

Prüfbericht-Nr.: Test report no.:	CN21SIDE (P15C-2.4G) 001	Auftrags-Nr.: Order no.:	238510165	Seite 1 von 27 Page 1 of 27
Kunden-Referenz-Nr.: Client reference no.:	N/A	Auftragsdatum: Order date:	2021-01-07	
Auftraggeber: Client:	Kingston Technology Company 17600 Newhope Street, Fountain Valley, California 92708, United States			
Prüfgegenstand: Test item:	HyperX Cloud Core Wireless Headset			
Bezeichnung / Typ-Nr.: Identification / Type no.:	CL004			
Auftrags-Inhalt: Order content:	FCC Part 15C Test report (2.4GHz)			
Prüfgrundlage: Test specification:	FCC 47CFR Part 15: Subpart C Section 15.247			
Wareneingangsdatum: Date of sample receipt:	2021-02-05			
Prüfmuster-Nr.: Test sample no:	A002999958-013 A002999958-012			
Prüfzeitraum: Testing period:	2021-02-17 - 2021-03-03			
Ort der Prüfung: Place of testing:	EMC/RF Taipei Testing Site			
Prüflaboratorium: Testing laboratory:	Taipei Testing Laboratories			
Prüfergebnis*: Test result*:	Pass			
überprüft von: reviewed by:			genehmigt von: authorized by:	
Datum: Date:	2021-03-04	Ausstellungsdatum: Issue date:	2021-03-04	
Stellung / Position:	Senior Project Manager	Stellung / Position:	Senior Project Manager	
Sonstiges / Other:				
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:		Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
* Legende:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	4 = ausreichend N/A = nicht anwendbar
* Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory F(ail) = failed a.m. test specification(s)	4 = sufficient N/A = not applicable
5 = mangelhaft N/T = nicht getestet				
5 = poor 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.				

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.

Contents

HISTORY OF THIS TEST REPORT	5
1. GENERAL REMARKS	6
1.1 COMPLEMENTARY MATERIALS.....	6
1.2 DECISION RULE OF CONFORMITY	6
2. TEST SITES	7
2.1 TEST LABORATORY	7
2.2 TEST FACILITY.....	7
2.3 TRACEABILITY	8
2.4 CALIBRATION	8
2.5 MEASUREMENT UNCERTAINTY	8
3. GENERAL PRODUCT INFORMATION.....	9
3.1 PRODUCT FUNCTION AND INTENDED USE	9
3.2 SYSTEM DETAILS AND RATINGS.....	9
3.3 NOISE GENERATING AND NOISE SUPPRESSING PARTS	10
3.4 SUBMITTED DOCUMENTS.....	10
4. TEST SET-UP AND OPERATION MODES.....	11
4.1 PRINCIPLE OF CONFIGURATION SELECTION	11
4.2 TEST OPERATION AND TEST SOFTWARE.....	12
4.3 SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT	13
4.4 TEST SETUP DIAGRAM	14
5. TEST RESULTS	15
5.1 TRANSMITTER REQUIREMENT & TEST SUITES	15
5.1.1 Antenna Requirement	15
5.1.2 Peak Output Power	16
5.1.3 6 dB Bandwidth and 99% Occupied Bandwidth.....	18
5.1.4 Power Spectral Density.....	19
5.1.5 Conducted Spurious Emissions and Frequency Band Edges Measured in 100 kHz Bandwidth.....	20
5.1.6 Radiated Spurious Emissions and Band Edges	21
5.2 MAINS EMISSION	26
5.2.1 Mains Conducted Emission.....	26

Prüfbericht - Nr.: CN21SIDE (P15C-2.4G) 001
Test Report No.

Seite 4 von 27
Page 4 of 27

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

Prüfbericht - Nr.: CN21SIDE (P15C-2.4G) 001
Test Report No.

Seite 5 von 27
Page 5 of 27

HISTORY OF THIS TEST REPORT

Report No.	Description	Date Issued
CN21SIDE (P15C-2.4G) 001	Original Release	2021-03-04

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 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 HyperX Cloud Core Wireless Headset. It contains a 2.4GHz 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	HyperX Cloud Core Wireless Headset
Type Identification	CL004
FCC ID	JIC-CL004

Technical Specification of EUT

Item	EUT information
Operating Frequency	2405.35 MHz ~ 2477.35 MHz
Channel Spacing	2 MHz
Channel Number	37
Operation Voltage	3.7 Vdc
Modulation	Pi/4 DQPSK
Maximum Output Power (mW)	3.28
Antenna Information	Refer to 5.1.1
Accessory Device	Refer to 4.3

Note: There're two antennas (Ant 1 and Ant 2) used for 2.4GHz function and supports SISO mode only.

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
2405.35	0x08
2439.35	0x08
2477.35	0x08

4.2 Test Operation and Test Software

Setup for testing: Test samples are provided with a USB interface which makes it possible to control them through a test software installed on a notebook computer.

This software was running on the laptop computer connected to the EUT. It was used to enable the operation modes listed as below.

Test Software	VMIttest-1.1.6.56
---------------	-------------------

The samples were used as follows:

A002999958-013

A002999958-012

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:

- The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when position on **Y-plane**.
- "-" 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)
ANT 1 / ANT 2 (Power)	2405.35 to 2477.35	2405.35, 2439.35, 2477.35
ANT 1 (other conducted test)	2405.35 to 2477.35	2405.35, 2439.35, 2477.35

Note: Based on the worst case of conducted power, only ANT 1 was performed for the full tests.

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)
ANT 1	2405.35 to 2477.35	2405.35, 2439.35, 2477.35
ANT 2	2405.35 to 2477.35	2405.35

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)
ANT 1	2405.35 to 2477.35	2405.35

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)
ANT 1	2405.35 to 2477.35	2405.35

Test Condition

Test Item	Ambient Temperature	Relative Humidity	Tested by
Conducted Measurement	21-23 °C	54.6-59.8 %	Stanislas Charles
Radiated Spurious Emissions above 1 GHz	18-22 °C	53.3-60.5 %	Johnson Chen
Radiated Spurious Emissions below 1 GHz	18-22 °C	53.3-60.5 %	Johnson Chen
Mains Conducted Emission	26 °C	65 %	Johnson Chen

4.3 Special Accessories and Auxiliary Equipment

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

Accessory of EUT

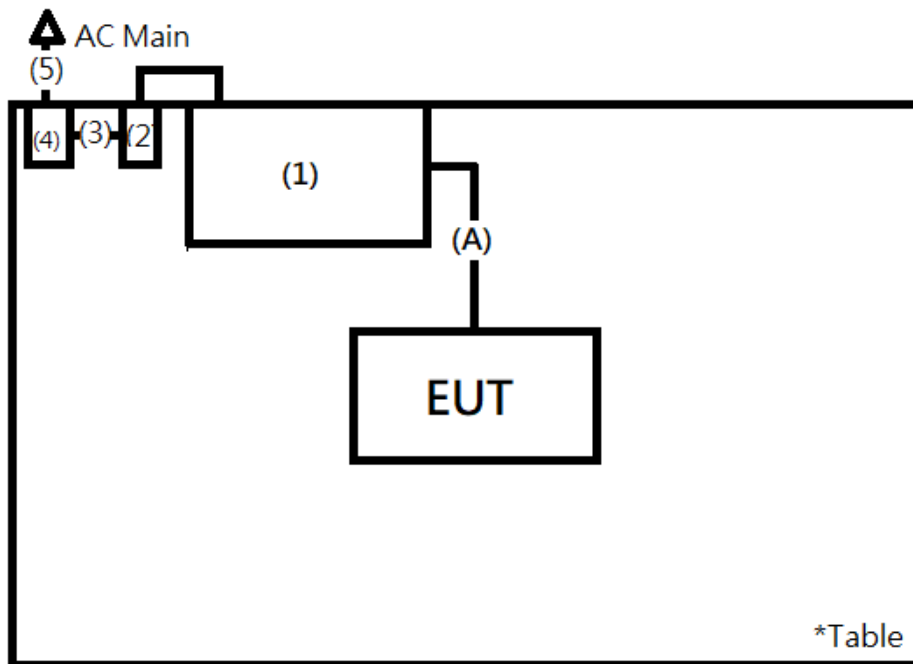
No.	Product	Brand	Model	Description
A	USB Cable	HYPERX	CL004	60 cm shielded cable w/o core
-	Rechargeable Li-Polymer Battery Pack	Hangzhou Future Power	FT533447P	3.7Vdc, 1020mAh

Support Unit

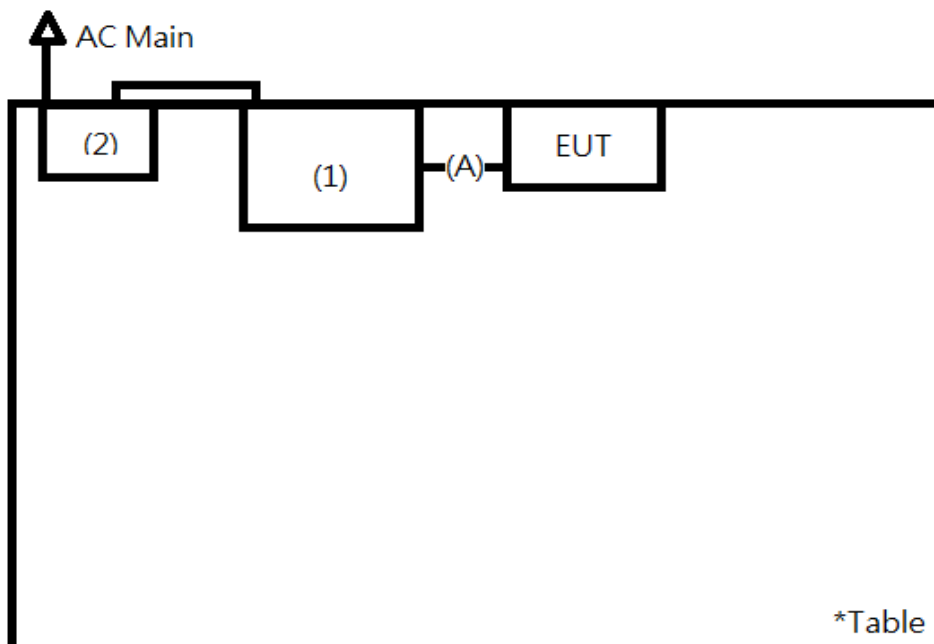
Radiated Emission							
No.	Description	Brand	Model	S/N	Shielded	Ferrite Core (Qty)	Length (cm)
1	Notebook	HP	15s-du0007TX	CND93662VF	-	-	-
2	Adapter	HP	15s-du0007TX	CND93662VF	YES	NO	180
3	Power Cable	TUV	0001	N/A	N/A	NO	150
4	Power Box	TUV	0002	N/A	-	-	-
5	Power Cable	TUV	0003	N/A	N/A	NO	200
Mains Conducted							
1	Notebook	HP	15s-du0007TX	CND93662VF	-	-	-
2	Adapter	HP	15s-du0007TX	CND93662VF	N/A	NO	120

4.4 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 antenna information is as listed below. The antenna is with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision.

Antenna No.	Antenna Type	Antenna Gain (dBi)
ANT 1	Monopole antenna	1.29
ANT 2	Monopole antenna	2.44

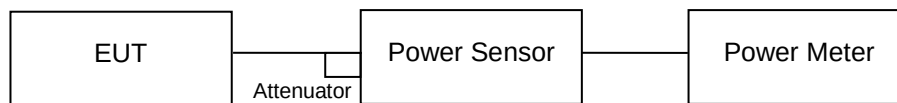
Refer to EUT photo for details.

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	2020/4/6	2021/4/5	2021/2/17	2021/2/17
Power Sensor	Anritsu	MA2411B	1725269	2020/4/7	2021/4/6	2021/2/17	2021/2/17

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

<Ant 1>

Channel	Channel Frequency (MHz)	Peak Output Power		Limit (dBm)
		(dBm)	(mW)	
2	2405.35	5.16	3.28	30
19	2439.35	4.91	3.10	30
38	2477.35	4.40	2.75	30

<Ant 2>

Channel	Channel Frequency (MHz)	Peak Output Power		Limit (dBm)
		(dBm)	(mW)	
2	2405.35	3.29	2.13	30
19	2439.35	3.41	2.19	30
38	2477.35	3.37	2.17	30

Average Power

<Ant 1>

Channel	Channel Frequency (MHz)	Average Power	
		(dBm)	(mW)
2	2405.35	3.17	2.07
19	2439.35	2.87	1.94
38	2477.35	2.30	1.70

<Ant 2>

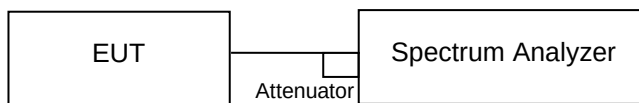
Channel	Channel Frequency (MHz)	Average Power	
		(dBm)	(mW)
2	2405.35	1.35	1.36
19	2439.35	1.40	1.38
38	2477.35	1.46	1.40

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	101513	2020/5/28	2021/5/27	2021/2/17	2021/3/3

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.

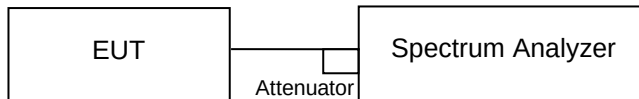
5.1.4 Power Spectral Density

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	101513	2020/5/28	2021/5/27	2021/2/17	2021/3/3

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.

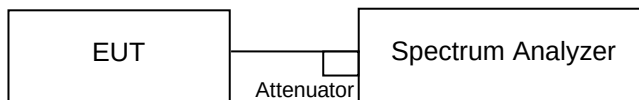
5.1.5 Conducted Spurious Emissions and Frequency Band Edges Measured in 100 kHz Bandwidth

Limit

20 dB (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	101513	2020/5/28	2021/5/27	2021/2/17	2021/3/3

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

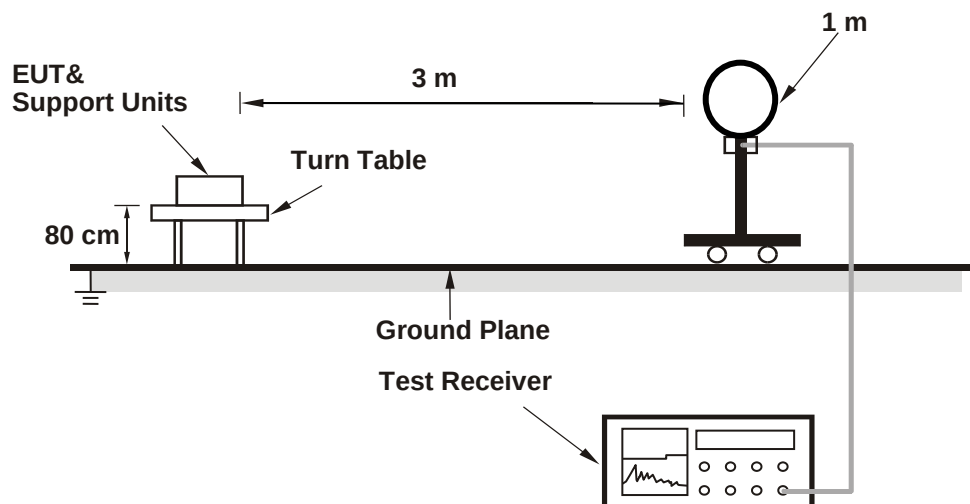
Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a).

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).

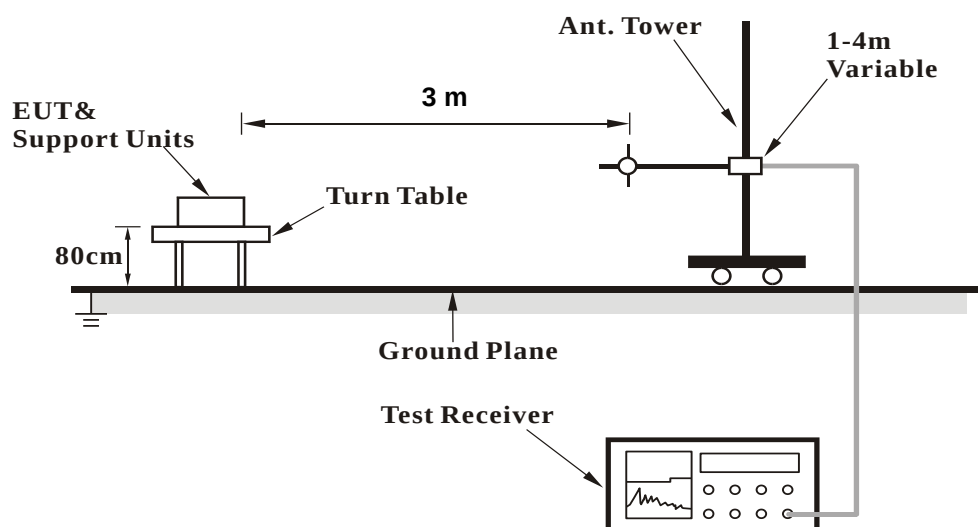
Kind of Test Site 3m Semi-Anechoic Chamber

Test Setup

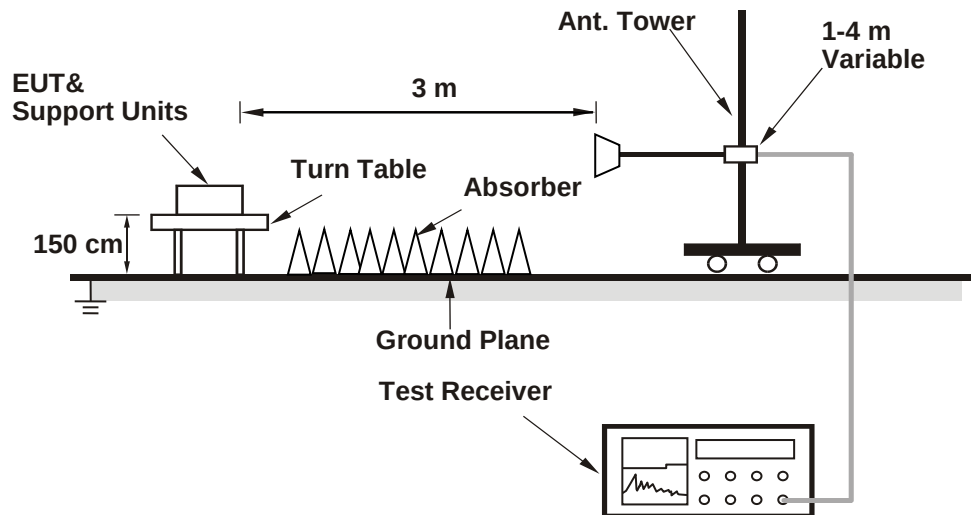
<Radiated Emissions below 30 MHz>



<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
Signal Analyzer	R&S	FSV40	101509	2020/5/5	2021/5/4
Receiver	R&S	ESR7	102109	2020/3/30	2021/3/29
Bilog Antenna	SCHWARZBECK	VULB-9168	00950	2021/1/25	2022/1/24
Horn Antenna	ETS-Lindgren	3117	00218929	2020/11/6	2021/11/5
LF-AMP	Agilent	8447D	2727A05146	2021/2/1	2022/1/31
HF-AMP + AC source	EMCI	EMC051845SE	980635	2021/2/1	2022/1/31
HF-AMP + AC source	EMCI	EMC184045SE	980657	2021/2/1	2022/1/31
Horn Antenna	SCHWARZBECK	BBHA 9170	00890	2020/4/13	2021/4/12
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104EA	800057/4EA	2020/4/22	2021/4/21
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104	802244/4	2020/4/22	2021/4/21
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104	MY37203/4	2020/4/22	2021/4/21
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	800897/2EA	2020/3/25	2021/3/24
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	800902/2EA	2020/3/25	2021/3/24
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	801026/2EA	2020/3/25	2021/3/24
Loop Antenna	Chance Most	EMCILPA600 +calibration	287	2021/1/18	2022/1/15

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, Y and Z axis orientation. The worst-case Axis orientation is recorded in this test report.

Prüfbericht - Nr.: CN21SIDE (P15C-2.4G) 001
Test Report No.

Seite 25 von 27
Page 25 of 27

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

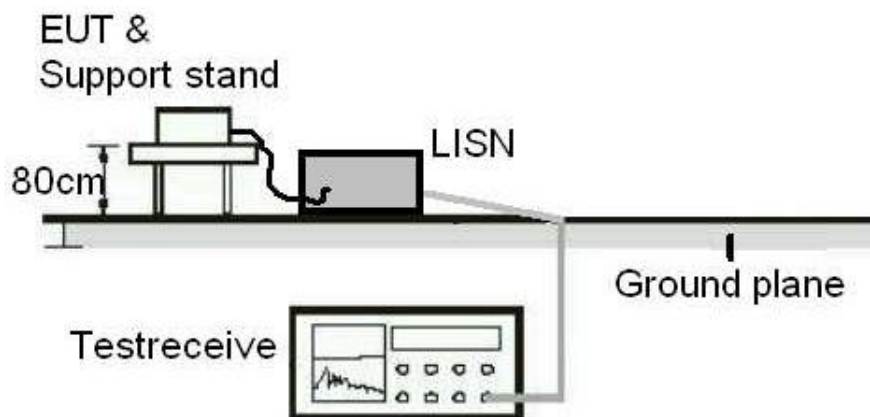
5.2.1 Mains Conducted Emission

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
EMI Test Receiver	Rohde & Schwarz	ESR 7	102114	2020/04/13	2021/04/13
Two-Line V-Network (for EUT)	Rohde & Schwarz	ENV216	101262	2020/08/04	2021/08/04
Pulse Limiter	Schwarzbeck	VTSD 9561 F-N	00660	2020/02/24	2021/02/24
Test Software	Audix	e3	Ver. 9	N/A	N/A

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

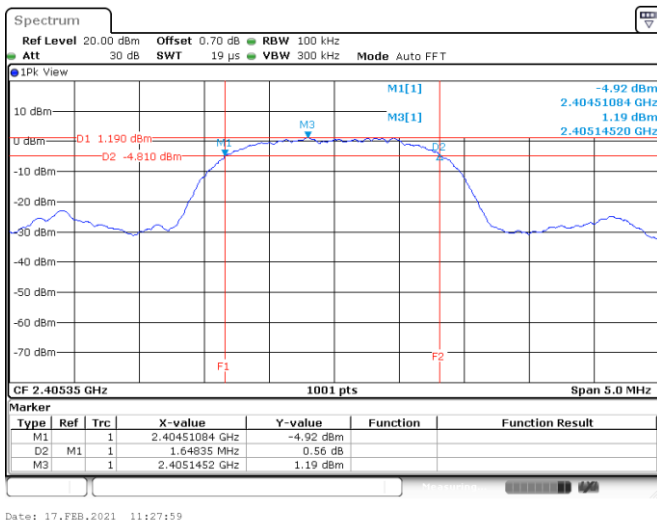
Please refer to Appendix B.

Appendix A: Test Results of Conducted Test

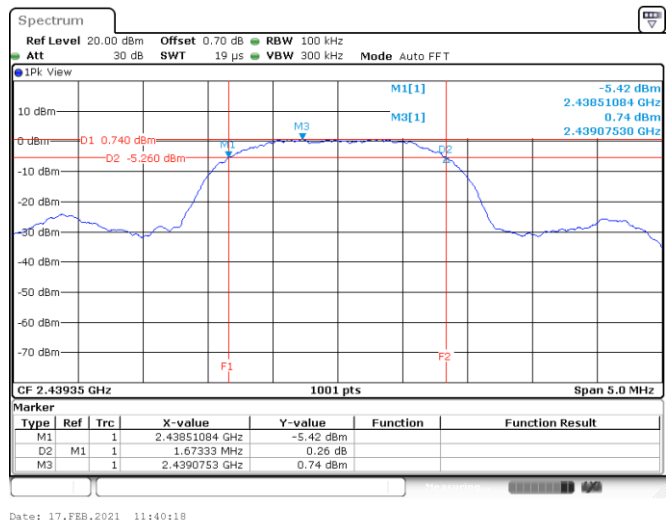
Test Result of 6 dB Bandwidth

Channel	Channel Frequency (MHz)	6 dB Bandwidth (kHz)	Limit (kHz)	Result
Low Channel	2405.35	1648.35	> 500	Pass
Middle Channel	2439.35	1673.33	> 500	Pass
High Channel	2477.35	1638.36	> 500	Pass

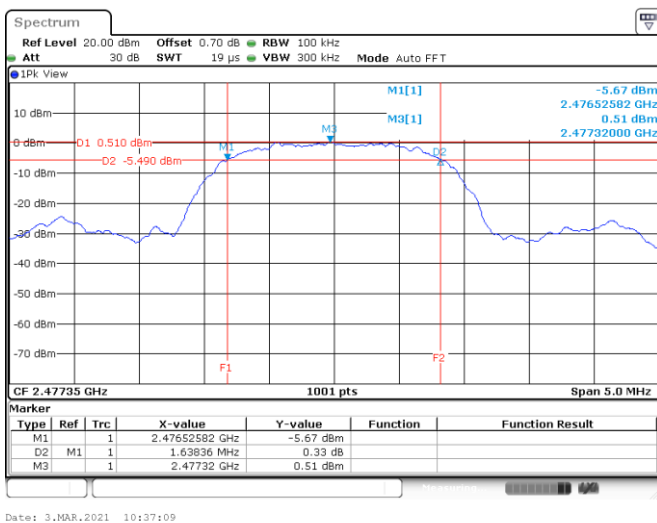
Low Channel



Middle Channel

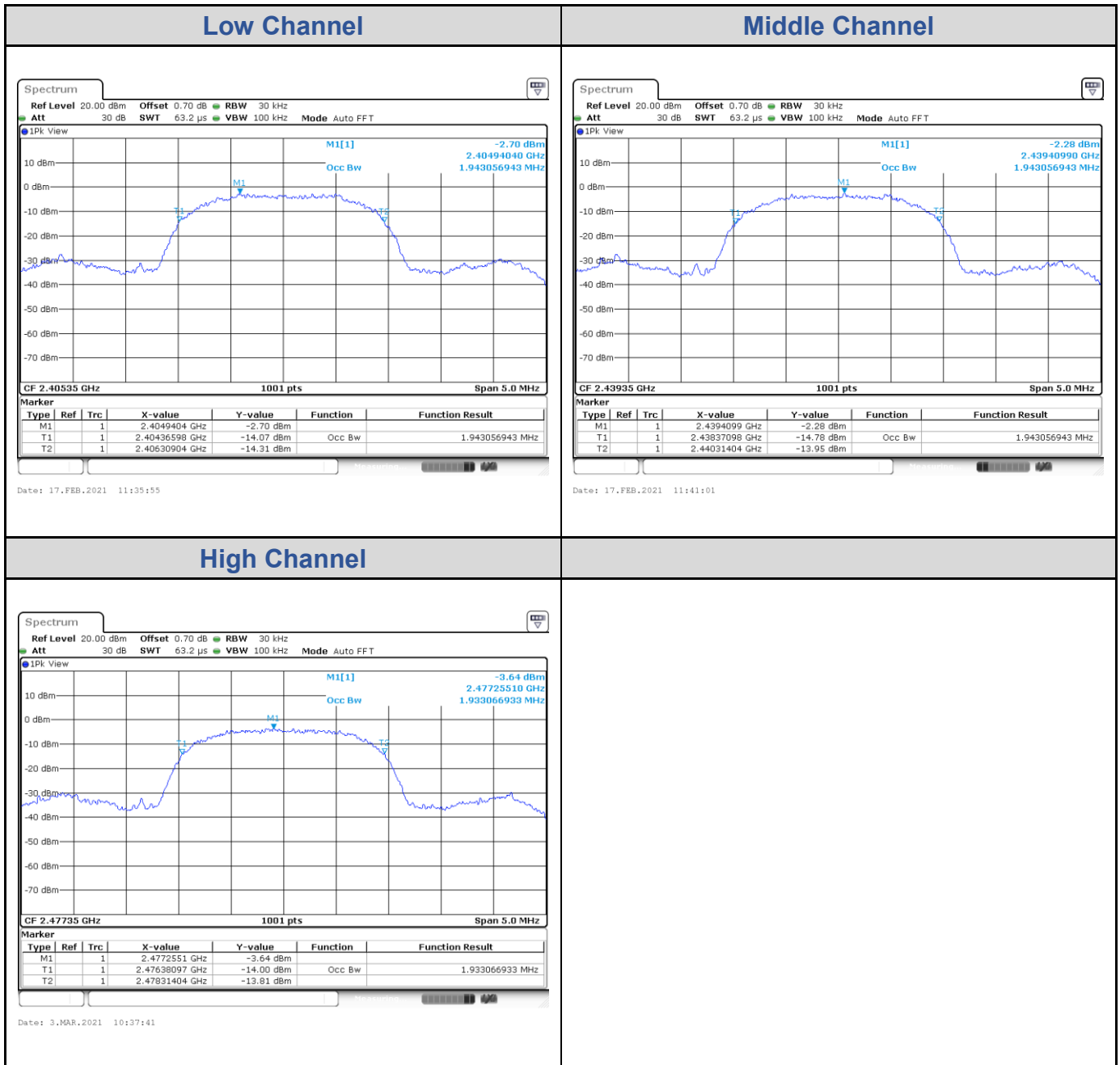


High Channel



Test Result of 99% Occupied Bandwidth

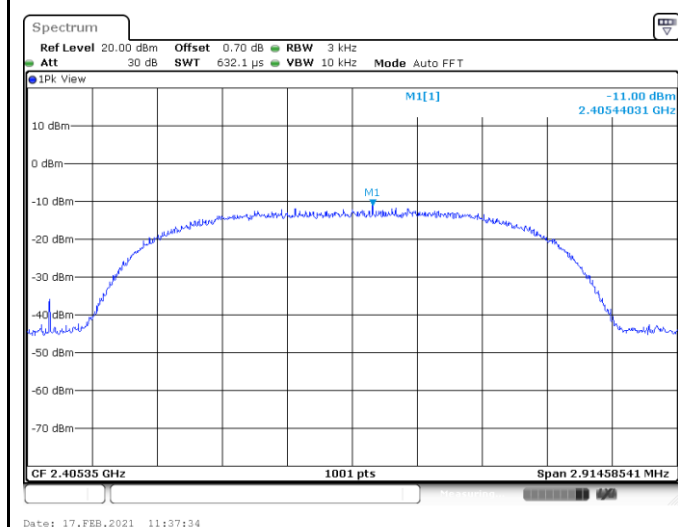
Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)
Low Channel	2405.35	1.943
Middle Channel	2439.35	1.943
High Channel	2477.35	1.933



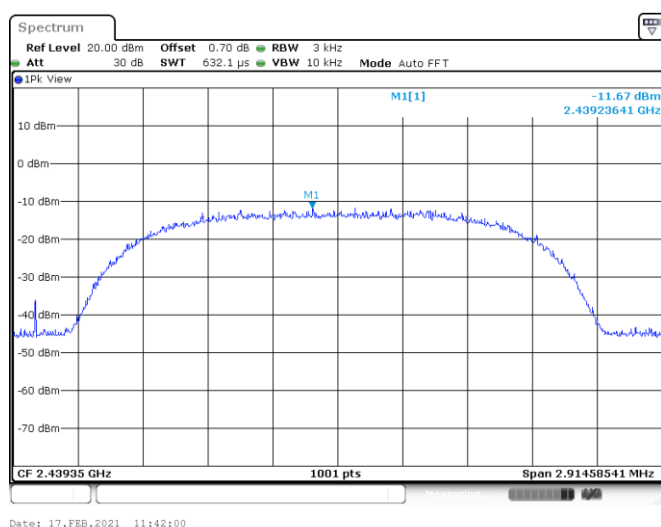
Test Result of Power Spectral Density

Channel	Channel Frequency (MHz)	Power Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
Low Channel	2405.35	-11.00	8	Pass
Middle Channel	2439.35	-11.67	8	Pass
High Channel	2477.35	-12.57	8	Pass

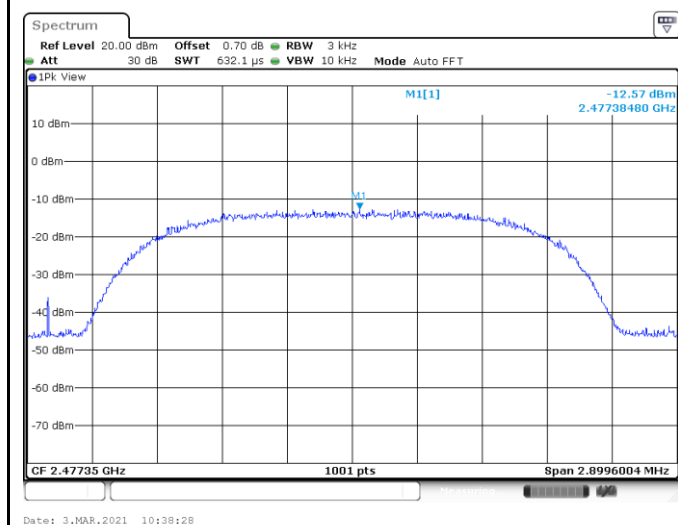
Low Channel



Middle Channel



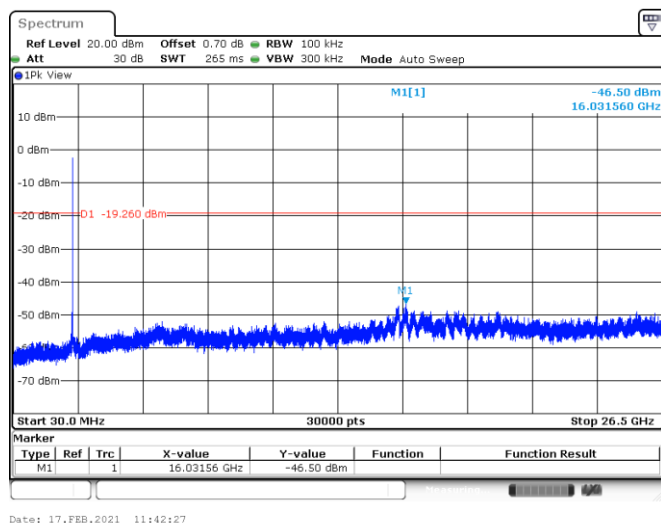
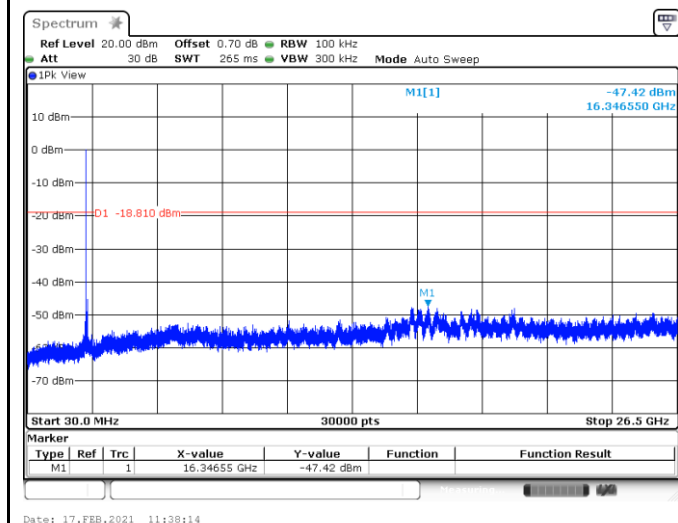
High Channel



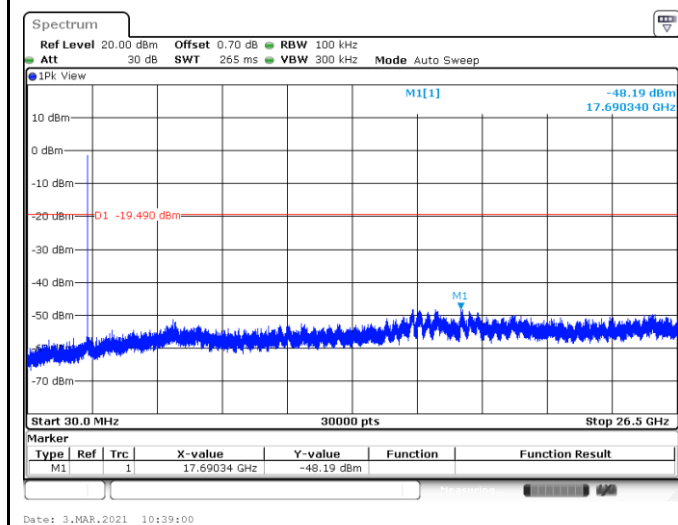
Test Result of Conducted Spurious Emissions, Tx Mode

Low Channel

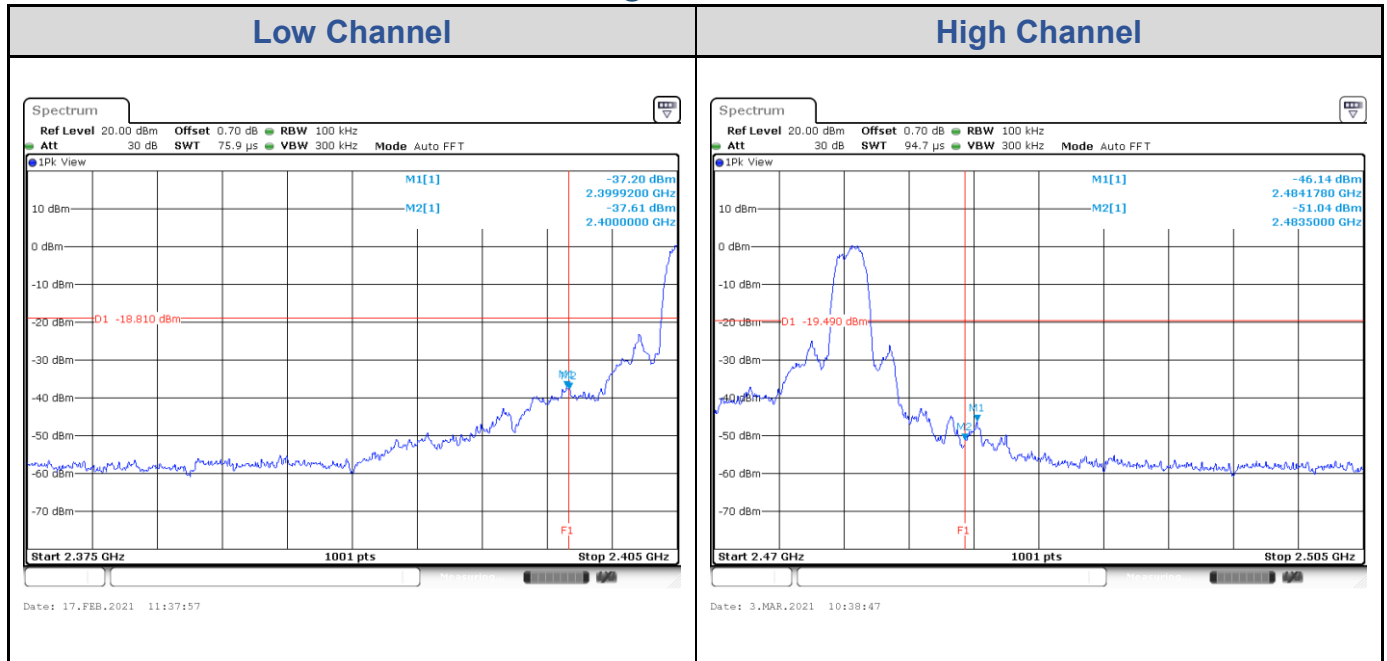
Middle Channel



High Channel



Test Result of Conducted Band Edge, Tx Mode



Appendix B: Test Results of Radiated Spurious Emissions & Mains

Conducted Emission Test

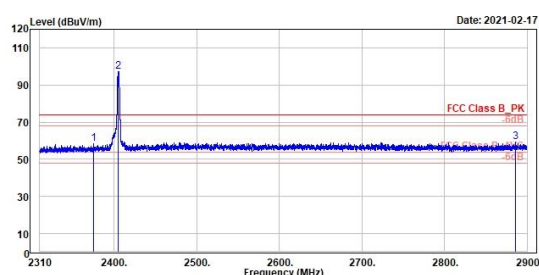
Band Edges, 2.31GHz ~ 2.9GHz

ANT 1

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

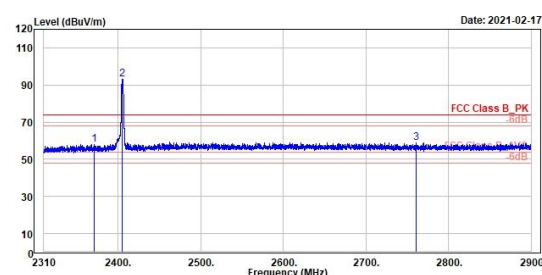


	Freq	Level	Read	Factor	Limit	Over	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
1	2375.00	58.22	24.33	33.89	74.00	-15.78	Peak	Horizontal
2 *	2405.35	97.06	62.98	34.08	74.00	23.06	Peak	Horizontal
3	2885.81	59.13	24.56	34.57	74.00	-14.87	Peak	Horizontal

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



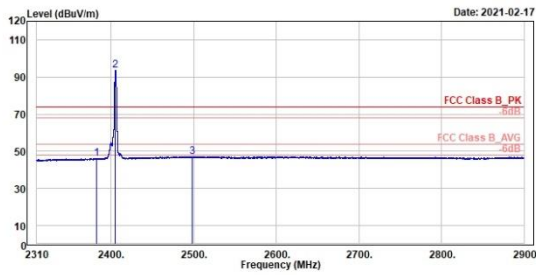
	Freq	Level	Read	Factor	Limit	Over	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
1	2371.19	58.17	24.30	33.87	74.00	-15.83	Peak	Vertical
2 *	2405.35	92.89	58.81	34.08	74.00	18.89	Peak	Vertical
3	2760.73	59.02	24.72	34.30	74.00	-14.98	Peak	Vertical

ANT 1

Low Channel (Horizontal) Average



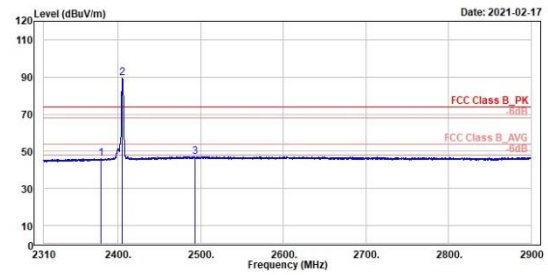
TÜV Rheinland Taiwan Ltd.
No. 458-18, Sec 2, Fenliao, Linkou Dist., New Taipei City 244, Taiwan(R.O.C.)
Tel: +886-2172-1000 Fax: +886-2172-1322



	Freq	Level	Read	Limit	Over		
	MHz	dBuV/m	Level	Line	Limit	Remark	Pol/Phase
			Factor				
1	2382.81	46.24	12.30	33.94	54.00	-7.76 Average	Horizontal
2 *	2405.35	93.42	59.34	34.08	54.00	39.42 Average	Horizontal
3	2498.38	47.21	12.63	34.58	54.00	-6.79 Average	Horizontal



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



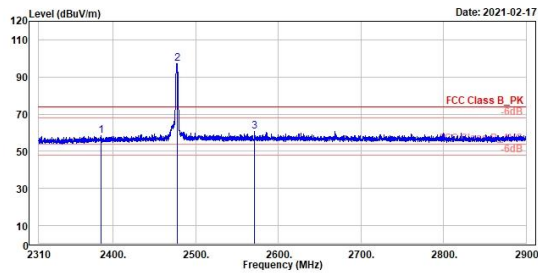
	Freq	Level	Read	Limit	Over		
	MHz	dBuV/m	Level	Line	Limit	Remark	Pol/Phase
			Factor				
1	2379.27	46.17	12.25	33.92	54.00	-7.83 Average	Vertical
2 *	2405.35	89.26	55.18	34.08	54.00	35.26 Average	Vertical
3	2493.21	47.11	12.55	34.56	54.00	-6.89 Average	Vertical

ANT 1

High Channel (Horizontal) Peak



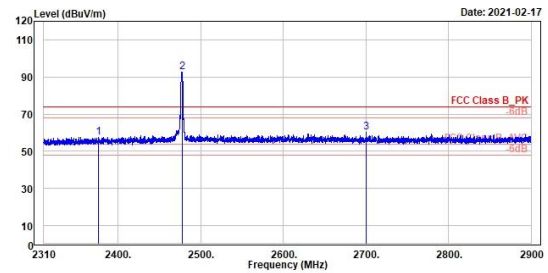
TÜV Rheinland Taiwan Ltd.
No. 458-18, Sec 2, Fenliiao, Linkou Dist., New Taipei City 244, Taiwan(R.O.C.)
Tel: +886-2172-1000 Fax: +886-2172-1322



	Freq	Level	Read	Factor	Limit	Over	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
1	2385.62	58.44	24.49	33.95	74.00	-15.56	Peak	Horizontal
2 *	2477.35	97.24	62.75	34.49	74.00	23.24	Peak	Horizontal
3	2571.20	60.84	26.46	34.38	74.00	-13.16	Peak	Horizontal



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



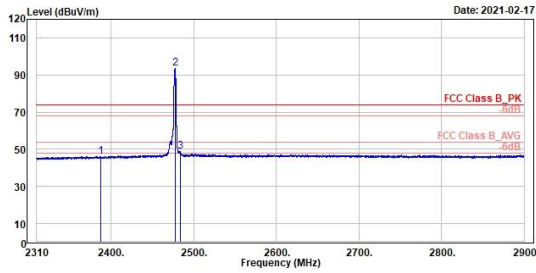
	Freq	Level	Read	Factor	Limit	Over	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
1	2376.43	57.55	23.65	33.90	74.00	-16.45	Peak	Vertical
2 *	2477.35	92.51	58.02	34.49	74.00	18.51	Peak	Vertical
3	2700.48	60.33	25.97	34.36	74.00	-13.67	Peak	Vertical

ANT 1

High Channel (Horizontal) Average



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

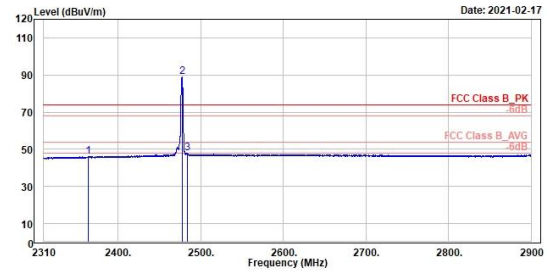


	Freq	Level	Read	Factor	Limit	Over	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
1	2387.36	46.08	12.12	33.96	54.00	-7.92	Average	Horizontal
2 *	2477.35	93.48	58.99	34.49	54.00	39.48	Average	Horizontal
3	2484.12	48.88	14.36	34.52	54.00	-5.12	Average	Horizontal

High Channel (Vertical) Average

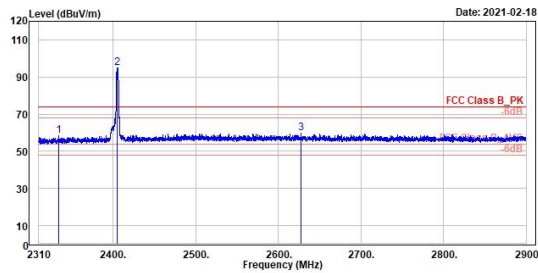
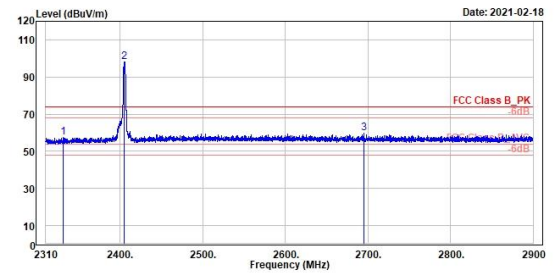


TÜV Rheinland Taiwan Ltd.
No. 458-18, Sec 2, Fenliiao, Linkou Dist., New Taipei City 244, Taiwan(R.O.C.)
Tel: +886-2172-1000 Fax: +886-2172-1322



	Freq	Level	Read	Factor	Limit	Over	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
1	2363.73	46.20	12.38	33.82	54.00	-7.80	Average	Vertical
2 *	2477.35	88.98	54.49	34.49	54.00	34.98	Average	Vertical
3	2483.98	47.86	13.34	34.52	54.00	-6.14	Average	Vertical

ANT 2
Low Channel (Horizontal) Peak

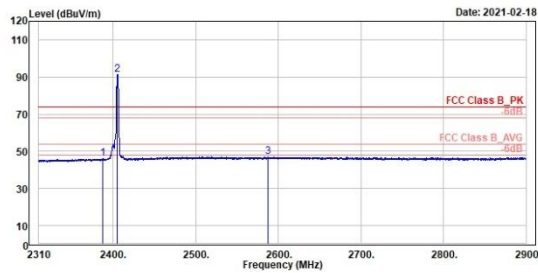
 TÜV Rheinland Taiwan Ltd.
 No. 458-18, Sec 2, Fenliiao, Linkou Dist., New Taipei City 244, Taiwan(R.O.C.)
 Tel: +886-2172-1000 Fax: +886-2172-1322

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


ANT 2

Low Channel (Horizontal) Average



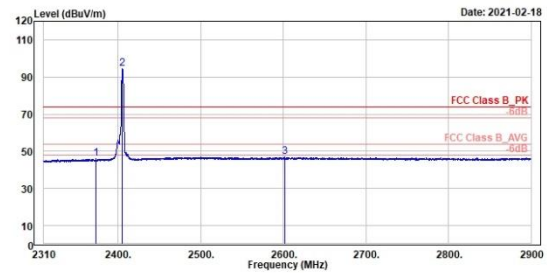
TÜV Rheinland Taiwan Ltd.
No. 458-18, Sec 2, Fenliao, Linkou Dist., New Taipei City 244, Taiwan(R.O.C.)
Tel: +886-2172-1000 Fax: +886-2172-1322



	Freq	Level	Read	Limit	Over		
	MHz	dBuV/m	Level	Line	Limit	Remark	Pol/Phase
			Factor				
1	2387.82	46.09	12.11	33.98	54.00	-7.91 Average	Horizontal
2 *	2405.35	91.42	57.34	34.08	54.00	37.42 Average	Horizontal
3	2587.89	47.01	12.67	34.34	54.00	-6.99 Average	Horizontal



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	Limit	Over		
	MHz	dBuV/m	Level	Line	Limit	Remark	Pol/Phase
			Factor				
1	2373.19	45.91	12.03	33.88	54.00	-8.09 Average	Vertical
2 *	2405.35	94.28	60.20	34.08	54.00	40.28 Average	Vertical
3	2602.17	46.81	12.48	34.33	54.00	-7.19 Average	Vertical

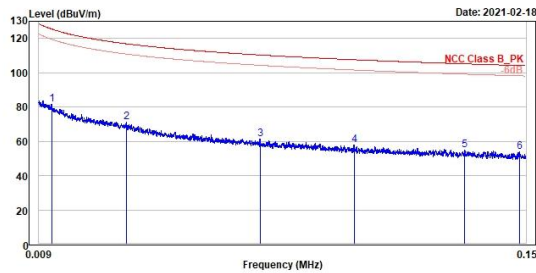
Spurious Emissions, Tx Mode, 9kHz ~ 30MHz

ANT 1

Low Channel (Open) 9kHz~150kHz



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

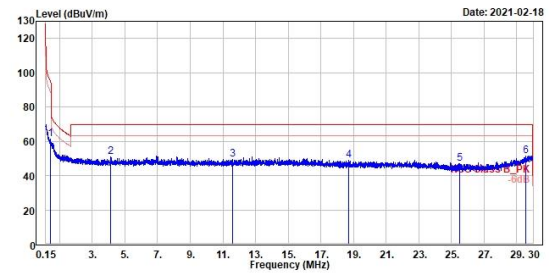


	Freq	Level	Read	Factor	Limit	Over	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
1	0.01	81.78	4.64	77.14	125.51	-43.73	QP	Open
2	0.03	71.39	2.03	69.36	116.87	-45.48	QP	Open
3	0.07	61.46	-0.56	62.02	110.33	-48.87	QP	Open
4	0.10	57.94	-1.31	59.25	107.58	-49.64	QP	Open
5	0.13	55.07	-2.32	57.39	105.17	-50.10	QP	Open
6	0.15	53.89	-2.58	56.47	104.18	-50.29	QP	Open

Low Channel (Open) 150kHz~30MHz

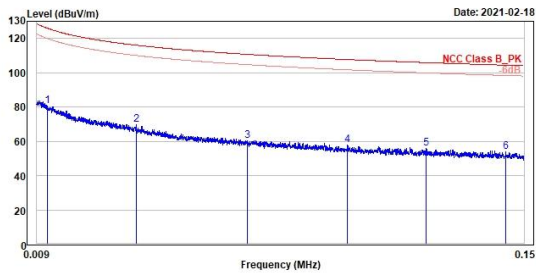


TÜV Rheinland Taiwan Ltd.
 No. 458-18, Sec 2, Fenliao, Linkou Dist., New Taipei City 244, Taiwan(R.O.C.)
 Tel: +886-2172-1000 Fax: +886-2172-1322



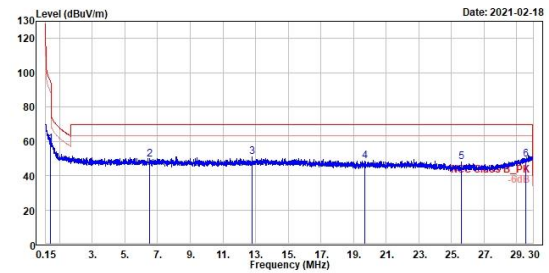
	Freq	Level	Read	Factor	Limit	Over	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
1	0.45	61.15	13.54	47.61	94.57	-33.42	QP	Open
2	4.15	51.10	12.76	38.34	69.50	-18.40	QP	Open
3	11.57	49.42	12.17	37.25	69.50	-20.08	QP	Open
4	18.71	48.90	12.34	36.56	69.50	-20.60	QP	Open
5	25.53	47.04	12.89	34.15	69.50	-22.46	QP	Open
6	29.58	51.32	12.60	38.72	69.50	-18.18	QP	Open

ANT 1
Low Channel (Close) 9kHz~150kHz

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


	Freq	Level	Read	Limit	Over	Remark	Pol/Phase
	MHz	dBuV/m	Level	Line	Limit		
			Factor				

Low Channel (Close) 150kHz~30MHz

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


	Freq	Level	Read	Limit	Over	Remark	Pol/Phase
	MHz	dBuV/m	Level	Line	Limit		
			Factor				

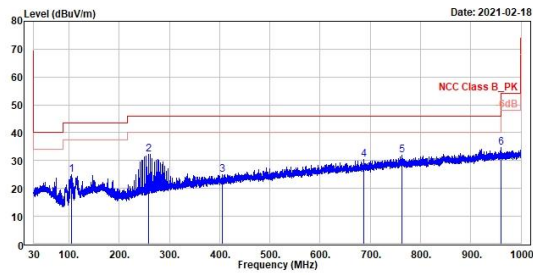
Spurious Emissions, Tx Mode, 30MHz ~ 1GHz

ANT 1

Low Channel (Horizontal)



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

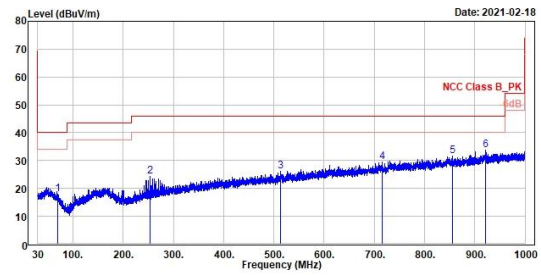


	Freq	Level	Read	Limit	Over	Remark	Pol/Phase
	MHz	dBuV/m	Level	Line	Limit		
			Factor				
				dB/m	dBuV/m	dB	
1	105.08	24.97	35.11	-10.14	43.50	-18.53	QP
2	257.95	32.36	38.78	-6.42	46.00	-13.64	QP
3	405.39	24.99	28.13	-3.14	46.00	-21.01	QP
4	686.79	30.35	28.99	1.36	46.00	-15.65	QP
5	763.13	31.79	29.07	2.72	46.00	-14.21	QP
6	960.13	34.64	29.32	5.32	54.00	-19.36	QP

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	Limit	Over	Remark	Pol/Phase
	MHz	dBuV/m	Level	Line	Limit		
			Factor				
				dB/m	dBuV/m	dB	
1	69.58	18.02	28.12	-10.10	40.00	-21.98	QP
2	253.97	24.21	32.26	-8.05	46.00	-21.79	QP
3	512.77	26.18	29.05	-2.87	46.00	-19.82	QP
4	715.11	29.38	28.98	0.40	46.00	-16.62	QP
5	855.57	31.52	28.71	2.81	46.00	-14.48	QP
6	921.24	33.76	29.60	4.16	46.00	-12.24	QP

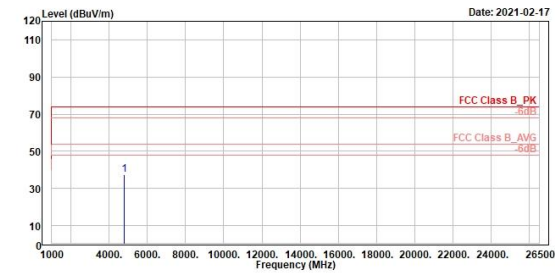
Spurious Emissions, Tx Mode, 1GHz ~ 26.5GHz

ANT 1

Low Channel (Horizontal)



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

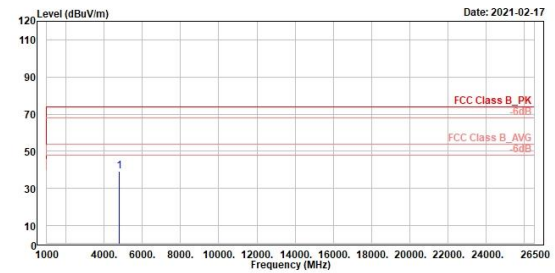


Freq	Level	Read	Level	Factor	Limit	Over	Limit	Remark	Pol/Phase
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB				
1 4811.00	37.54	47.50	-9.96	74.00	-36.46	Peak			horizontal

Low Channel (Vertical)



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



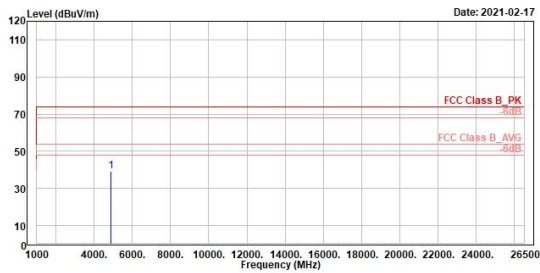
Freq	Level	Read	Level	Factor	Limit	Over	Limit	Remark	Pol/Phase
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB				
1 4811.00	39.40	49.36	-9.96	74.00	-34.60	Peak			vertical

ANT 1

Middle Channel (Horizontal)



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

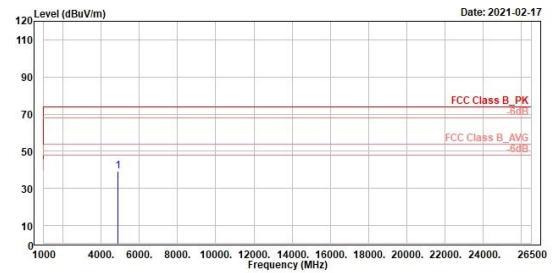


	Freq	Level	Read	Limit	Over		
	MHz	dBuV/m	Level Factor	Line	Limit	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	
1	4879.00	39.04	48.90	-9.86	74.00	-34.96 Peak	horizontal

Middle Channel (Vertical)



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



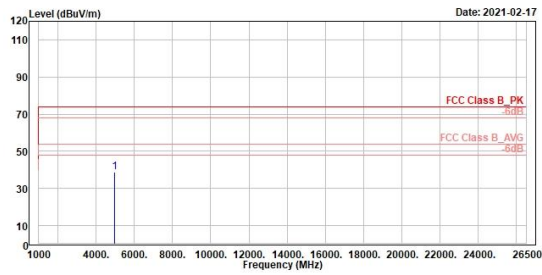
	Freq	Level	Read	Limit	Over		
	MHz	dBuV/m	Level Factor	Line	Limit	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	
1	4879.00	39.06	48.92	-9.86	74.00	-34.94 Peak	vertical

ANT 1

High Channel (Horizontal)



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

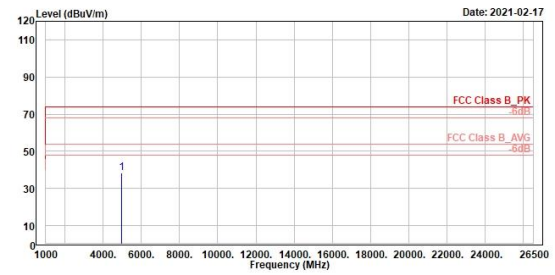


Freq	Level	Read	Level	Factor	Limit	Over	Limit	Remark	Pol/Phase
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB				
1 4955.00	38.88	48.56	-9.68	74.00	-35.12	Peak		horizontal	

High Channel (Vertical)



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



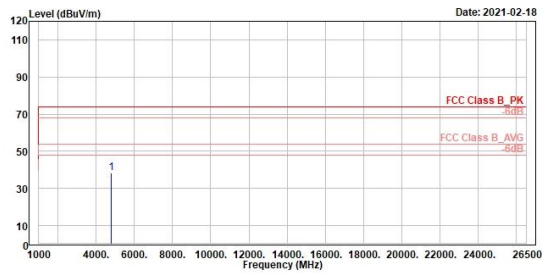
Freq	Level	Read	Level	Factor	Limit	Over	Limit	Remark	Pol/Phase
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB				
1 4955.00	38.54	48.22	-9.68	74.00	-35.46	Peak		vertical	

ANT 2

Low Channel (Horizontal)



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

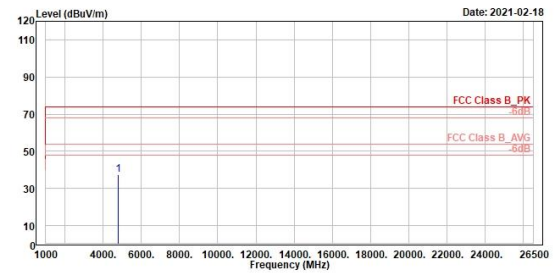


Freq	Level	Read	Level	Factor	Limit	Over	Limit	Remark	Pol/Phase
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB				
1 4811.00	38.46	48.42	-9.96	74.00	-35.54	Peak			horizontal

Low Channel (Vertical)



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



Freq	Level	Read	Level	Factor	Limit	Over	Limit	Remark	Pol/Phase
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB				
1 4811.00	37.26	47.22	-9.96	74.00	-36.74	Peak			vertical

Mains Conducted Emission, 150kHz ~ 30MHz

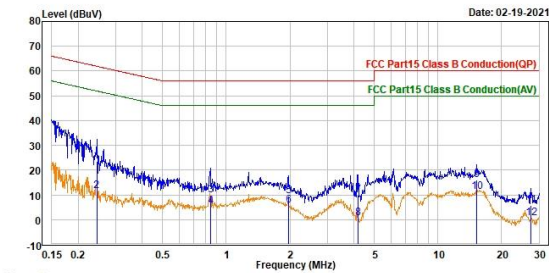
Worst Band

(Line)

(Neutral)



TÜV Rheinland Taiwan Ltd(New Taipei City Branch).
 No. 458-19, Sec. 2, Fenliao Rd., Linkou Dist., New Taipei City 244
 Tel:+886-2172-1000 Fax:+886-2172-1322

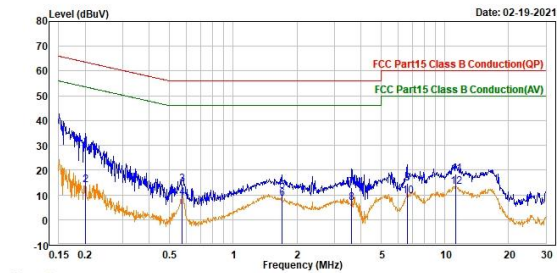


Trace: 1

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark	Pol/Phase	Note
	MHz	dBuV	dB	dBuV	dBuV	dB			
1	0.244	23.46	0.05	23.51	61.94	-38.43	QP	line1	
2	0.244	11.42	0.05	11.47	51.94	-40.47	Average	line1	
3	0.842	9.87	0.08	9.95	56.00	-46.05	QP	line1	
4	0.842	5.40	0.08	5.48	46.00	-40.52	Average	line1	
5	1.964	9.36	0.11	9.47	56.00	-46.53	QP	line1	
6	1.964	5.52	0.11	5.63	46.00	-40.37	Average	line1	
7	4.210	9.56	0.16	9.72	56.00	-46.28	QP	line1	
8	4.210	0.35	0.16	0.51	46.00	-45.49	Average	line1	
9	15.307	15.62	0.42	16.04	60.00	-43.96	QP	line1	
10	15.307	10.81	0.42	11.23	50.00	-38.77	Average	line1	
11	27.426	5.21	0.54	5.75	60.00	-54.25	QP	line1	
12	27.426	0.10	0.54	0.64	50.00	-49.36	Average	line1	



TÜV Rheinland Taiwan Ltd(New Taipei City Branch).
 No. 458-19, Sec. 2, Fenliao Rd., Linkou Dist., New Taipei City 244
 Tel:+886-2172-1000 Fax:+886-2172-1322



Trace: 1

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark	Pol/Phase	Note
	MHz	dBuV	dB	dBuV	dBuV	dB			
1	0.200	29.44	0.05	29.49	63.60	-34.11	QP	neutral	
2	0.200	14.05	0.05	14.10	53.60	-39.50	Average	neutral	
3	0.573	14.11	0.06	14.17	56.00	-41.83	QP	neutral	
4	0.573	8.75	0.06	8.81	46.00	-37.19	Average	neutral	
5	1.699	11.62	0.10	11.72	56.00	-44.28	QP	neutral	
6	1.699	8.29	0.10	8.39	46.00	-37.61	Average	neutral	
7	3.625	12.77	0.14	12.91	56.00	-43.09	QP	neutral	
8	3.625	6.64	0.14	6.78	46.00	-39.22	Average	neutral	
9	6.626	14.49	0.23	14.72	60.00	-45.28	QP	neutral	
10	6.626	9.24	0.23	9.47	50.00	-40.53	Average	neutral	
11	11.294	17.95	0.33	18.28	60.00	-41.72	QP	neutral	
12	11.294	12.79	0.33	13.12	50.00	-36.88	Average	neutral	