

Prüfbericht-Nr.: <i>Test report no.:</i>	CN22032Q(P15C-LoRa) 001	Auftrags-Nr.: <i>Order no.:</i>	238521227	Seite 1 von 31 Page 1 of 31	
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	2022-02-24		
Auftraggeber: <i>Client:</i>	Luxshare Electronic Technology (KunShan) Ltd. No.158, Jinchang Road, Jinxi Town, Kunshan Jiangsu China				
Prüfgegenstand: <i>Test item:</i>	Lora Gateway				
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	Lora Gateway				
Auftrags-Inhalt: <i>Order content:</i>	FCC Part 15C Test report (LoRa)				
Prüfgrundlage: <i>Test specification:</i>	FCC 47CFR Part 15: Subpart C Section 15.247				
Wareneingangsdatum: <i>Date of sample receipt:</i>	2022-03-01				
Prüfmuster-Nr.: <i>Test sample no:</i>	A003219374-002 A003219374-010				
Prüfzeitraum: <i>Testing period:</i>	2022-05-24 - 2022-06-06				
Ort der Prüfung: <i>Place of testing:</i>	EMC/RF Taipei Testing Site				
Prüflaboratorium: <i>Testing laboratory:</i>	Taipei Testing Laboratories				
Prüfergebnis*: <i>Test result*:</i>	Pass				
zusammengestellt von: <i>compiled by:</i>	genehmigt von: <i>authorized by:</i>				
Datum: <i>Date:</i> 2022-06-06	 Ryan Chen		 Brenda Chen		
Stellung / Position:	Senior Project Manager		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	5 = mangelhaft N/T = nicht getestet
* 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 = 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>					

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 Edge	Pass
5.1.6	15.247(d) & 15.205 & 15.209	Radiated Spurious Emissions and Band Edge	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 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
CN22032Q(P15C-LoRa) 001	Original Release	2022-05-25

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 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 Lora Gateway. It contains a wireless 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	Lora Gateway
Type Identification	Lora Gateway
FCC ID	2A2EXLRDN106

Technical Specification of EUT

Item	EUT information
Operating Frequency	923.3 – 927.5 MHz
Channel Spacing	600 kHz
Channel Number	8
Operation Voltage	5Vdc
Modulation	LoRa
Maximum Output Power (mW)	564.94
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

Mode	Channel Frequency (MHz)		
	LoRa		
	923.3	925.1	927.5
GFSK	--pa 1 --pwid 16	--pa 1 --pwid 16	--pa 1 --pwid 16

4.2 Carrier Frequency and Channel

Channel	Freq. (MHz)
1	923.3
2	923.9
3	924.5
4	925.1
5	925.7
6	926.3
7	926.9
8	927.5

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	PuTTY
---------------	-------

The samples were used as follows:

A003219374-002 for conducted test

A003219374-010 for radiated 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 X-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)	Modulation Type
-	923.3 to 927.5	923.3, 925.1, 927.5	LoRa

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)	Modulation Type
-	923.3 to 927.5	923.3, 925.1, 927.5	LoRa

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)	Modulation Type
-	923.3 to 927.5	923.3, 925.1, 927.5	LoRa

Mains Conducted Emission Test

☒ 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)	Modulation Type
-	923.3 to 927.5	925.1	LoRa

Test Condition

Test Item	Ambient Temperature	Relative Humidity	Tested by
Conducted Measurement	21.2 °C	71 %	Andy Chen
Radiated Spurious Emissions above 1 GHz	22.7-23.8 °C	54-62 %	Ivan Chiang
Radiated Spurious Emissions below 1 GHz	22.7-23.8 °C	54-62 %	Ivan Chiang
Mains Conducted Emission	21.5 °C	54 %	Ray Huang

4.4 Special Accessories and Auxiliary Equipment

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

Accessory of EUT

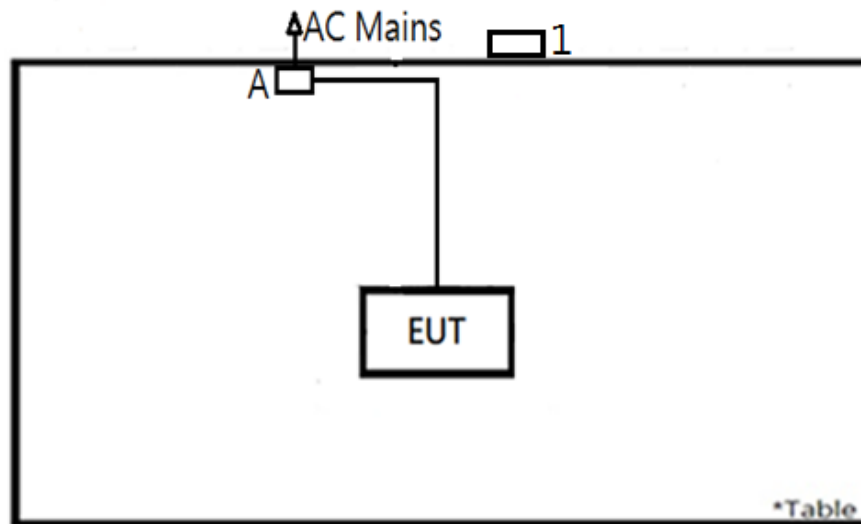
None.

Support Unit

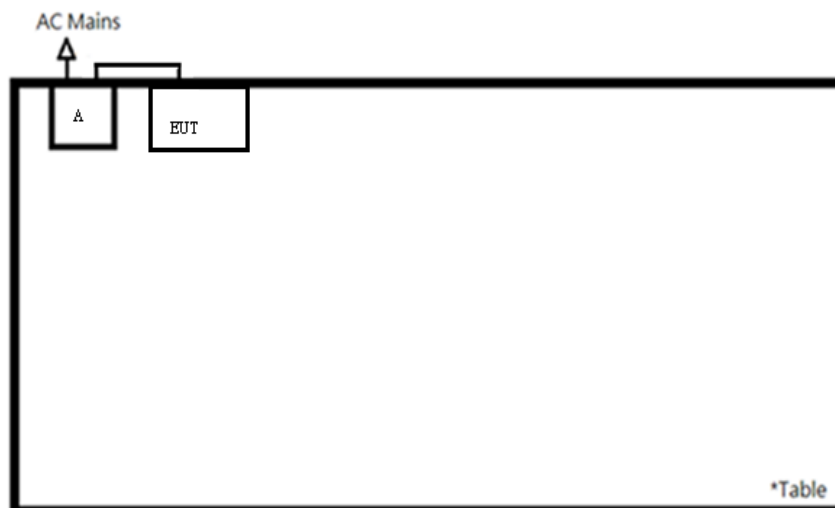
No.	Description	Brand	Model	S/N	Remark
Radiated Test					
A	Switching Adapter	HOIOTO	ADS-12AM-06	-	I/P: 100-240 Vac, 50/60 Hz, 0.3 A O/P: 5 Vdc, 2.0 A 180 cm non-shielded cable w/o core
1	Notebook	Lenovo	TP00088C	SL10M95132	-
Mains Conducted Test					
A	Switching Adapter	HOIOTO	ADS-12AM-06	-	I/P: 100-240 Vac, 50/60 Hz, 0.3 A O/P: 5 Vdc, 2.0 A 180 cm non-shielded cable w/o core
Conducted Test					
-	Notebook	HP	TPN-C139	CND93662VF	-

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.

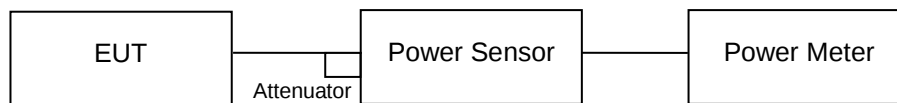
According to the manufacturer declaration, the EUT has an antenna with a directional gain of 3.0 dBi. The antenna is a dipole antenna with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision.
Refer to EUT photo for details.

5.1.2 Peak Output Power

Limit 1 watt (30 dBm)

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Power Meter	Anritsu	ML2495A	1901008	2022/3/15	2023/3/14	2022/5/26	2022/6/6
Power Sensor	Anritsu	MA2411B	1725269	2022/3/15	2023/3/14	2022/5/26	2022/6/6

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
	(MHz)	(dBm)	(mW)	(dBm)
Low Channel	923.3	27.23	528.45	30
Middle Channel	925.1	27.52	564.94	30
High Channel	927.5	27.35	543.25	30

Average Power

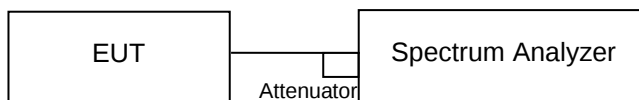
Channel	Channel Frequency	Average Power	
	(MHz)	(dBm)	(mW)
Low Channel	923.3	26.98	498.88
Middle Channel	925.1	27.31	538.27
High Channel	927.5	27.24	529.66

5.1.3 6 dB Bandwidth and 99% Occupied Bandwidth

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

Kind of Test Site Shielded room

Test Setup



Test Instruments

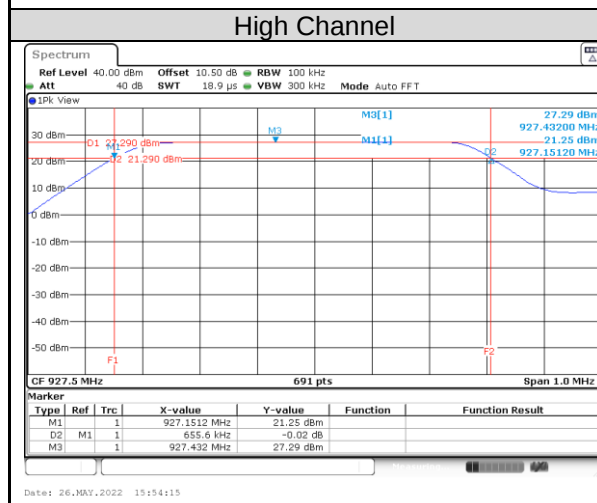
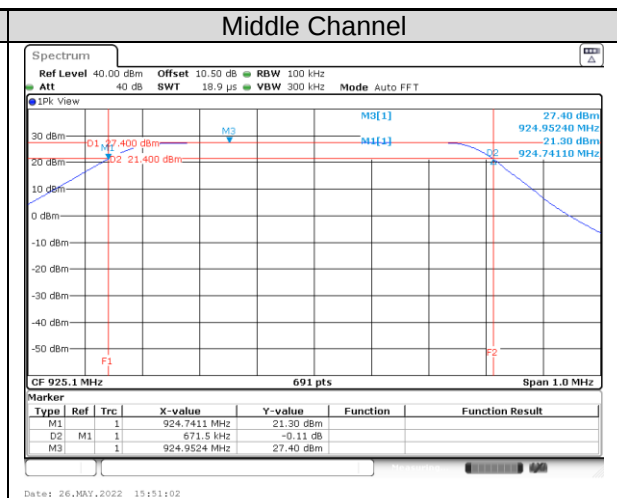
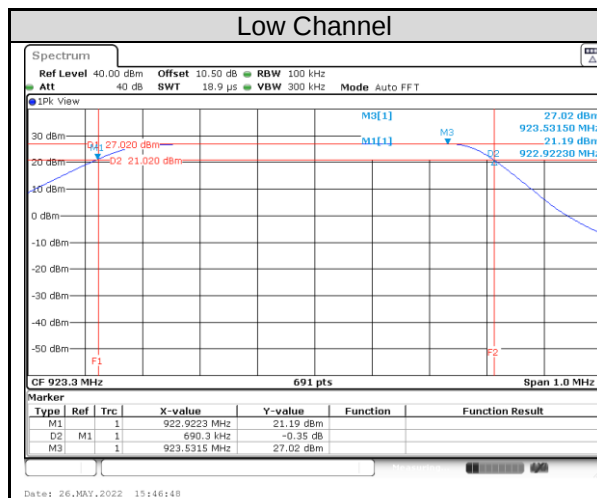
Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2022/2/24	2023/2/23	2022/5/26	2022/5/26

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.

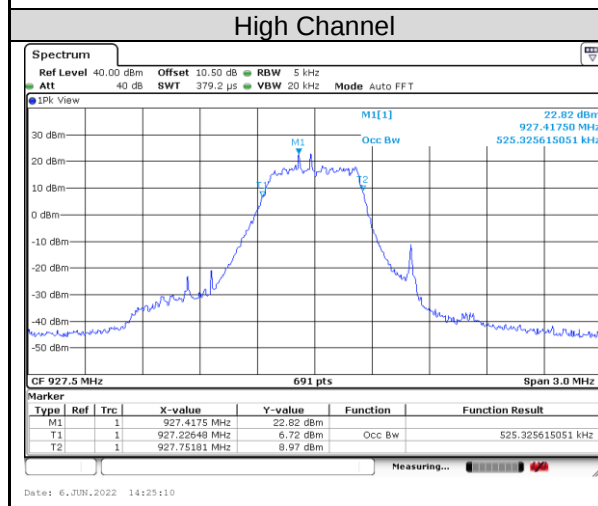
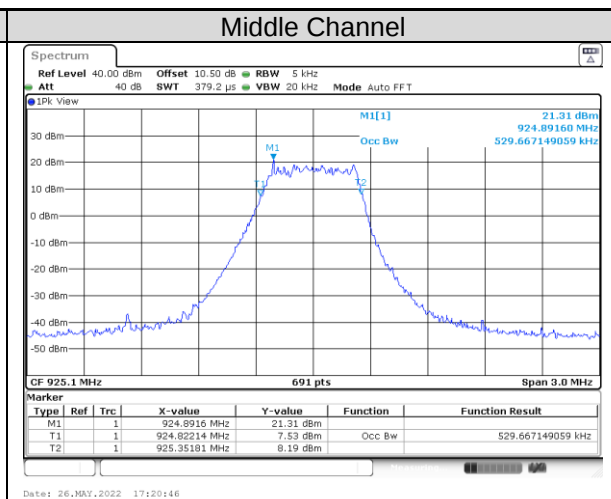
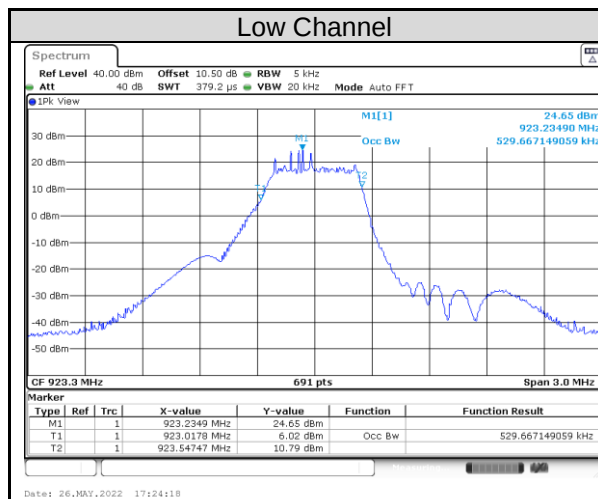
Test Results
<6 dB Bandwidth>

Channel	Channel Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)	Result
Low Channel	923.30	690.30	> 0.5	Pass
Middle Channel	925.10	671.50	> 0.5	Pass
High Channel	927.50	655.60	> 0.5	Pass



<99% Occupied Bandwidth>

Channel	Channel Frequency (MHz)	99% Occupied Bandwidth (MHz)
Low Channel	923.30	0.53
Middle Channel	925.10	0.53
High Channel	927.50	0.53



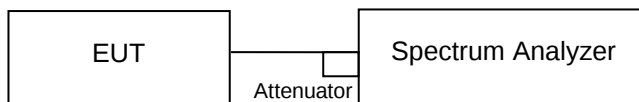
5.1.4 Power Spectral Density

Limit

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

Kind of Test Site Shielded room

Test Setup



Test Instruments

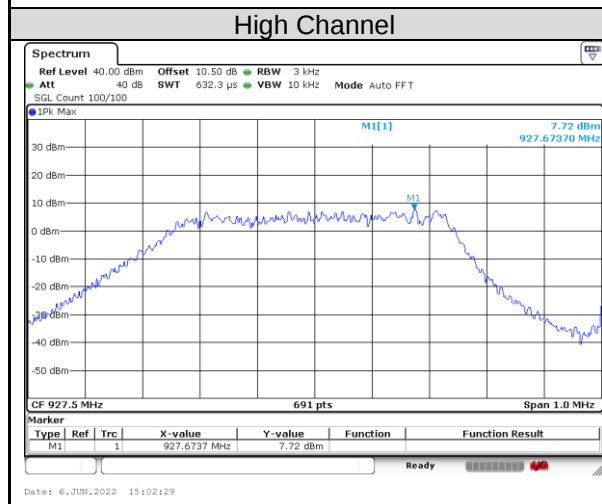
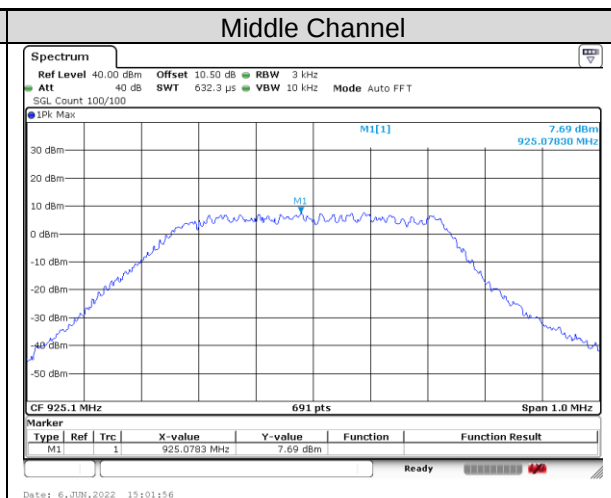
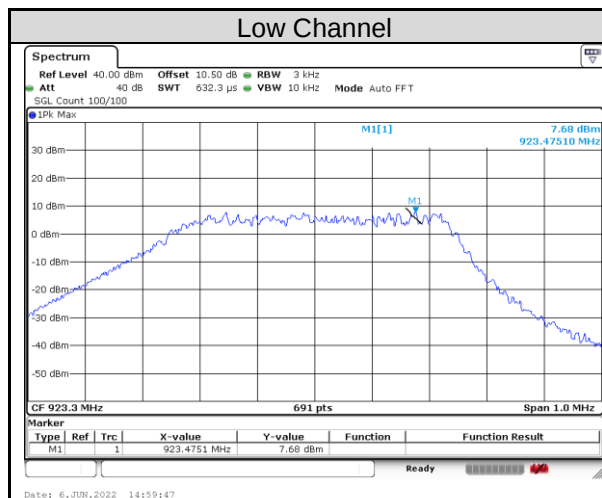
Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2022/2/24	2023/2/23	2022/6/6	2022/6/6

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

Channel	Channel Frequency (MHz)	Power Density (dBm/3kHz)	Limit (dBm/3kHz)
Low Channel	923.30	7.68	8
Middle Channel	925.10	7.69	8
High Channel	927.50	7.72	8



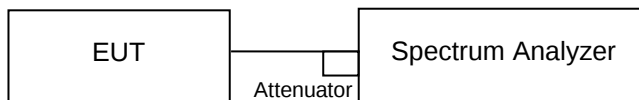
5.1.5 Conducted Spurious Emissions and Frequency Band Edges Measured in 100 kHz Bandwidth

Limit

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

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2022/2/24	2023/2/23	2022/5/26	2022/6/6

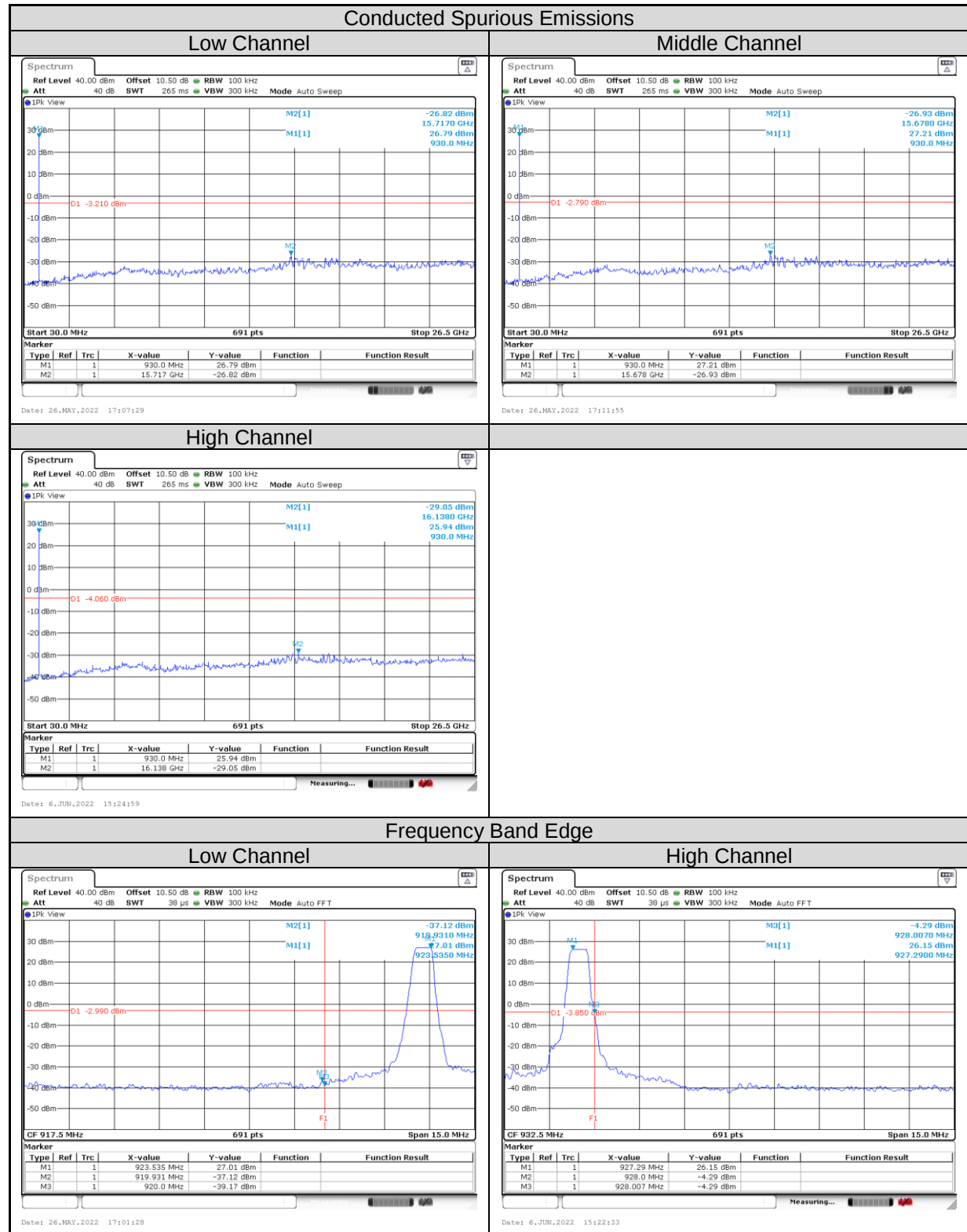
Test Procedure

Measurement procedure REF

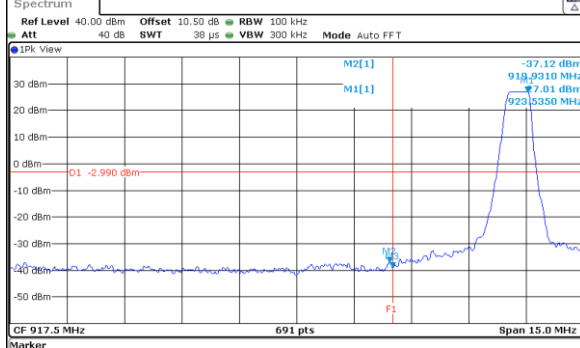
1. Set the RBW = 100 kHz.
2. Set the VBW $\geq$ 300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

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
**Frequency Band Edge**

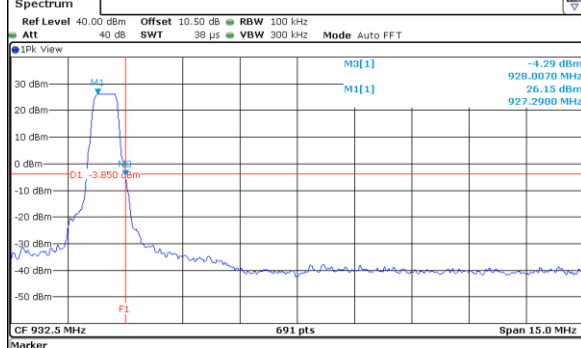
Low Channel



Marker	Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1		923.535 MHz	27.01 dBm		
M2		1		919.931 MHz	-37.12 dBm		
M3		1		920.0 MHz	-39.17 dBm		

Date: 26.MAY.2022 17:01:28

High Channel



Marker	Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1		927.29 MHz	26.15 dBm		
M2		1		928.0 MHz	-4.29 dBm		
M3		1		928.007 MHz	-4.29 dBm		

Date: 6.JUN.2022 15:22:33

5.1.6 Radiated Spurious Emissions and Band Edges

Limit

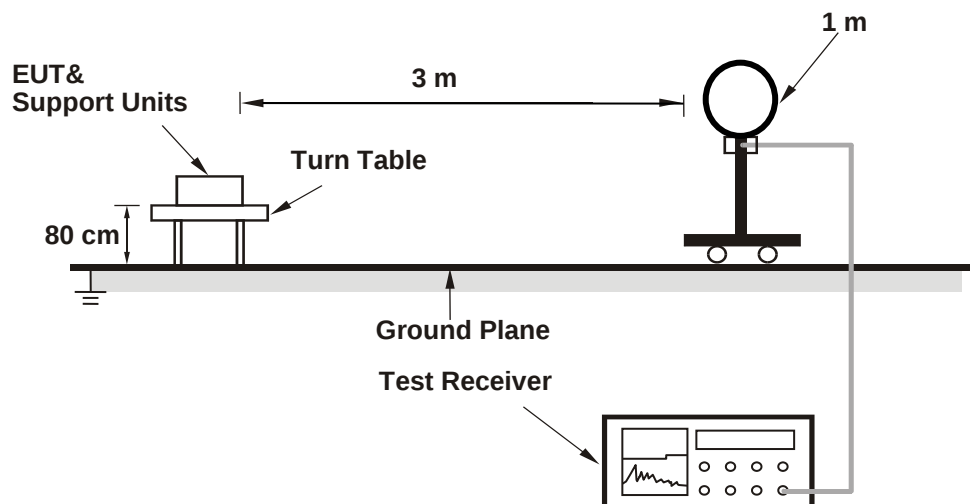
Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a).

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).

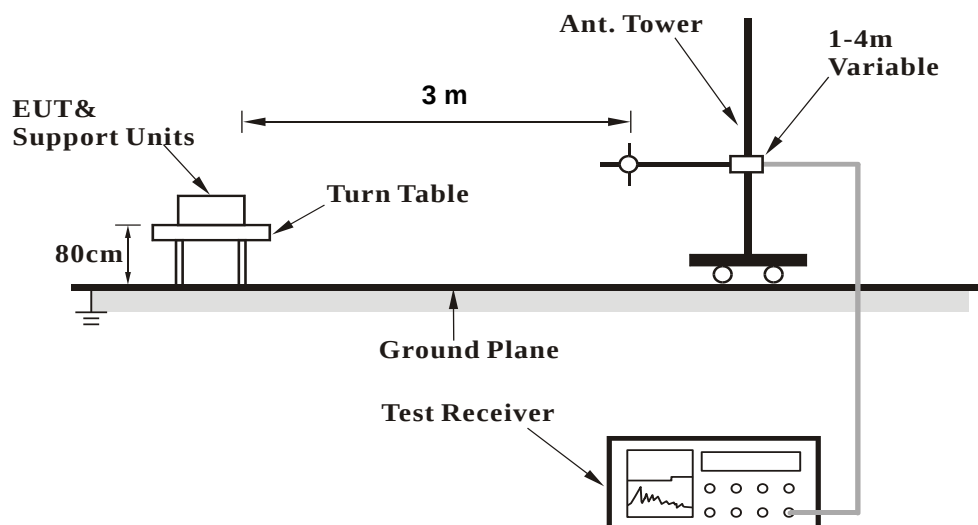
Kind of Test Site 3m Semi-Anechoic Chamber

Test Setup

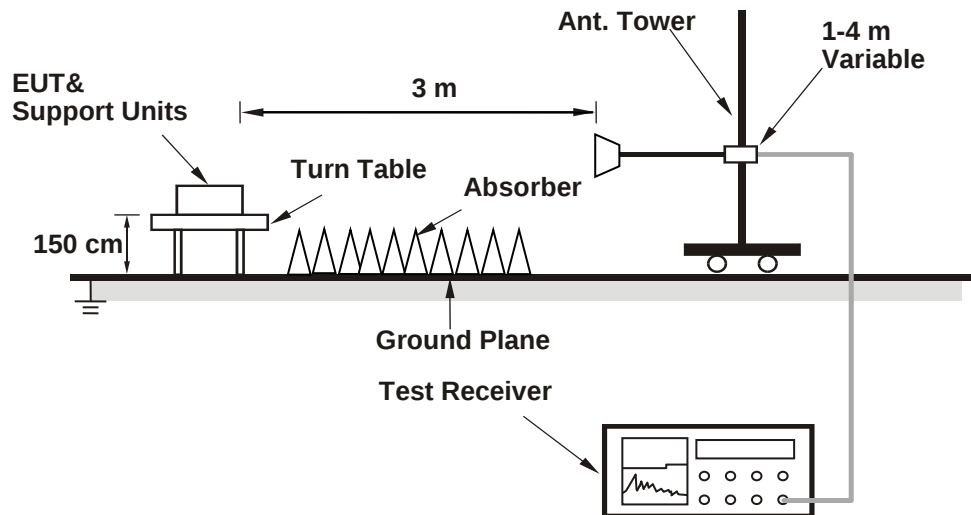
<Radiated Emissions below 30 MHz>



<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 Date: 2022/5/24

Below 30MHz

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
Receiver	R&S	ESR7	102109	2022/2/25	2023/2/24
Microwave Cable	SUCOFLEX 104EA	800056/4EA	804680/4	2022/3/22	2023/3/21
Loop Antenna	SCHWARZBECK	FMZB 1519B	00215	2021/12/8	2022/12/7

30MHz-1GHz

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
Receiver	R&S	ESR7	102109	2022/2/25	2023/2/24
Bilog Antenna	SCHWARZBECK	VULB-9168	00949	2021/5/30	2022/5/29
LF-AMP	Agilent	8447D	2727A05146	2022/2/16	2023/2/15

Above 1GHz

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
Signal Analyzer	R&S	FSV40	101513	2021/5/28	2022/5/27
Horn Antenna	ETS-Lindgren	3117	00218929	2021/11/25	2022/11/24
HF-AMP + AC source	EMCI	EMC051845SE	980635	2022/1/20	2023/1/19
HF-AMP + AC source	EMCI	EMC184045SE	980656	2022/1/20	2023/1/19
Horn Antenna	SCHWARZBECK	BBHA 9170	00887	2022/3/29	2023/3/28
Test Software	Audix E3	15914a_20191106_tuv	PK-001087	N/A	N/A

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 A.

5.2 Mains Emission

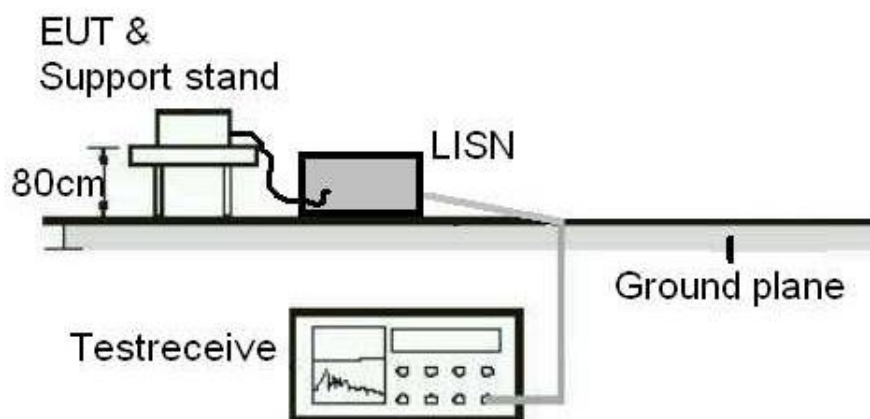
5.2.1 Mains Conducted Emission

Limit

Mains Conducted emissions 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: 2022/5/24

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
RF Cable	N/A	N/A	EMC-003	2022/3/14	2023/3/13
Two-Line V-Network	Rohde & Schwarz	ENV216	101938	2021/9/23	2022/9/22
EMI Test Receiver	R&S	ESCI	1816063	2021/11/15	2022/11/14

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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

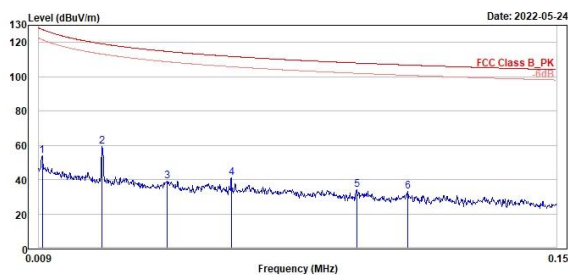
Please refer to Appendix A.

Appendix A: Test Results of Radiated Spurious Emissions & Mains

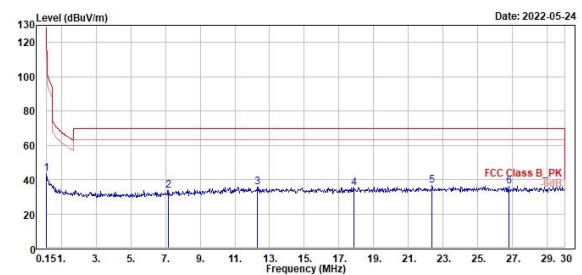
Conducted Emission Test

Spurious Emissions, Tx Mode, 9kHz ~ 30MHz

923.3 MHz
(Open) 9kHz~150kHz
(Open) 150kHz~30MHz

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	Freq	Level	Read	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	0.01	53.94	36.23	17.71	127.60	-73.66	100	152 QP	Open	
2	0.03	59.39	40.21	19.18	119.18	-59.79	100	210 QP	Open	
3	0.04	39.08	19.71	19.37	114.73	-75.65	100	118 QP	Open	
4	0.06	40.91	21.85	19.06	111.82	-70.91	100	190 QP	Open	
5	0.10	34.25	15.93	18.32	107.99	-73.74	100	44 QP	Open	
6	0.11	32.95	14.70	18.25	106.82	-73.87	100	153 QP	Open	


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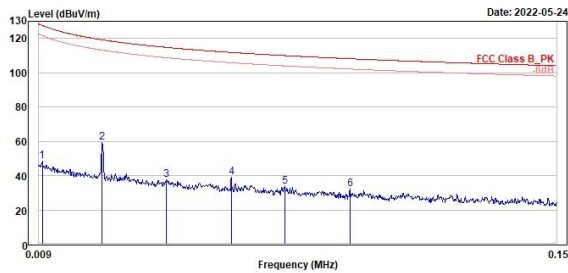
	Freq	Level	Read	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	0.15	43.43	25.03	18.40	104.00	-60.65	100	250 QP	Open	
2	7.16	33.77	13.51	20.26	69.50	-35.73	100	211 QP	Open	
3	12.30	35.67	14.01	21.66	69.50	-33.83	100	295 QP	Open	
4	17.85	35.10	13.05	22.05	69.50	-34.40	100	217 QP	Open	
5	22.36	36.82	14.51	22.31	69.50	-32.68	100	140 QP	Open	
6	26.78	36.06	13.56	22.50	69.50	-33.44	100	86 QP	Open	

923.3 MHz

(Close) 9kHz~150kHz



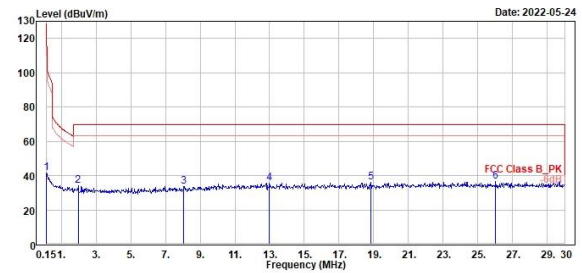
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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	0.01	48.50	30.79	17.71	127.60	-79.10	100	150 QP		Close		
2	0.03	59.34	40.16	19.18	119.18	-59.84	100	152 QP		Close		
3	0.04	37.72	18.35	19.37	114.76	-77.04	100	216 QP		Close		
4	0.06	39.05	19.99	19.06	111.82	-72.77	100	73 QP		Close		
5	0.08	33.67	14.93	18.74	109.98	-76.31	100	195 QP		Close		
6	0.09	32.11	13.76	18.35	108.16	-76.05	100	200 QP		Close		



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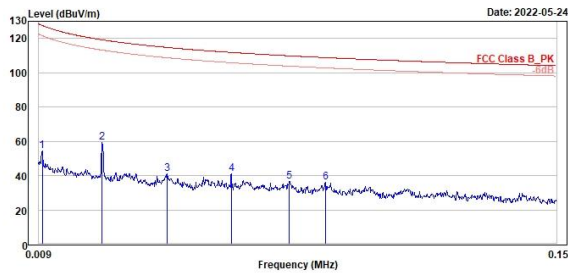
	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	0.15	41.76	23.36	18.40	104.80	-62.32	100	5 QP		Close		
2	1.97	34.02	14.61	19.41	69.50	-35.48	100	220 QP		Close		
3	8.06	33.80	13.18	20.62	69.50	-35.70	100	233 QP		Close		
4	12.99	35.50	13.79	21.71	69.50	-34.00	100	101 QP		Close		
5	18.84	36.29	14.17	22.12	69.50	-33.21	100	354 QP		Close		
6	26.03	36.50	14.03	22.47	69.50	-33.00	100	360 QP		Close		

925.1 MHz

(Open) 9kHz~150kHz



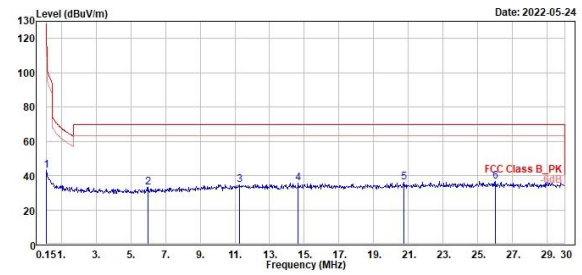
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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	0.01	54.35	36.64	17.71	127.60	-73.25	100	360	QP	Open		
2	0.03	59.21	40.03	19.18	119.18	-59.97	100	149	QP	Open		
3	0.04	40.99	21.62	19.37	114.73	-73.74	100	132	QP	Open		
4	0.06	41.17	22.11	19.06	111.82	-70.65	100	132	QP	Open		
5	0.08	36.59	17.88	18.71	109.84	-73.25	100	102	QP	Open		
6	0.09	35.96	17.47	18.49	108.79	-72.83	100	145	QP	Open		



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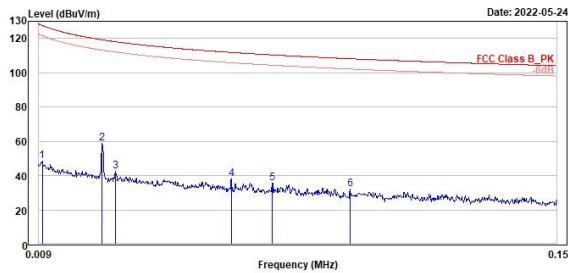
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	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	0.15	42.99	24.59	18.40	104.00	-61.09	100	153	QP	Open		
2	6.00	33.26	13.48	19.78	69.50	-36.24	100	117	QP	Open		
3	11.25	34.77	13.18	21.59	69.50	-34.73	100	51	QP	Open		
4	14.66	35.79	13.96	21.83	69.50	-33.71	100	156	QP	Open		
5	20.72	35.90	13.67	22.23	69.50	-33.60	100	82	QP	Open		
6	26.03	36.42	13.95	22.47	69.50	-33.08	100	13	QP	Open		

925.1 MHz

(Close) 9kHz~150kHz



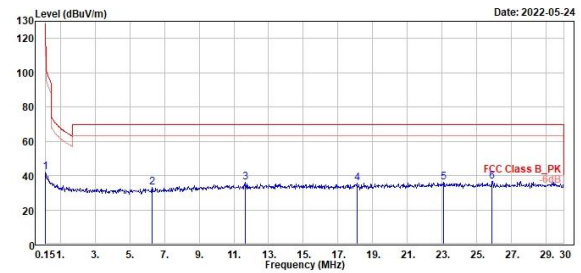
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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	0.01	48.21	30.50	17.71	127.60	-79.39	100	300	QP	Close		
2	0.03	59.06	39.88	19.18	119.18	-60.12	100	7	QP	Close		
3	0.03	42.46	22.95	19.51	118.05	-75.59	100	305	QP	Close		
4	0.06	38.04	18.98	19.06	111.82	-73.78	100	133	QP	Close		
5	0.07	35.68	16.87	18.81	110.38	-74.70	100	196	QP	Close		
6	0.09	32.03	13.68	18.35	108.16	-76.13	100	182	QP	Close		



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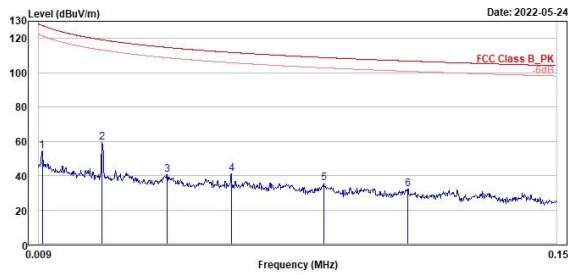
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1	0.15	42.06	23.66	18.40	104.00	-62.02	100	266	QP	Close		
2	6.30	32.99	13.09	19.90	69.50	-36.51	100	335	QP	Close		
3	11.67	36.04	14.42	21.62	69.50	-33.46	100	263	QP	Close		
4	18.09	35.71	13.64	22.07	69.50	-33.79	100	314	QP	Close		
5	23.07	36.22	13.88	22.34	69.50	-33.28	100	24	QP	Close		
6	25.88	36.47	14.00	22.47	69.50	-33.03	100	279	QP	Close		

927.5 MHz

(Open) 9kHz~150kHz



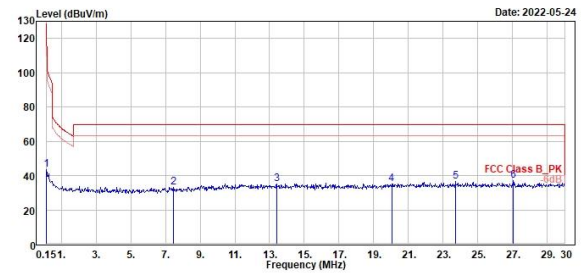
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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	0.01	54.18	36.47	17.71	127.60	-73.42	100	40	QP	Open		
2	0.03	59.38	40.20	19.18	119.18	-59.80	100	198	QP	Open		
3	0.04	40.68	21.31	19.37	114.73	-74.05	100	258	QP	Open		
4	0.06	41.26	22.20	19.06	111.82	-70.56	100	109	QP	Open		
5	0.09	35.64	17.13	18.51	108.85	-73.21	100	153	QP	Open		
6	0.11	32.21	13.96	18.25	106.82	-74.61	100	151	QP	Open		



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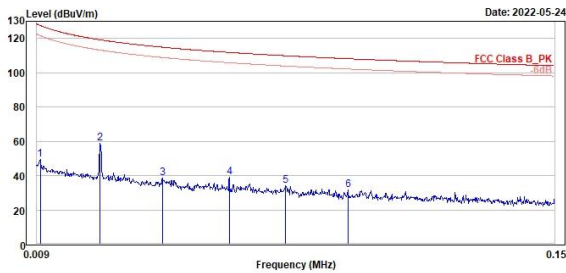
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	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	0.15	43.47	25.07	18.40	104.80	-60.61	100	228	QP	Open		
2	7.46	33.23	12.85	20.38	69.50	-36.27	100	43	QP	Open		
3	13.40	35.16	13.43	21.73	69.50	-34.34	100	159	QP	Open		
4	20.03	35.22	13.02	22.20	69.50	-34.28	100	180	QP	Open		
5	23.70	36.70	14.33	22.37	69.50	-32.80	100	258	QP	Open		
6	27.04	36.89	14.37	22.52	69.50	-32.61	100	62	QP	Open		

927.5 MHz

(Close) 9kHz~150kHz



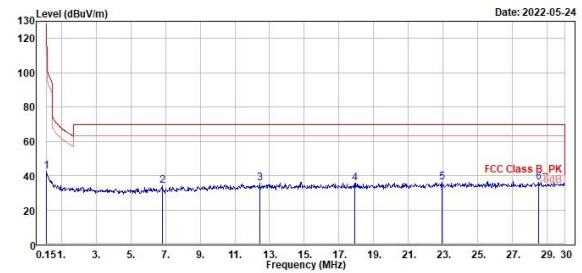
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	Freq	Level	Read	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1	0.01	49.19	31.48	17.71	127.60	-78.41	100	195 QP	Close		
2	0.03	59.01	39.83	19.18	119.18	-69.17	100	268 QP	Close		
3	0.04	38.57	19.19	19.38	114.87	-76.30	100	190 QP	Close		
4	0.06	38.82	19.76	19.06	111.82	-73.00	100	324 QP	Close		
5	0.08	34.00	15.28	18.72	109.89	-75.89	100	232 QP	Close		
6	0.09	31.52	13.17	18.35	108.16	-76.64	100	35 QP	Close		



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	Freq	Level	Read	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1	0.15	42.35	23.05	18.40	104.00	-61.73	100	116 QP	Close		
2	6.81	34.17	14.06	20.11	69.50	-35.33	100	45 QP	Close		
3	12.42	35.77	14.10	21.67	69.50	-33.73	100	58 QP	Close		
4	17.91	35.70	13.65	22.05	69.50	-33.80	100	274 QP	Close		
5	22.93	36.12	13.79	22.33	69.50	-33.38	100	124 QP	Close		
6	28.48	35.92	13.34	22.58	69.50	-33.58	100	103 QP	Close		

Spurious Emissions, Tx Mode, 30MHz ~ 1GHz

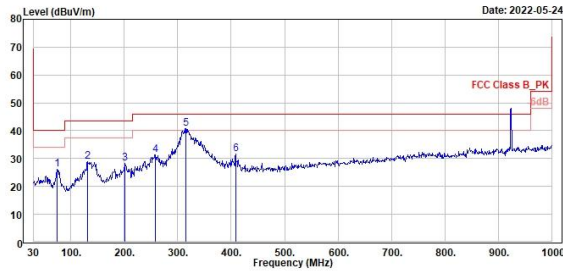
923.3 MHz

(Horizontal)

(Vertical)



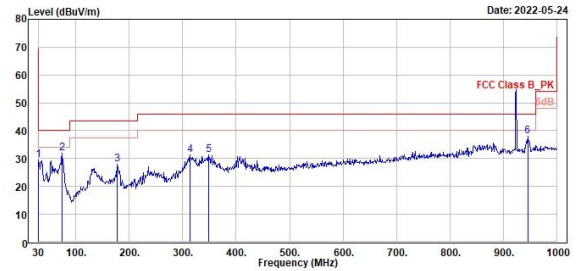
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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	dB	cm	deg			
1	74.62	26.28	35.78	-9.50	40.00	-13.80	242	26	QP	Horizontal		
2	131.85	29.01	36.11	-7.10	43.50	-14.49	280	86	QP	Horizontal		
3	201.69	28.15	36.50	-8.35	43.50	-15.35	100	220	QP	Horizontal		
4	257.95	31.27	37.61	-6.34	46.00	-14.73	114	360	QP	Horizontal		
5	315.18	40.79	45.38	-4.59	46.00	-5.21	100	41	QP	Horizontal		
6	408.38	31.61	34.45	-2.84	46.00	-14.39	100	215	QP	Horizontal		



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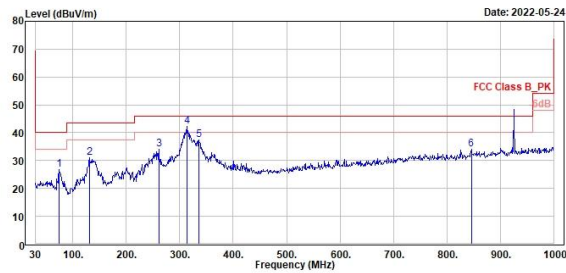
	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	dB	cm	deg			
1	38.00	29.46	36.70	-7.24	40.00	-10.54	100	25	QP	Vertical		
2	73.65	31.82	41.12	-9.30	40.00	-8.18	100	203	QP	Vertical		
3	176.47	27.92	34.84	-6.92	43.50	-15.58	100	166	QP	Vertical		
4	313.24	31.37	36.00	-4.63	46.00	-14.63	200	136	QP	Vertical		
5	349.13	31.41	35.32	-3.91	46.00	-14.59	100	310	QP	Vertical		
6	945.68	38.01	32.71	5.30	46.00	-7.99	100	310	QP	Vertical		

925.1 MHz

(Horizontal)



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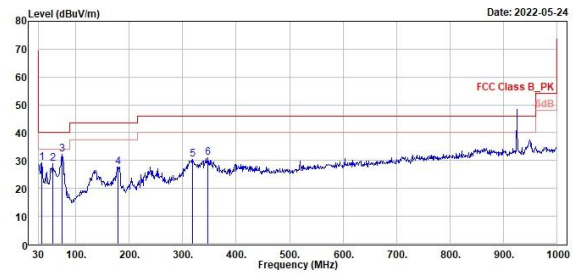


	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	dB	cm	deg			
1	73.65	26.63	35.93	-9.30	40.00	-13.37		300	141	QP	Horizontal	
2	130.88	31.05	38.26	-7.21	43.50	-12.45		200	110	QP	Horizontal	
3	260.86	34.00	40.29	-6.29	46.00	-12.00		100	359	QP	Horizontal	
4	314.21	42.26	46.87	-4.61	46.00	-3.74		100	39	QP	Horizontal	
5	335.55	37.34	41.25	-3.91	46.00	-8.66		100	39	QP	Horizontal	
6	845.77	34.14	38.41	-3.73	46.00	-11.06		100	325	QP	Horizontal	

(Vertical)



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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	dB	cm	deg			
1	35.82	29.12	35.88	-6.76	40.00	-10.88		100	201	QP	Vertical	
2	56.19	28.95	35.63	-6.68	40.00	-11.05		100	200	QP	Vertical	
3	73.65	32.18	41.48	-9.30	40.00	-7.82		100	237	QP	Vertical	
4	178.41	27.69	34.84	-7.15	43.50	-15.81		100	165	QP	Vertical	
5	318.09	30.56	35.06	-4.50	46.00	-15.44		200	123	QP	Vertical	
6	347.19	30.97	34.90	-3.93	46.00	-15.03		100	305	QP	Vertical	

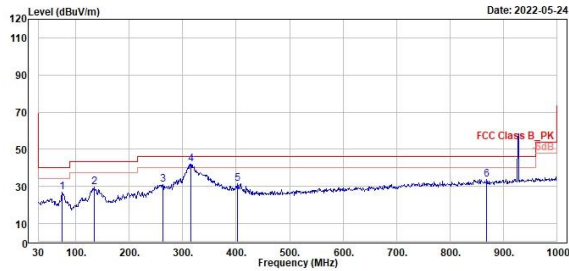
927.5 MHz

(Horizontal)

(Vertical)



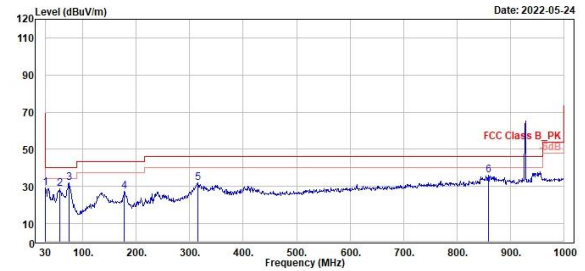
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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	74.62	27.01	36.51	-9.50	40.00	-12.99	300	168	QP		Horizontal	
2	133.79	29.52	36.41	-6.89	43.50	-13.98	200	111	QP		Horizontal	
3	262.80	31.10	37.30	-6.20	46.00	-14.90	100	36	QP		Horizontal	
4	315.18	42.15	46.74	-4.59	46.00	-3.85	100	40	QP		Horizontal	
5	402.48	31.48	34.41	-2.93	46.00	-14.52	100	216	QP		Horizontal	
6	859.05	33.91	29.68	4.23	46.00	-12.09	100	33	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	30.00	29.35	36.59	-7.24	40.00	-10.65	100	223	QP		Vertical	
2	56.19	28.58	35.26	-6.68	40.00	-11.42	100	303	QP		Vertical	
3	73.65	31.71	41.01	-9.30	40.00	-8.29	100	151	QP		Vertical	
4	177.44	27.46	34.51	-7.05	43.50	-16.04	100	165	QP		Vertical	
5	315.18	32.12	36.71	-4.59	46.00	-13.88	200	134	QP		Vertical	
6	859.35	35.92	31.67	4.05	46.00	-10.08	100	81	QP		Vertical	

Spurious Emissions, Tx Mode, 1GHz ~ 10GHz

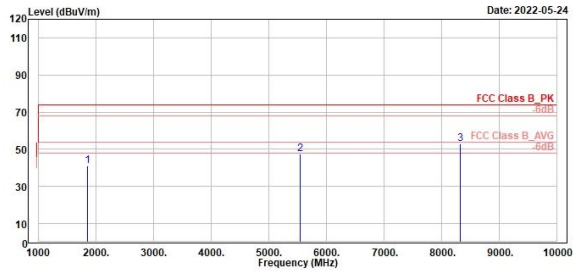
925.1 MHz

(Horizontal)

(Vertical)



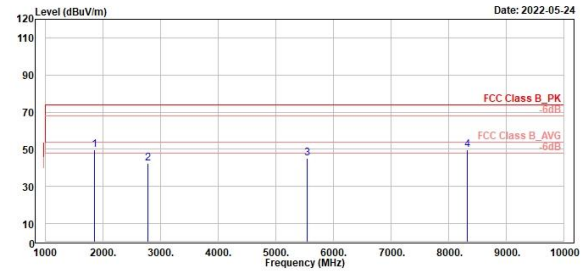
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Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	1859.20	41.05	57.05	-16.00	74.00	-32.95	280	284 Peak	Horizontal		
2	2775.30	42.49	56.10	-13.61	74.00	-31.51	300	264 Peak	Vertical		
3	5558.60	45.02	53.66	-8.64	74.00	-28.98	100	287 Peak	Vertical		



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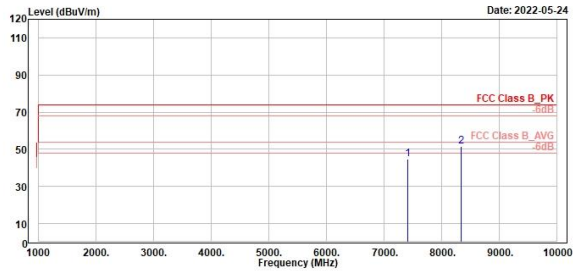
Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	1859.20	41.05	57.05	-16.00	74.00	-32.95	280	284 Peak	Horizontal		
2	2775.30	42.49	56.10	-13.61	74.00	-31.51	300	264 Peak	Vertical		
3	5558.60	45.02	53.66	-8.64	74.00	-28.98	100	287 Peak	Vertical		
4	8325.90	49.60	56.47	-6.87	74.00	-24.40	200	203 Peak	Vertical		

927.5 MHz

(Horizontal)



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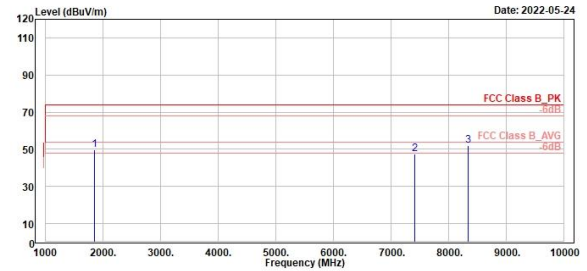


	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	7420.00	44.52	51.91	-7.39	74.00	-29.48	480	74	Peak	Horizontal		
2	8347.50	51.52	58.38	-6.86	74.00	-22.48	180	325	Peak	Horizontal		

(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	1855.00	49.69	65.67	-15.98	74.00	-24.31	215	45	Peak	Vertical		
2	7420.00	47.26	54.65	-7.39	74.00	-26.74	293	102	Peak	Vertical		
3	8347.50	52.08	58.94	-6.86	74.00	-21.92	200	216	Peak	Vertical		

Mains Conducted Emission, 150kHz ~ 30MHz

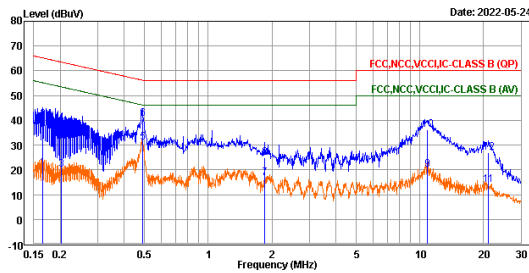
Worst Band

(Line)

(Neutral)



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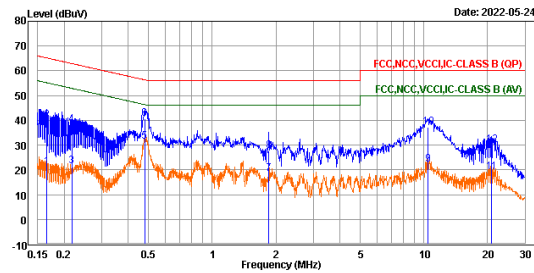


Trace: 1

	Freq	Level	Read	Factor	Limit	Over			
	MHz	dBuV	dBuV	dB	dBuV	dB	Remark	Pol/Phase	Note
1	0.17	20.64	10.95	9.69	55.17	-34.53	Average	line1	
2	0.17	40.21	30.52	9.69	65.17	-24.96	QP	line1	
3	0.20	20.08	10.40	9.68	53.47	-33.39	Average	line1	
4	0.20	38.77	29.09	9.68	63.47	-24.70	QP	line1	
5	0.49	31.23	21.55	9.68	46.19	-14.96	Average	line1	
6	0.49	40.54	30.86	9.68	56.19	-15.65	QP	line1	
7	1.84	16.69	6.97	9.72	46.00	-29.31	Average	line1	
8	1.84	25.02	15.30	9.72	56.00	-30.98	QP	line1	
9	10.80	20.16	10.35	9.81	50.00	-29.84	Average	line1	
10	10.80	36.26	26.45	9.81	60.00	-23.74	QP	line1	
11	21.06	13.78	3.98	9.80	50.00	-36.22	Average	line1	
12	21.06	27.10	17.30	9.80	60.00	-32.90	QP	line1	



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Trace: 1

	Freq	Level	Read	Factor	Limit	Over			
	MHz	dBuV	dBuV	dB	dBuV	dB	Remark	Pol/Phase	Note
1	0.17	21.05	11.38	9.67	55.17	-34.12	Average	neutral	
2	0.17	39.95	30.28	9.67	65.17	-25.22	QP	neutral	
3	0.22	21.44	11.78	9.66	52.94	-31.50	Average	neutral	
4	0.22	38.27	28.61	9.66	62.94	-24.67	QP	neutral	
5	0.48	31.52	21.86	9.66	46.35	-14.83	Average	neutral	
6	0.48	40.77	31.11	9.66	56.35	-15.58	QP	neutral	
7	1.85	18.40	8.71	9.69	46.00	-27.60	Average	neutral	
8	1.85	27.57	17.88	9.69	56.00	-28.43	QP	neutral	
9	10.48	22.22	12.43	9.79	50.00	-27.78	Average	neutral	
10	10.48	37.39	27.60	9.79	60.00	-22.61	QP	neutral	
11	20.85	19.04	9.17	9.87	50.00	-30.96	Average	neutral	
12	20.85	29.89	20.02	9.87	60.00	-30.11	QP	neutral	