	55.45	104.61	-52.47	100	318	QP	Close	

High Channel (Close) 150kHz~30MHz

TUV Rheinland Taiwan Ltd.
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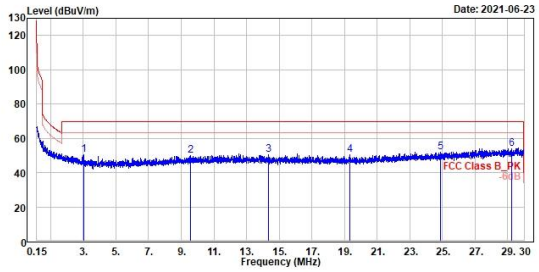

	Freq	Level	Read Level	Factor	Limit Line	Over Limit	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1	3.01	50.36	13.44	36.92	69.50	-19.14	100	83	QP	Close	
2	9.58	49.79	11.68	38.11	69.50	-19.71	100	350	QP	Close	
3	14.33	50.41	12.42	37.99	69.50	-19.09	100	167	QP	Close	
4	19.34	50.40	12.76	37.64	69.50	-19.10	100	292	QP	Close	
5	24.88	52.00	12.09	39.91	69.50	-17.50	100	356	QP	Close	
6	29.24	54.01	12.02	41.99	69.50	-15.49	100	85	QP	Close	

Spurious Emissions, Tx Mode, 30MHz ~ 1GHz

BLE_1M

High Channel (Horizontal)

TÜVRheinland

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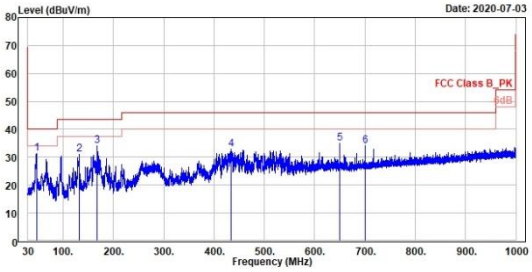

	Freq	Level	Read Level	Factor	Limit Line	Over Limit	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1	46.98	31.29	38.83	-7.54	40.00	-8.71	200	77	QP	horizontal	
2	131.85	31.04	39.91	-8.87	43.50	-12.46	200	132	QP	horizontal	
3	167.84	34.18	41.39	-7.21	43.50	-9.32	200	282	QP	horizontal	
4	433.71	32.75	36.75	-4.00	46.00	-13.25	100	134	QP	horizontal	
5	650.12	35.08	35.65	-0.57	46.00	-10.92	100	234	QP	horizontal	
6	700.08	34.19	34.04	0.15	46.00	-11.81	100	184	QP	horizontal	

High Channel (Vertical)

TÜVRheinland

TUV Rheinland Taiwan Ltd.
No. 458-18, Sec 2, Fenliao., Linkou Dist., New Taipei City 244, Taiwan(R.O.C.)
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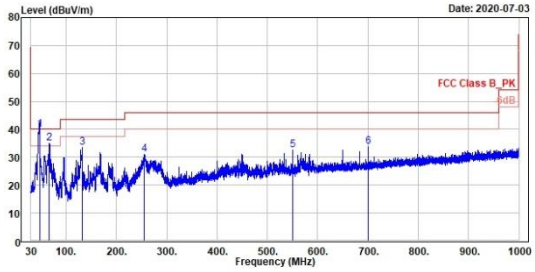

	Freq	Level	Read Level	Factor	Limit Line	Over Limit	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1 !	47.07	39.96	47.50	-7.54	40.00	-0.04	100	4	QP	vertical	
2 !	66.76	35.12	44.52	-9.40	40.00	-4.88	100	351	QP	vertical	
3	131.56	33.48	42.38	-8.90	43.50	-10.02	100	147	QP	vertical	
4	255.72	31.16	39.12	-7.96	46.00	-14.84	100	250	QP	vertical	
5	550.11	32.57	34.99	-2.42	46.00	-13.43	100	193	QP	vertical	
6	700.08	33.64	33.49	0.15	46.00	-12.36	100	270	QP	vertical	

Spurious Emissions, Tx Mode, 1GHz ~ 26.5GHz

BLE_1M

Low Channel (Horizontal)

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No. 458-18, Sec 2, Fenliao., Linkou Dist., New Taipei City 244, Taiwan(R.O.C.)
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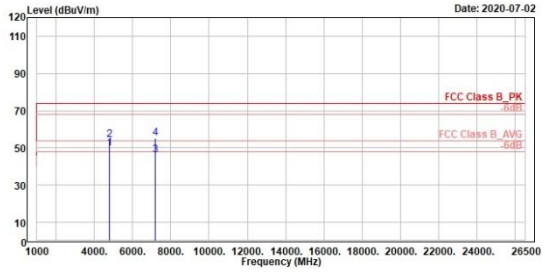
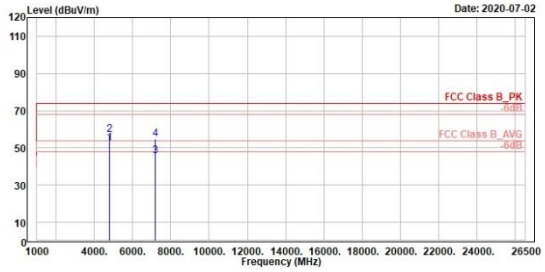


	Freq	Level	Read Level	Factor	Limit Line	Over Limit	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1 !	4804.00	49.57	59.77	-10.20	54.00	-4.43	299	33	Average	horizontal	
2	4804.00	54.27	64.47	-10.20	74.00	-19.73	299	33	Peak	horizontal	
3	7206.00	45.96	53.61	-7.65	54.00	-8.04	112	67	Average	horizontal	
4	7206.00	55.27	62.92	-7.65	74.00	-18.73	112	67	Peak	horizontal	

Low Channel (Vertical)

TÜV Rheinland Taiwan Ltd.
No. 458-18, Sec 2, Fenliao., Linkou Dist., New Taipei City 244, Taiwan(R.O.C.)
Tel:+886-2172-1000 Fax:+886-2172-1322



	Freq	Level	Read Level	Factor	Limit Line	Over Limit	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1 !	4804.00	52.52	62.72	-10.20	54.00	-1.48	302	6	Average	vertical	
2	4804.00	56.97	67.17	-10.20	74.00	-17.03	302	6	Peak	vertical	
3	7206.00	45.62	53.27	-7.65	54.00	-8.38	120	344	Average	vertical	
4	7206.00	54.92	62.57	-7.65	74.00	-19.08	120	344	Peak	vertical	

BLE_1M

Middle Channel (Horizontal)

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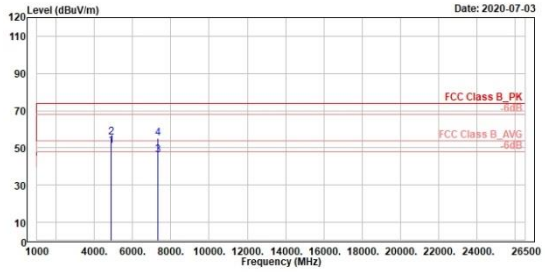

	Freq	Level	Read Level	Factor	Limit Line	Over Limit	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1 !	4880.00	50.94	61.00	-10.06	54.00	-3.06	106	94	Average	horizontal	
2	4880.00	55.74	65.80	-10.06	74.00	-18.26	106	94	Peak	horizontal	
3	7320.00	46.14	53.92	-7.78	54.00	-7.86	126	96	Average	horizontal	
4	7320.00	55.37	63.15	-7.78	74.00	-18.63	126	96	Peak	horizontal	

Middle Channel (Vertical)

TÜV Rheinland Taiwan Ltd.
No. 458-18, Sec 2, Fenliao., Linkou Dist., New Taipei City 244, Taiwan(R.O.C.)
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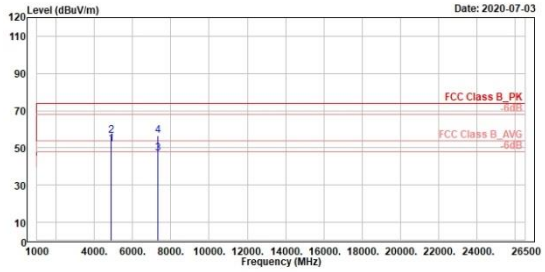

	Freq	Level	Read Level	Factor	Limit Line	Over Limit	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1 !	4880.00	51.86	61.92	-10.06	54.00	-2.14	101	109	Average	vertical	
2	4880.00	56.48	66.54	-10.06	74.00	-17.52	101	109	Peak	vertical	
3	7320.00	46.84	54.62	-7.78	54.00	-7.16	277	321	Average	vertical	
4	7320.00	56.74	64.52	-7.78	74.00	-17.26	277	321	Peak	vertical	

BLE_1M

High Channel (Horizontal)

TUV Rheinland Taiwan Ltd.
No. 458-18, Sec 2, Fenliao., Linkou Dist., New Taipei City 244, Taiwan(R.O.C.)
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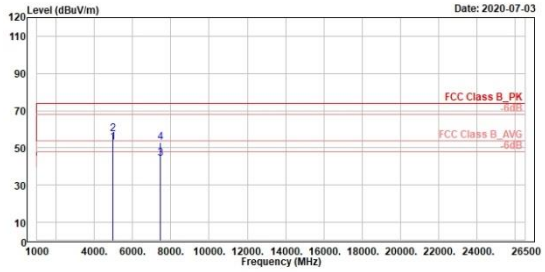

	Freq	Level	Read Level	Factor	Limit Line	Over Limit	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1 !	4960.00	52.75	62.51	-9.76	54.00	-1.25	361	352	Average	horizontal	
2	4960.00	57.45	67.21	-9.76	74.00	-16.55	361	352	Peak	horizontal	
3	7440.00	44.14	51.86	-7.72	54.00	-9.86	125	100	Average	horizontal	
4	7440.00	53.10	60.82	-7.72	74.00	-20.90	125	100	Peak	horizontal	

High Channel (Vertical)

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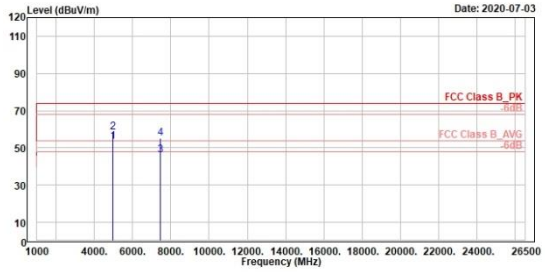

	Freq	Level	Read Level	Factor	Limit Line	Over Limit	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1 !	4960.00	53.44	63.20	-9.76	54.00	-0.56	104	113	Average	vertical	
2	4960.00	58.57	68.33	-9.76	74.00	-15.43	104	113	Peak	vertical	
3	7440.00	46.00	53.72	-7.72	54.00	-8.00	320	341	Average	vertical	
4	7440.00	55.29	63.01	-7.72	74.00	-18.71	320	341	Peak	vertical	

Mains Conducted Emission, 150kHz ~ 30MHz

Worst Band

(Line)

TUV Rheinland Taiwan Ltd(New Taipei City Branch).
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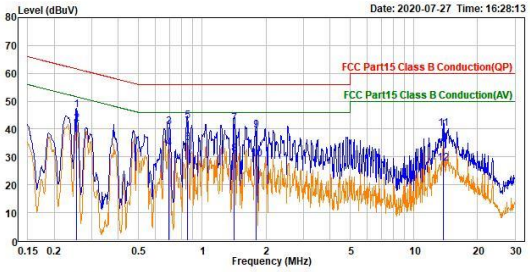

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark	Note
	MHz	dBuV	dB	dBuV	dBuV	dB			
1	0.256	36.67	10.11	46.78	61.57	-14.79	line1	QP	
2	0.256	31.93	10.11	42.04	51.57	-9.53	line1	Average	
3	0.693	30.54	10.13	40.67	56.00	-15.33	line1	QP	
4	0.693	22.99	10.13	33.12	46.00	-12.88	line1	Average	
5	0.850	32.80	10.14	42.94	56.00	-13.06	line1	QP	
6	0.850	24.84	10.14	34.98	46.00	-11.02	line1	Average	
7	1.420	31.94	10.15	42.09	56.00	-13.91	line1	QP	
8	1.420	20.91	10.15	31.06	46.00	-14.94	line1	Average	
9	1.804	29.32	10.17	39.49	56.00	-16.51	line1	QP	
10	1.804	19.16	10.17	29.33	46.00	-16.67	line1	Average	
11	13.717	29.66	10.46	40.12	60.00	-19.88	line1	QP	
12	13.717	17.31	10.46	27.77	50.00	-22.23	line1	Average	

(Neutral)

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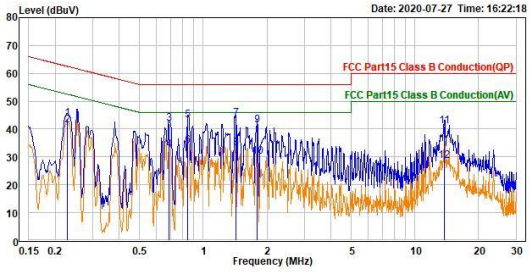

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark	Note
	MHz	dBuV	dB	dBuV	dBuV	dB			
1	0.228	33.83	10.11	43.94	62.52	-18.58	neutral	QP	
2	0.228	31.29	10.11	41.40	52.52	-11.12	neutral	Average	
3	0.689	31.85	10.12	41.97	56.00	-14.03	neutral	QP	
4	0.689	22.54	10.12	32.66	46.00	-13.34	neutral	Average	
5	0.846	33.20	10.14	43.34	56.00	-12.66	neutral	QP	
6	0.846	23.97	10.14	34.11	46.00	-11.89	neutral	Average	
7	1.427	33.63	10.15	43.78	56.00	-12.22	neutral	QP	
8	1.427	22.95	10.15	33.10	46.00	-12.90	neutral	Average	
9	1.804	31.10	10.16	41.26	56.00	-14.74	neutral	QP	
10	1.804	19.81	10.16	29.97	46.00	-16.03	neutral	Average	
11	13.717	30.59	10.47	41.06	60.00	-18.94	neutral	QP	
12	13.717	18.08	10.47	28.55	50.00	-21.45	neutral	Average	