



Prüfbericht-Nr.: <i>Test report no.:</i>	CN21W7YW(P15C-ZigBee) 001	Auftrags-Nr.: <i>Order no.:</i>	238518902	Seite 1 von 27 Page 1 of 27
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	2021-08-17	
Auftraggeber: <i>Client:</i>	TAIYO YUDEN CO., LTD. 43-1, Yawatabara-machi, Takasaki-shi, Gumma, Japan			
Prüfgegenstand: <i>Test item:</i>	Bluetooth low energy/ANT/802.15.4 Module			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	EYSRCN			
Auftrags-Inhalt: <i>Order content:</i>	FCC Part 15C Test report (ZigBee)			
Prüfgrundlage: <i>Test specification:</i>	FCC 47CFR Part 15: Subpart C Section 15.247			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2021-08-17			
Prüfmuster-Nr.: <i>Test sample no:</i>	A003101792-001 A003101532-001			
Prüfzeitraum: <i>Testing period:</i>	2021-08-20 - 2021-09-02			
Ort der Prüfung: <i>Place of testing:</i>	EMC/RF Taipei Testing Site			
Prüflaboratorium: <i>Testing laboratory:</i>	Taipei Testing Laboratories			
Prüfergebnis*: <i>Test result*:</i>	Pass			
überprüft von: <i>compiled by:</i>	genehmigt von: <i>authorized by:</i>			
Datum: <i>Date:</i> 2021-09-08	Jack Wang	Ausstellungsdatum: <i>Issue date:</i> 2021-09-08	Ryan Chen	
Stellung / Position:	Senior Project Engineer	Stellung / Position:	Senior Project Manager	
Sonstiges / Other:				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* Legende:	1 = sehr gut 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. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

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

APPENDIX SP - PHOTOGRAPHS OF TEST SETUP

APPENDIX EP - PHOTOGRAPHS OF EUT

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HISTORY OF THIS TEST REPORT

Report No.	Description	Date Issued
CN21W7YW(P15C-ZigBee) 001	Original Release	2021-09-08

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)	± 1.32 dB
Radiated Emission (200 MHz ~ 1 GHz)	± 1.31 dB
Radiated Emission (1 GHz ~ 18 GHz)	± 1.53 dB
Radiated Emission (18 GHz ~ 40 GHz)	± 2.50 dB
Mains Conducted Emission	± 1.65 dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a Bluetooth low energy/ANT/802.15.4 Module. It contains a ZigBee 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	Bluetooth low energy/ANT/802.15.4 Module
Type Identification	EYSRCN
FCC ID	RYYEYSRCN

Technical Specification of EUT

Item	EUT information
Operating Frequency	2405 MHz ~ 2475 MHz
Channel Spacing	5MHz
Channel Number	16
Data Rate	250kbps
Operation Voltage	3Vdc
Modulation	GFSK
Maximum Output Power (mW)	6.55
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
2405	pos8
2440	pos8
2475	pos8

4.2 Carrier Frequency and Channel

Channel	Freq. (MHz)	Channel	Freq. (MHz)
11	2405	19	2445
12	2410	20	2450
13	2415	21	2455
14	2420	22	2460
15	2425	23	2465
16	2430	24	2470
17	2435	25	2475
18	2440	26	2480

4.3 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	Radio Test Tool
---------------	-----------------

The samples were used as follows:

A003101792-001 for radiated test

A003101532-001 for conducted test

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 (kbps)
-	2405 to 2475	2405, 2440, 2475	250

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 (kbps)
-	2405 to 2475	2405, 2440, 2475	250

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 (kbps)
-	2405 to 2475	2405	250

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 (kbps)
-	2405 to 2475	2405	250

Test Condition

Test Item	Ambient Temperature	Relative Humidity	Tested by
Conducted Measurement	23.8-24.8 °C	49-57 %	Nick Hsu
Radiated Spurious Emissions above 1 GHz	23.6-24.1 °C	61.3-62.5 %	Hunter Wang
Radiated Spurious Emissions below 1 GHz	23.6-24.1 °C	61.3-62.5 %	Hunter Wang
Mains Conducted Emission	20 °C	54 %	Simon Tsai

4.4 Special Accessories and Auxiliary Equipment

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

Accessory of EUT

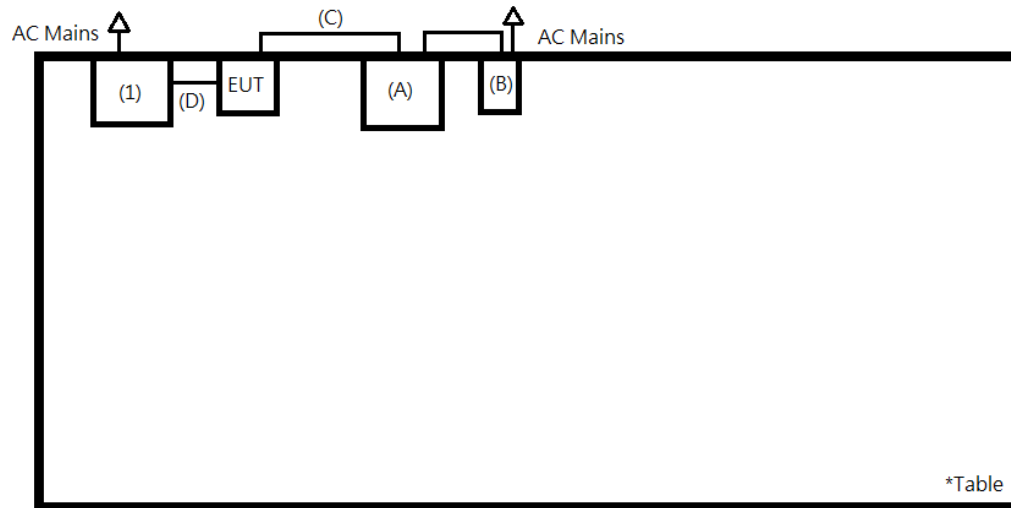
None.

Support Unit

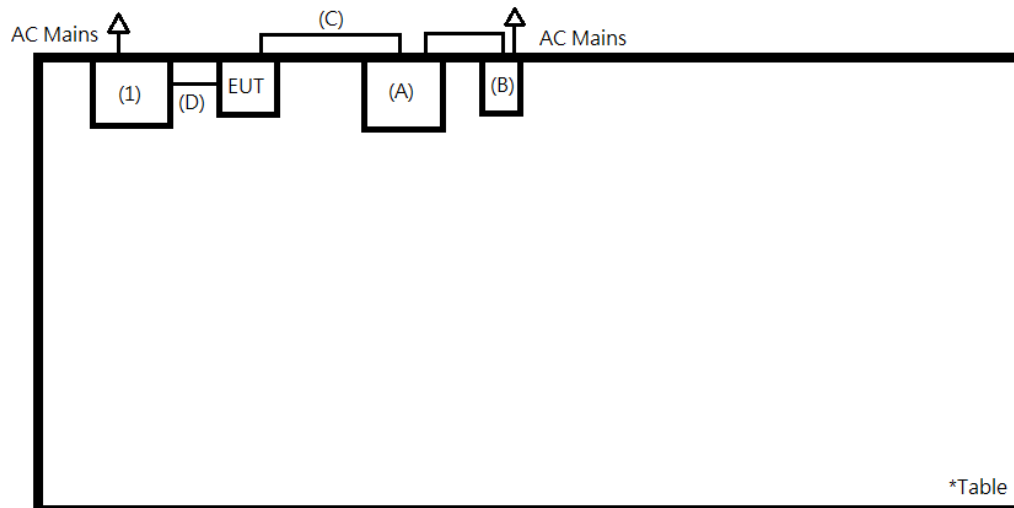
No.	Description	Brand	Model	S/N	Remark
Radiated Test					
A	DC Power Cable	TUV-JP	L25748	-	55 cm non-shielded cable w/o core
B	Mini USB Cable	TUV-JP	C1148	-	180 cm shielded cable w/o core
C	Notebook	Panasonic	CF-T2	-	-
1	DC Power Supply	Gwinstek	GPS-3030	-	-
2	Power Cable	TUV	TUV-06	-	80 cm non-shielded cable w/o core
Mains Conducted Test					
A	Notebook	Panasonic	CF-T2	-	-
B	Adapter	Panasonic	CF-AA1625A M4	-	120 cm non-shielded cable with core
C	Mini USB Cable	TUV-JP	C1148	-	180 cm shielded cable w/o core
D	DC Power Cable	TUV-JP	L25748	-	55 cm non-shielded cable w/o core
1	DC Power Supply	Gwinstek	GPS-3030	-	-

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

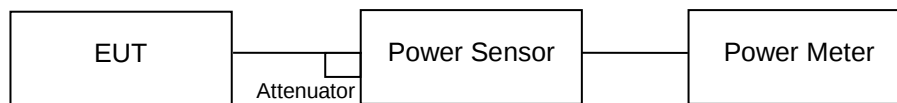
According to the manufacturer declaration, the EUT has an antenna with a directional gain of 2.6 dBi. The antenna is a PCB antenna with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision.
Refer to EUT photo for details.

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	2021/3/24	2022/3/23	2021/8/21	2021/8/21
Power Sensor	Anritsu	MA2411B	1725269	2021/3/24	2022/3/23	2021/8/21	2021/8/21

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**

Channel	Channel Frequency	Peak Output Power		Limit (dBm)
	(MHz)	(dBm)	(mW)	
Low Channel	2405	7.77	5.98	30
Middle Channel	2440	8.11	6.47	30
High Channel	2475	8.16	6.55	30

Average Power

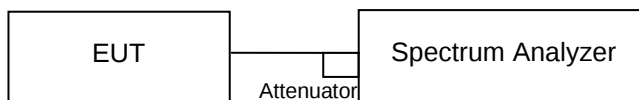
Channel	Channel Frequency	Average Power	
	(MHz)	(dBm)	(mW)
Low Channel	2405	7.75	5.96
Middle Channel	2440	8.09	6.44
High Channel	2475	8.15	6.53

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	2021/1/29	2022/1/28	2021/8/23	2021/8/23

Test Procedure

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

Test Results

Please refer to Appendix A.

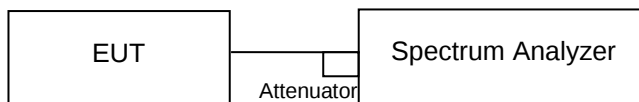
5.1.4 Power Spectral Density

Limit

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

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2021/1/29	2022/1/28	2021/8/23	2021/8/23

Test Procedure

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

Test Results

Please refer to Appendix A.

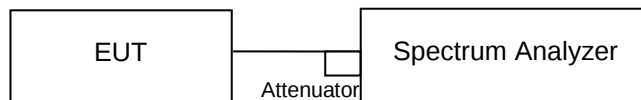
5.1.5 Conducted Spurious Emissions and Frequency Band Edges Measured in 100kHz Bandwidth

Limit

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

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2021/1/29	2022/1/28	2021/8/23	2021/8/23

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

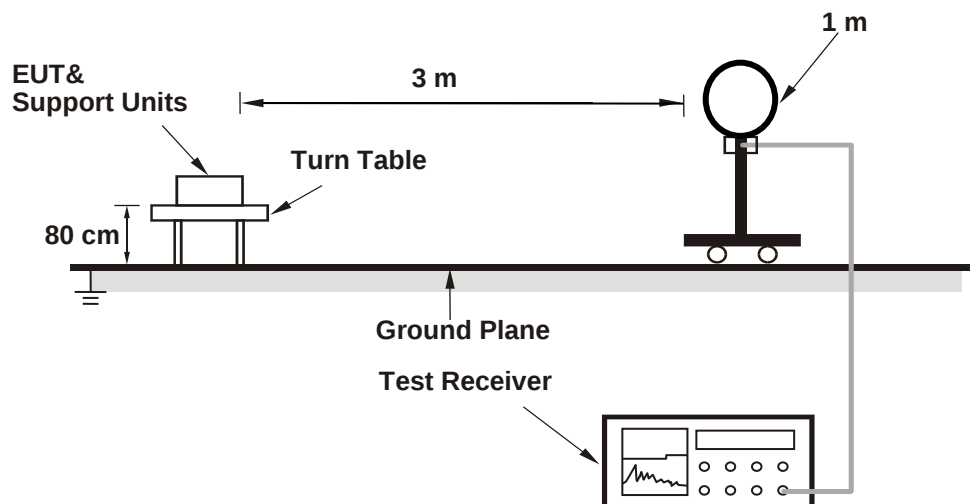
Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a).

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).

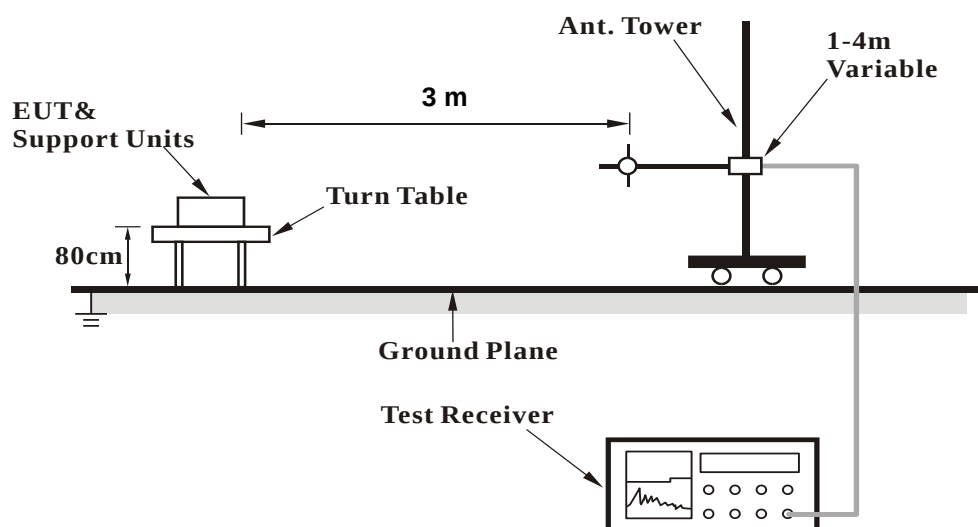
Kind of Test Site 3m Semi-Anechoic Chamber

Test Setup

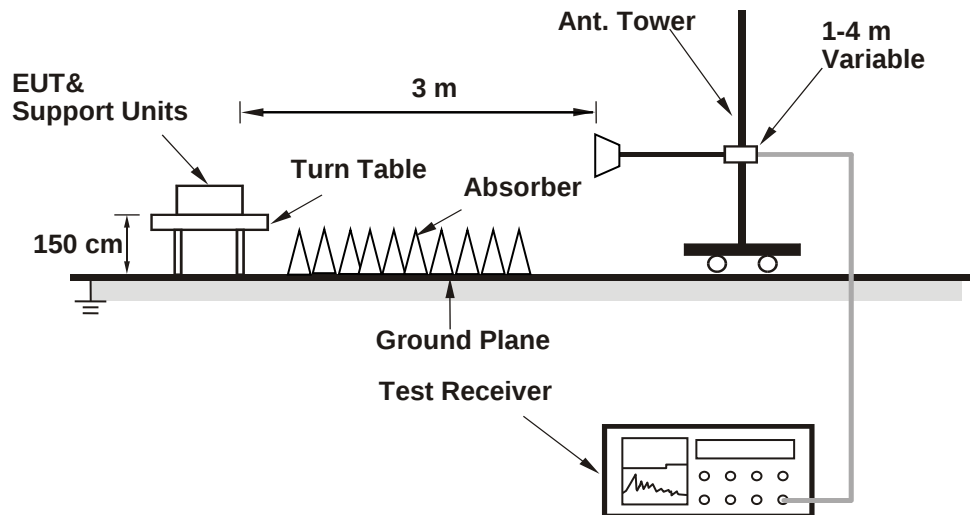
<Radiated Emissions below 30 MHz>



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

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Test Results

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

Please refer to Appendix B.

5.2 Mains Emission

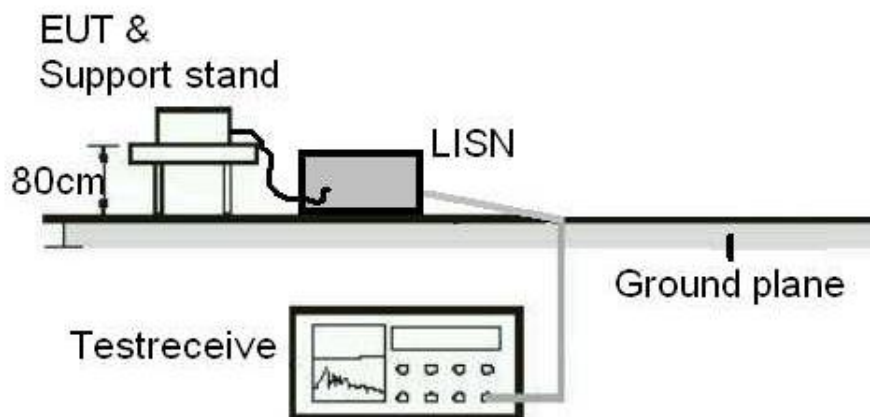
5.2.1 Mains Conducted Emission

Limit

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

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
TWO-LINE V-NETWORK	R&S	ENV216	1816064	2020/9/10	2021/9/9
EMI Test Receiver	R&S	ESCI	1816063	2020/11/17	2021/11/16
RF Cable	N/A	N/A	EMC-003	2020/11/15	2021/11/14

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.

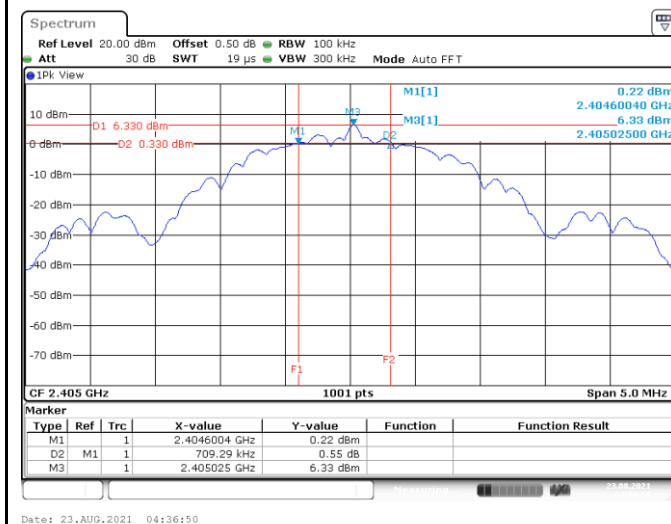
Appendix A: Test Results of Conducted Test

Test Result of 6 dB Bandwidth

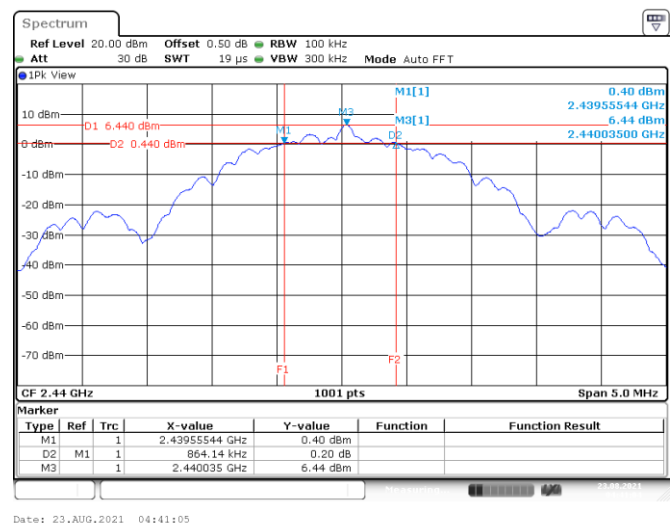
ZIGBEE

Channel	Channel Frequency (MHz)	6 dB Bandwidth (kHz)	Limit (kHz)	Result
Low Channel	2405	709.29	> 500	Pass
Middle Channel	2440	864.14	> 500	Pass
High Channel	2475	809.19	> 500	Pass

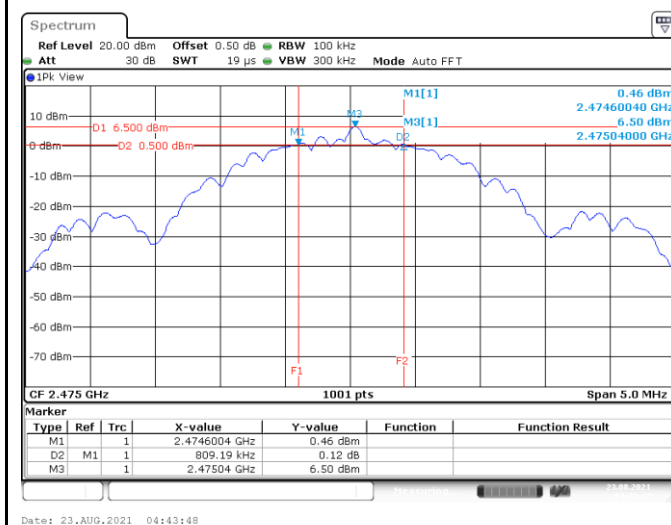
Low Channel



Middle Channel



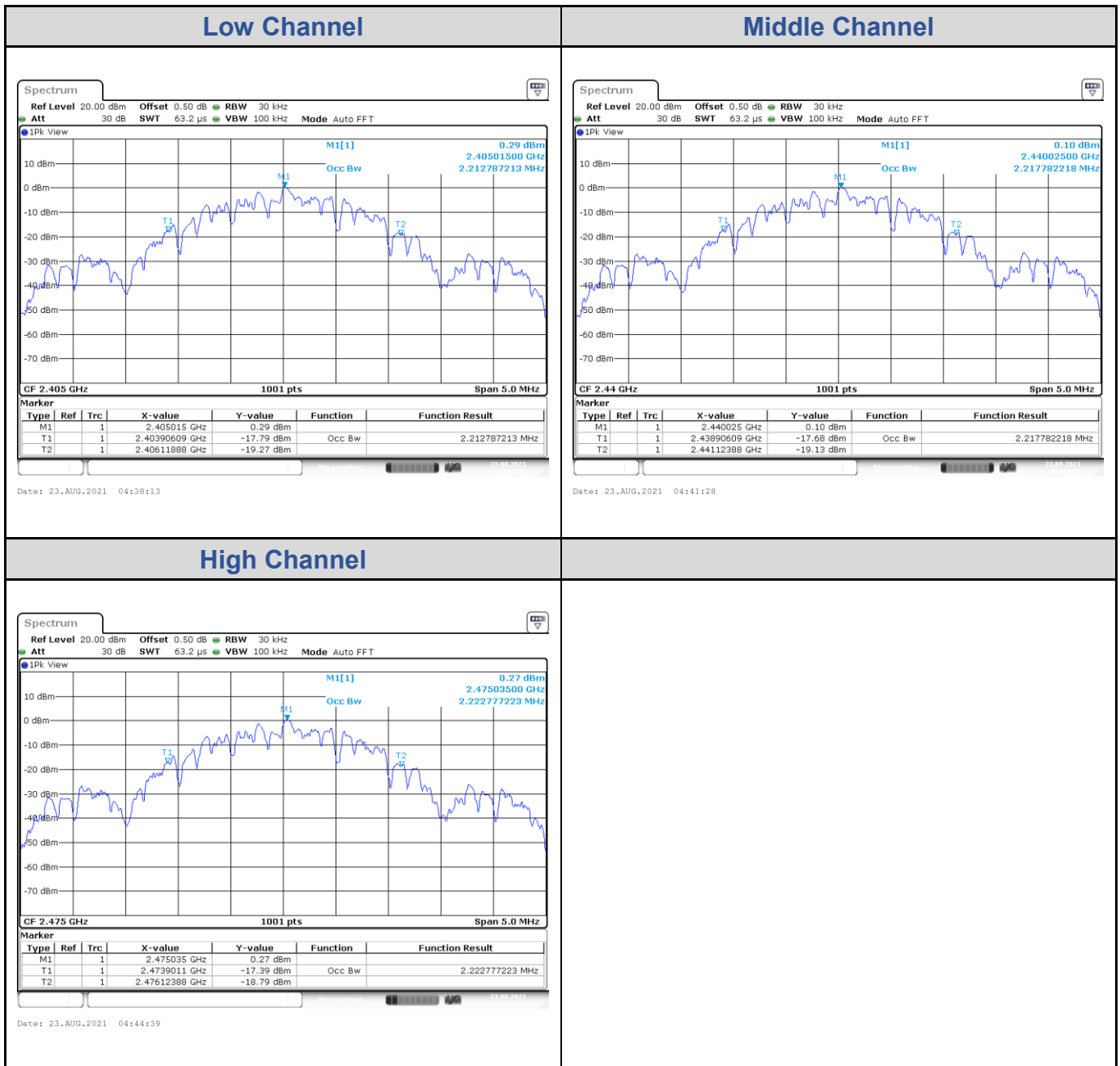
High Channel



Test Result of 99% Occupied Bandwidth

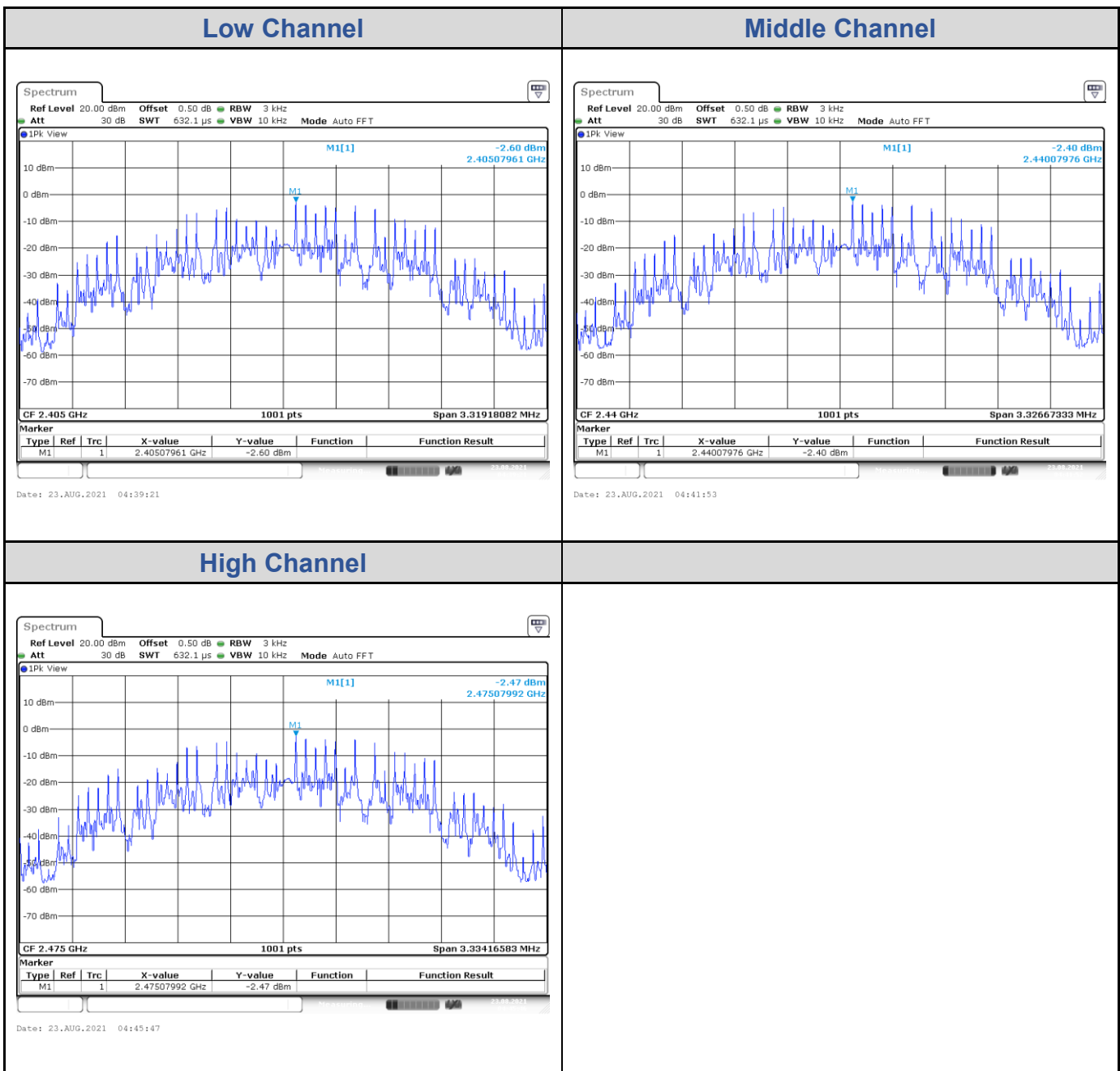
ZIGBEE

Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)
Low Channel	2405	2.21
Middle Channel	2440	2.22
High Channel	2475	2.22



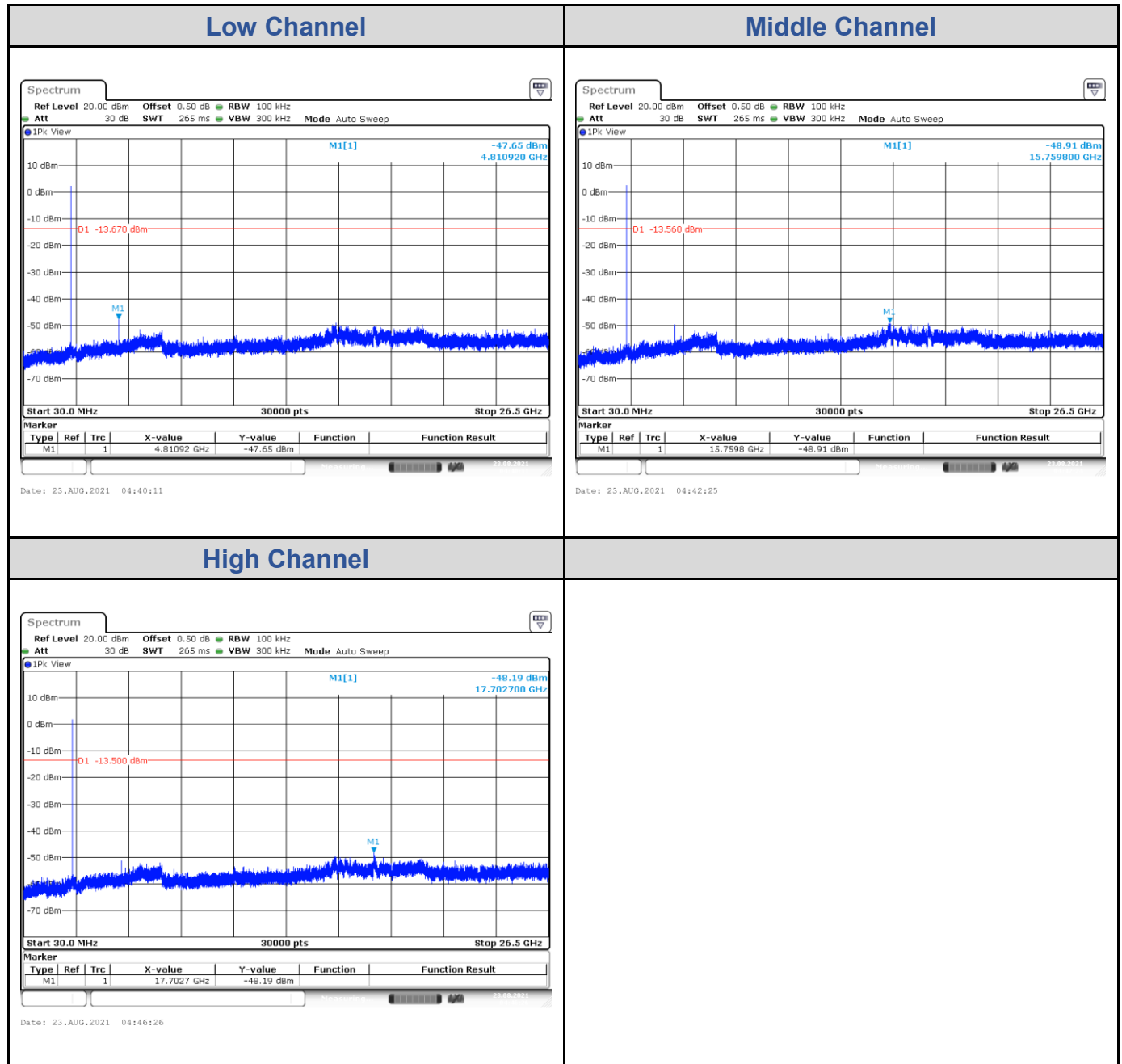
Test Result of Power Spectral Density ZIGBEE

Channel	Channel Frequency (MHz)	Power Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
Low Channel	2405	-2.60	8	Pass
Middle Channel	2440	-2.40	8	Pass
High Channel	2475	-2.47	8	Pass



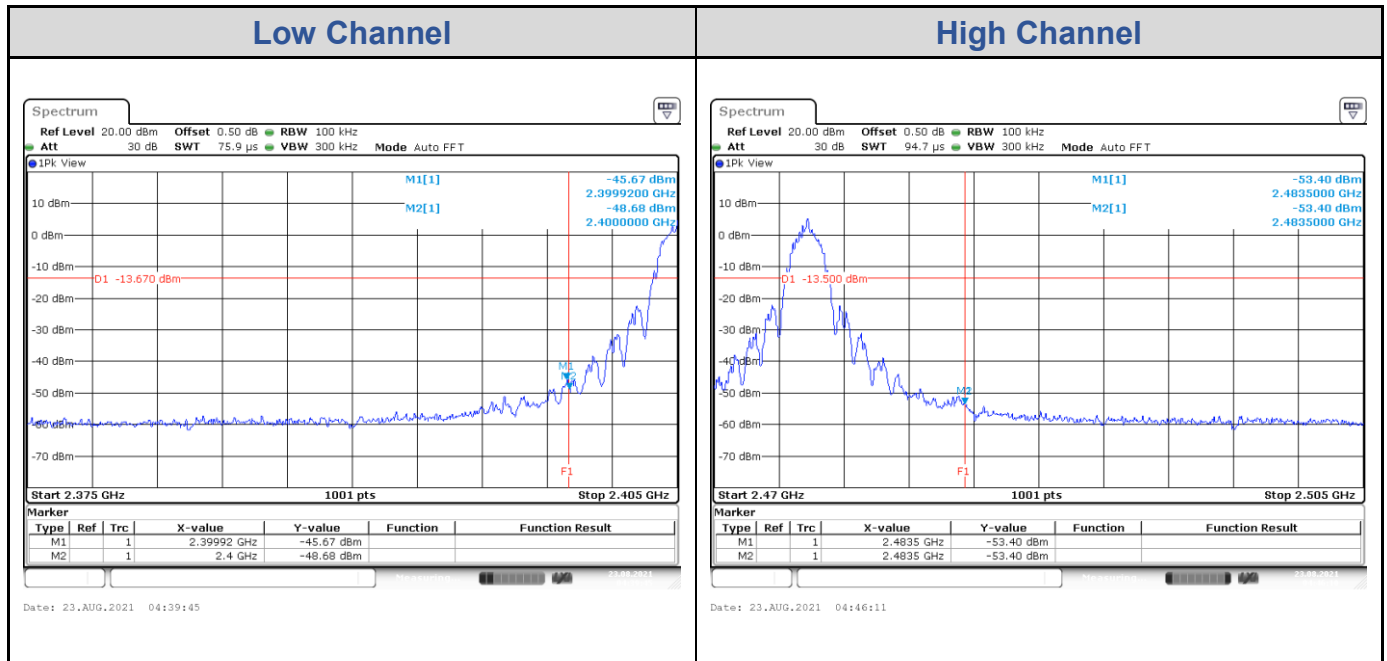
Test Result of Conducted Spurious Emissions, Tx Mode

ZIGBEE



Test Result of Conducted Band Edge, Tx Mode

ZIGBEE



Appendix B: Test Results of Radiated Emissions & Mains Conducted

Emission Test

Band Edges, 2.31GHz ~ 2.9GHz

ZIGBEE

Low Channel (Horizontal) Peak

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Level (dBuV/m)

Date: 2021-08-30

Frequency (MHz)

FCC Class B, PK

FCC Class B, AVG

	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	2373.01	52.75	15.47	37.28	74.00	-21.25	150	40	Peak	Horizontal		
2 *	2405.00	104.22	66.89	37.33	74.00	30.22	150	40	Peak	Horizontal		
3	2843.12	54.69	16.46	38.23	74.00	-19.31	150	40	Peak	Horizontal		

Low Channel (Vertical) Peak

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Level (dBuV/m)

Date: 2021-08-30

Frequency (MHz)

FCC Class B, PK

FCC Class B, AVG

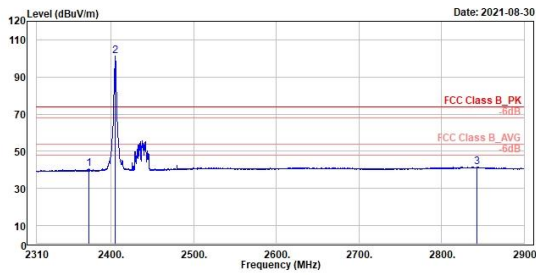
	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	2373.13	53.14	15.86	37.28	74.00	-20.86	100	100	Peak	Vertical		
2 *	2405.00	101.20	63.87	37.33	74.00	27.20	100	100	Peak	Vertical		
3	2838.76	55.47	17.25	38.22	74.00	-18.53	100	100	Peak	Vertical		

ZIGBEE

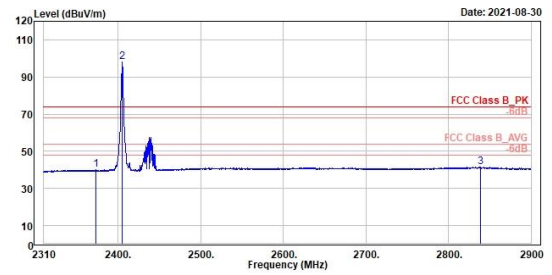
Low Channel (Horizontal) Average



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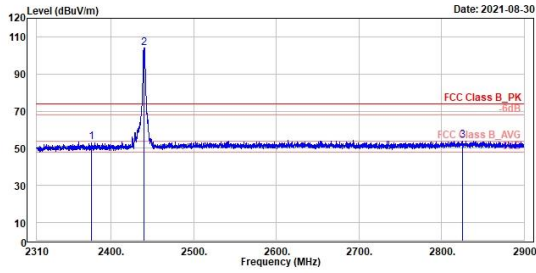


ZIGBEE

Middle Channel (Horizontal) Peak



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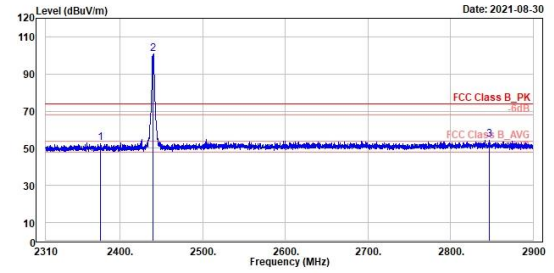


	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	dB	cm	deg			
1	2375.73	53.21	15.92	37.29	74.00	-20.79	119	42	Peak	Horizontal		
2 *	2440.00	104.14	66.70	37.44	74.00	30.14	119	42	Peak	Horizontal		
3	2825.19	54.23	16.02	38.21	74.00	-19.77	119	42	Peak	Horizontal		

Middle Channel (Vertical) Peak



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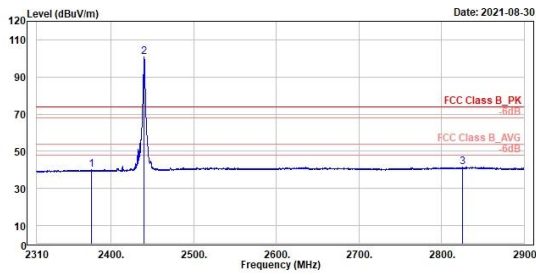
	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	dB	cm	deg			
1	2376.32	52.99	15.70	37.29	74.00	-21.01	100	107	Peak	Vertical		
2 *	2440.00	100.83	63.39	37.44	74.00	26.83	100	107	Peak	Vertical		
3	2847.37	54.56	16.33	38.23	74.00	-19.44	100	107	Peak	Vertical		

ZIGBEE

Middle Channel (Horizontal) Average



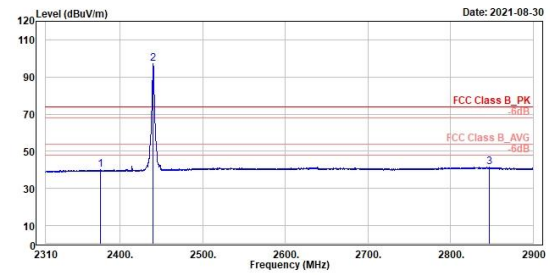
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Middle Channel (Vertical) Average



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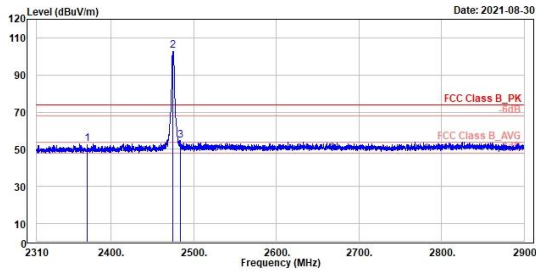


ZIGBEE

High Channel (Horizontal) Peak



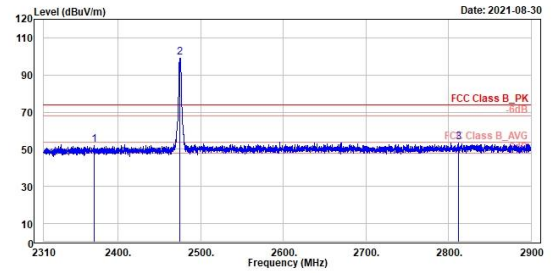
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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	dB	cm	deg			
1	2371.24	52.85	15.57	37.28	74.00	-21.15	120	42	Peak	Horizontal		
2 *	2475.00	103.02	65.37	37.65	74.00	29.02	120	42	Peak	Horizontal		
3	2483.50	54.57	16.86	37.71	74.00	-19.43	120	42	Peak	Horizontal		



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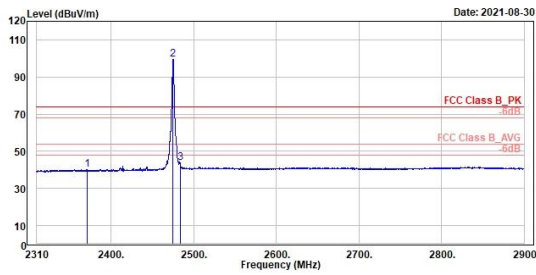
	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	dB	cm	deg			
1	2371.12	52.26	14.08	37.28	74.00	-21.74	122	109	Peak	Vertical		
2 *	2475.00	99.59	61.94	37.65	74.00	25.59	122	109	Peak	Vertical		
3	2811.85	53.68	15.49	38.19	74.00	-20.32	122	109	Peak	Vertical		

ZIGBEE

High Channel (Horizontal) Average



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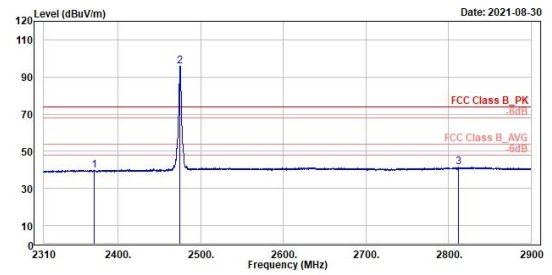


	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	dB	cm	deg			
1	2371.24	40.28	3.00	37.28	54.00	-13.72	120	42	Average	Horizontal		
2 *	2475.00	99.64	61.99	37.65	54.00	45.64	120	42	Average	Horizontal		
3	2483.50	43.64	5.93	37.71	54.00	-10.36	120	42	Average	Horizontal		

High Channel (Vertical) Average



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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	dB	cm	deg			
1	2371.12	39.87	2.59	37.28	54.00	-14.13	122	109	Average	Vertical		
2 *	2475.00	96.03	58.38	37.65	54.00	42.03	122	109	Average	Vertical		
3	2811.85	41.46	3.27	38.19	54.00	-12.54	122	109	Average	Vertical		

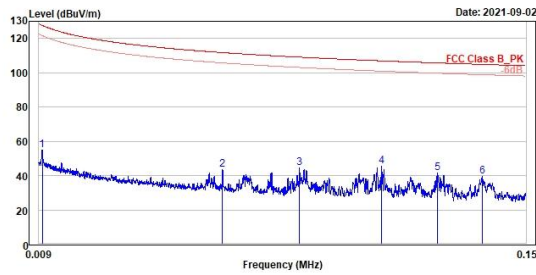
Spurious Emissions, Tx Mode, 9kHz ~ 30MHz

ZIGBEE

Low Channel (Open) 9kHz~150kHz



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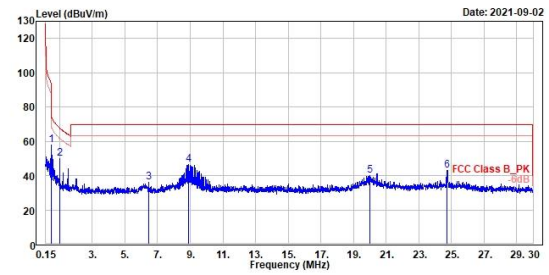


	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		cm	deg			
1	0.01	54.90	34.06	19.94	127.60	-72.70	100		1	QP	Open	
2	0.06	43.36	23.11	20.25	111.72	-68.36	100		202	QP	Open	
3	0.08	44.55	24.34	20.21	109.06	-64.51	100		203	QP	Open	
4	0.11	45.25	25.06	20.19	106.91	-61.66	100		154	QP	Open	
5	0.12	41.40	21.22	20.18	105.71	-64.31	100		189	QP	Open	
6	0.14	39.49	19.33	20.16	104.04	-65.35	100		174	QP	Open	

Low Channel (Open) 150kHz~30MHz



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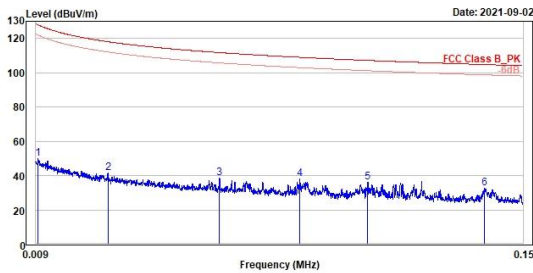
	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		cm	deg			
1	0.50	57.75	37.67	20.08	73.59	-15.84	100		176	QP	Open	
2	1.01	49.86	29.69	20.17	67.52	-17.66	100		176	QP	Open	
3	6.47	35.90	15.62	20.28	69.50	-33.60	100		150	QP	Open	
4	8.90	46.42	26.05	20.37	69.50	-23.08	100		180	QP	Open	
5	20.00	40.09	19.45	20.64	69.50	-29.41	100		168	QP	Open	
6	24.75	43.07	22.34	20.73	69.50	-26.43	100		275	QP	Open	

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Low Channel (Close) 9kHz~150kHz



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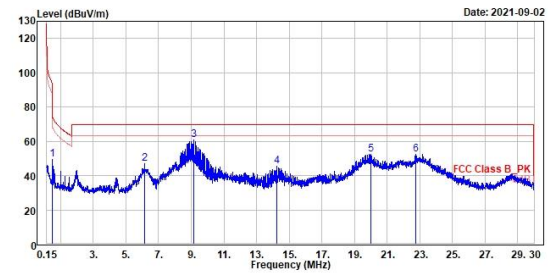


Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	0.01	49.74	29.78	19.96	127.85	-78.11	100	126	QP	Close	
2	0.03	41.47	21.20	20.27	118.09	-76.62	100	200	QP	Close	
3	0.06	38.33	18.08	20.25	111.72	-73.39	100	100	QP	Close	
4	0.09	37.88	17.67	20.21	108.97	-71.09	100	134	QP	Close	
5	0.11	36.06	15.87	20.19	107.16	-71.10	100	132	QP	Close	
6	0.14	32.50	12.34	20.16	104.74	-72.24	100	151	QP	Close	

Low Channel (Close) 150kHz~30MHz



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Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	0.50	49.67	29.59	20.08	73.59	-23.92	100	232	QP	Close	
2	6.15	47.17	26.90	20.27	69.50	-22.33	100	248	QP	Close	
3	9.16	60.69	40.30	20.39	69.50	-8.81	100	78	QP	Close	
4	14.25	45.59	25.04	20.55	69.50	-23.91	100	265	QP	Close	
5	20.00	52.38	31.74	20.64	69.50	-17.12	100	200	QP	Close	
6	22.74	52.30	31.61	20.69	69.50	-17.20	100	161	QP	Close	

Spurious Emissions, Tx Mode, 30MHz ~ 1GHz

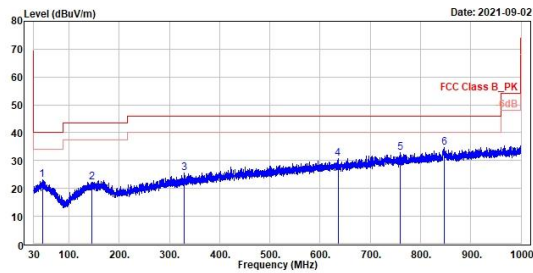
ZIGBEE

Low Channel (Horizontal)

Low Channel (Vertical)



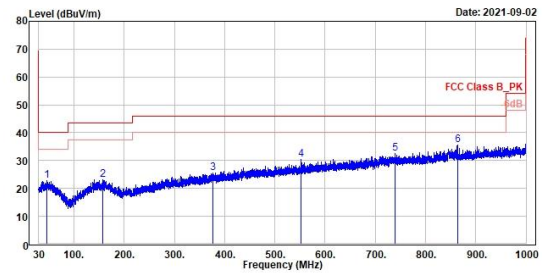
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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	46.88	23.17	28.84	-5.67	48.00	-16.83	200	214	QP	Horizontal		
2	145.14	22.30	28.11	-5.81	43.50	-21.20	200	152	QP	Horizontal		
3	329.44	25.53	29.48	-3.95	46.00	-20.47	100	347	QP	Horizontal		
4	635.67	30.62	29.92	0.70	46.00	-15.38	400	277	QP	Horizontal		
5	760.41	32.88	29.98	2.90	46.00	-13.12	186	360	QP	Horizontal		
6	847.03	34.59	30.47	4.12	46.00	-11.41	300	16	QP	Horizontal		



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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	46.39	22.90	28.67	-5.77	48.00	-17.10	100	124	QP	Vertical		
2	158.04	23.19	28.98	-5.79	43.50	-20.31	200	225	QP	Vertical		
3	375.90	25.61	28.80	-3.19	46.00	-20.39	300	259	QP	Vertical		
4	552.44	30.38	30.96	-0.58	46.00	-15.62	100	16	QP	Vertical		
5	739.85	32.44	29.92	2.52	46.00	-13.56	200	174	QP	Vertical		
6	864.78	35.64	31.36	4.28	46.00	-10.36	200	263	QP	Vertical		

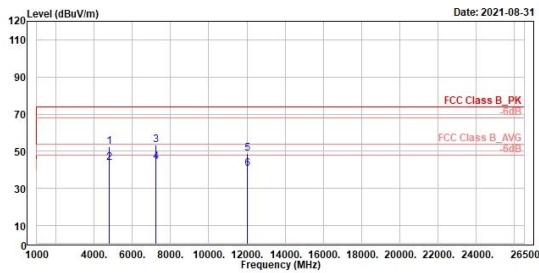
Spurious Emissions, Tx Mode, 1GHz ~ 26.5GHz

ZIGBEE

Low Channel (Horizontal)



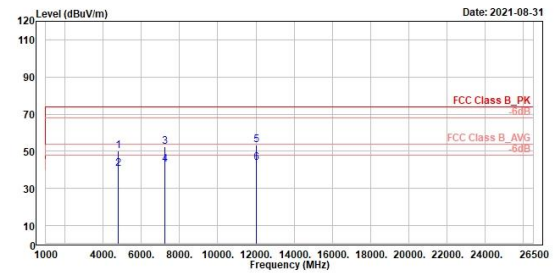
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Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1 4810.00	52.62	62.02	-9.40	74.00	-21.38	331	292	Peak	Horizontal		
2 4810.00	43.88	53.28	-9.40	54.00	-10.12	331	292	Average	Horizontal		
3 7215.00	53.39	60.02	-6.63	84.22	-30.83	356	168	Peak	Horizontal		
4 7215.00	44.13	50.76	-6.63	81.09	-36.96	356	168	Average	Horizontal		
5 12025.00	48.70	48.25	0.45	74.00	-25.30	292	268	Peak	Horizontal		
6 12025.00	40.43	39.98	0.45	54.00	-13.57	292	268	Average	Horizontal		



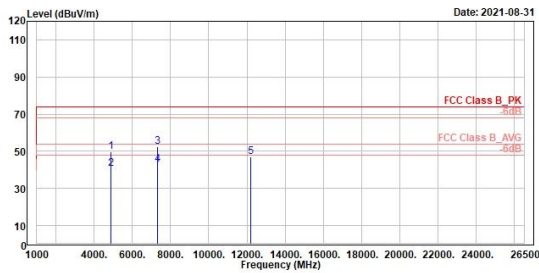
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Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1 4810.00	50.06	59.46	-9.40	74.00	-23.94	365	342	Peak	Vertical		
2 4810.00	40.44	49.84	-9.40	54.00	-13.56	365	342	Average	Vertical		
3 7215.00	52.33	58.96	-6.63	81.20	-28.87	140	33	Peak	Vertical		
4 7215.00	42.73	49.36	-6.63	78.13	-35.40	140	33	Average	Vertical		
5 12025.00	53.44	52.99	0.45	74.00	-20.56	306	295	Peak	Vertical		
6 12025.00	43.70	43.25	0.45	54.00	-10.30	306	295	Average	Vertical		

ZIGBEE
Middle Channel (Horizontal)

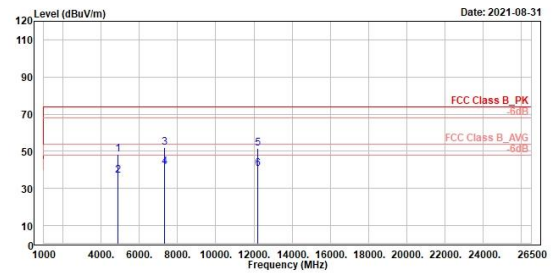

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Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	4880.00	49.68	59.04	-9.36	74.00	-24.32	382	315	Peak	Horizontal	
2	4880.00	40.49	49.85	-9.36	54.00	-13.51	382	315	Average	Horizontal	
3	7320.00	52.39	59.02	-6.63	74.00	-21.61	367	153	Peak	Horizontal	
4	7320.00	42.89	49.52	-6.63	54.00	-11.11	367	153	Average	Horizontal	
5	12200.00	47.11	46.23	0.88	74.00	-26.89	200	186	Peak	Horizontal	



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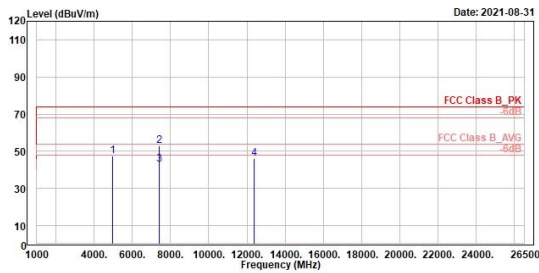
Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	4880.00	48.59	57.95	-9.36	74.00	-25.41	340	138	Peak	Vertical	
2	4880.00	37.17	46.53	-9.36	54.00	-16.83	340	138	Average	Vertical	
3	7320.00	51.99	58.62	-6.63	74.00	-22.01	265	32	Peak	Vertical	
4	7320.00	41.71	48.34	-6.63	54.00	-12.29	265	32	Average	Vertical	
5	12200.00	51.50	50.62	0.88	74.00	-22.50	314	269	Peak	Vertical	
6	12200.00	40.81	39.93	0.88	54.00	-13.19	314	269	Average	Vertical	

ZIGBEE

High Channel (Horizontal)



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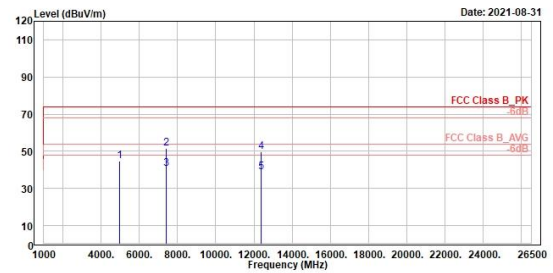


Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	4950.00	47.25	56.52	-9.27	74.00	-26.75	300	121	Peak	Horizontal	
2	7425.00	53.09	59.65	-6.56	74.00	-20.91	346	6	Peak	Horizontal	
3	7425.00	42.69	49.25	-6.56	54.00	-11.31	346	6	Average	Horizontal	
4	12375.00	45.99	44.96	1.03	74.00	-28.01	100	253	Peak	Horizontal	

High Channel (Vertical)



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Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	4950.00	44.49	53.76	-9.27	74.00	-29.51	100	343	Peak	Vertical	
2	7425.00	51.35	57.91	-6.56	74.00	-22.65	300	252	Peak	Vertical	
3	7425.00	40.76	47.32	-6.56	54.00	-13.24	300	252	Average	Vertical	
4	12375.00	49.65	48.62	1.03	74.00	-24.35	263	201	Peak	Vertical	
5	12375.00	38.61	37.58	1.03	54.00	-15.39	263	201	Average	Vertical	

Mains Conducted Emission, 150kHz ~ 30MHz

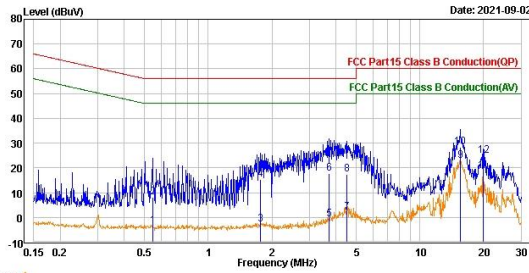
Worst Band

(Line)

(Neutral)



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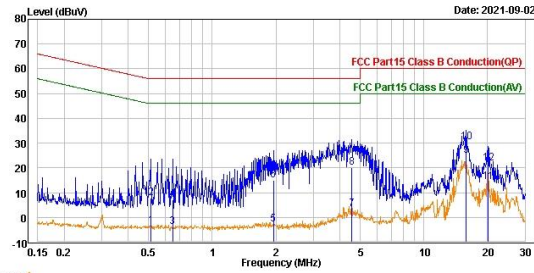


Trace: 1

Line	Level	Read Level Factor	Limit Line	Over Limit Remark	Pol/Phase	Note
Freq	Level	dBuV	dB	dBuV	dB	
MHz	dBuV	dBuV	dB	dBuV	dB	
1	0.55	-3.52	-13.17	9.65	46.00	-49.52 Average
2	0.55	8.14	-1.51	9.65	56.00	-47.86 QP
3	1.77	-2.65	-12.33	9.68	46.00	-48.65 Average
4	1.77	15.30	5.62	9.68	56.00	-40.70 QP
5	3.72	-0.93	-10.63	9.70	46.00	-46.93 Average
6	3.72	17.81	8.11	9.70	56.00	-38.19 QP
7	4.51	2.07	-7.64	9.71	46.00	-43.93 Average
8	4.51	17.32	7.61	9.71	56.00	-38.68 QP
9	15.46	22.77	13.02	9.75	50.00	-27.23 Average
10	15.46	28.36	18.61	9.75	60.00	-31.64 QP
11	19.84	18.72	8.99	9.73	50.00	-31.28 Average
12	19.84	24.98	15.25	9.73	60.00	-35.02 QP



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Trace: 1

Line	Level	Read Level Factor	Limit Line	Over Limit Remark	Pol/Phase	Note
Freq	Level	dBuV	dB	dBuV	dB	
MHz	dBuV	dBuV	dB	dBuV	dB	
1	0.51	-3.45	-13.11	9.66	46.00	-49.45 Average
2	0.51	7.90	-1.76	9.66	56.00	-48.10 QP
3	0.65	-3.70	-13.37	9.67	46.00	-49.70 Average
4	0.65	7.06	-2.61	9.67	56.00	-48.94 QP
5	1.94	-2.66	-12.36	9.70	46.00	-48.66 Average
6	1.94	15.10	5.40	9.70	56.00	-40.90 QP
7	4.56	3.18	-6.55	9.73	46.00	-42.82 Average
8	4.56	20.14	10.41	9.73	56.00	-35.86 QP
9	15.85	24.78	14.97	9.81	50.00	-25.22 Average
10	15.85	30.37	20.56	9.81	60.00	-29.63 QP
11	20.03	14.30	4.48	9.82	50.00	-35.70 Average
12	20.03	21.67	11.85	9.82	60.00	-38.33 QP