

Partial FCC Test Report

Report No.: RFBEAD-WTW-P21050937A

FCC ID: M82-WISE2410

Test Model: WISE-2410B

Series Model: WISE-2410Bxxxxxxxxxxx (where "X" may be any alphanumeric character or blank or "-")

Received Date: Sep. 16, 2022

Test Date: Oct. 06 ~ Nov. 20, 2022

Issued Date: Nov. 25, 2022

Applicant: ADVANTECH CO., LTD

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lin Kou Laboratories

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Test Location (2): No. 70, Wenming Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)

FCC Registration / 788550 / TW0003
Designation Number (1):

FCC Registration / 281270 / TW0032
Designation Number (2):



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Release Control Record

Issue No.	Description	Date Issued
RFBEAD-WTW-P21050937A	Original release	Nov. 25, 2022

1 Certificate of Conformity

Product: WISE-2410B LoRa board

Brand: ADVANTECH

Test Model: WISE-2410B

Series Model: WISE-2410Bxxxxxxxxxx (where "X" may be any alphanumeric character or blank or "-")

Sample Status: Engineering sample

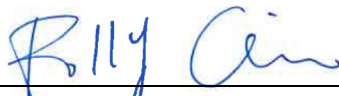
Applicant: ADVANTECH CO., LTD

Test Date: Oct. 06 ~ Nov. 20, 2022

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)
ANSI C63.10-2013

This report is issued as a duplicate report of RF190520C05. This report shall be used combined together with its original report.

Prepared by :


Polly Chien / Specialist

Date:

Nov. 25, 2022

Approved by :



Jeremy Lin / Project Engineer

Date:

Nov. 25, 2022

Note: The conducted power, radiated emission and conducted emission test items are performed for the addendum. Refer to original report for the other test data.

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	Pass	Meet the requirement of limit. Minimum passing margin is -9.37dB at 0.17000MHz.
15.247(a)(1)(i)	Number of Hopping Frequency Used	N/A	Refer to Note 1
15.247(a)(1)(i)	Dwell Time on Each Channel	N/A	Refer to Note 1
15.247(a)(1)	1. Hopping Channel Separation 2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	N/A	Refer to Note 1
15.247(b)(2)	Maximum Peak Output Power	Pass	Meet the requirement of limit.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -3.3dB at 7319.20MHz.
15.247(d)	Antenna Port Emission	N/A	Refer to Note 1
15.203	Antenna Requirement	Pass	No antenna connector is used.

Note:

1. The conducted power, radiated emission and conducted emission test items are performed for the addendum. Refer to original report for the other test data.
2. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.79 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.00 dB
	30MHz ~ 200MHz	2.91 dB
	200MHz ~ 1000MHz	2.93 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	1.76 dB
	18GHz ~ 40GHz	1.77 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	WISE-2410B LoRa board
Brand	ADVANTECH
Test Model	WISE-2410B
Series Model	WISE-2410Bxxxxxxxxxxx (where "X" may be any alphanumeric character or blank or "-")
Model Difference	Refer to note for more details
Sample Status	Engineering sample
Test Software Version	Com Tool
S/N	LKD0218077
Power Supply Rating	5Vdc from host equipment 3.7Vdc from battery
Modulation Type	chirp spread spectrum (CSS)
Transfer Rate	980bps ~ 5.47kbps
Operating Frequency	902.3 ~ 914.9MHz
Number of Channel	64
Channel Spacing	0.2MHz
Output Power	57.280mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	N/A
Cable Supplied	N/A

Note:

1. This report is prepared for FCC class II permissive change. This report is issued as a supplementary report to the original BV CPS report no.: RF190520C05. The difference compared with original report is adding an antenna. Therefore, only conducted power, radiated emission and conducted emission test items are performed for the addendum. Refer to original report for the other test data.
2. The following models are provided to this EUT.

Brand	Model	Description
ADVANTECH	WISE-2410B (Main test)	Where "X" may be any alphanumeric character or blank or "-" for marketing purpose only.
	WISE-2410Bxxxxxxxxxxx	

3. The following antennas were provided to the EUT. (Antenna 2 is the new antenna)

No.	Type	Connector	Gain (dBi)
1	Chip	NA	1.00
2	Monopole	NA	-0.90

* Detail antenna specification please refer to antenna datasheet and/or an antenna gain measurement report.

4. The transmitter module is authorized for use in specific End-product (LoRaWAN Smart Condition Monitoring Sensor, Brand: Advantech, Model: WISE-2410).

3.2 Description of Test Modes

64 channels are provided (125kHz Bandwidth):

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	902.3	16	905.5	32	908.7	48	911.9
1	902.5	17	905.7	33	908.9	49	912.1
2	902.7	18	905.9	34	909.1	50	912.3
3	902.9	19	906.1	35	909.3	51	912.5
4	903.1	20	906.3	36	909.5	52	912.7
5	903.3	21	906.5	37	909.7	53	912.9
6	903.5	22	906.7	38	909.9	54	913.1
7	903.7	23	906.9	39	910.1	55	913.3
8	903.9	24	907.1	40	910.3	56	913.5
9	904.1	25	907.3	41	910.5	57	913.7
10	904.3	26	907.5	42	910.7	58	913.9
11	904.5	27	907.7	43	910.9	59	914.1
12	904.7	28	907.9	44	911.1	60	914.3
13	904.9	29	908.1	45	911.3	61	914.5
14	905.1	30	908.3	46	911.5	62	914.7
15	905.3	31	908.5	47	911.7	63	914.9

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to				Description
	RE $\geq$ 1G	RE<1G	PLC	Power	
-	√	√	√	√	-

Where RE $\geq$ 1G: Radiated Emission above 1GHz & Bandedge Measurement
 RE<1G: Radiated Emission below 1GHz
 PLC: Power Line Conducted Emission
 Power: Conducted Output Power Measurement

Note: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.

Radiated Emission Test (Above 1GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate
-	0 to 63	0, 31, 63	CSS	980bps

Radiated Emission Test (Below 1GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate
-	0 to 63	0, 31, 63	CSS	980bps

Power Line Conducted Emission Test:

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate
-	0 to 63	63	CSS	980bps

Conducted Output Power Measurement:

- ☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

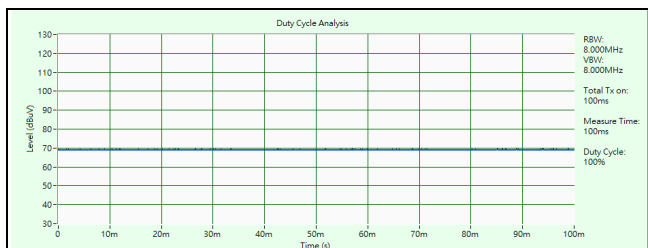
EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate
-	0 to 63	0, 31, 63	CSS	980bps

Test Condition:

Applicable to	Environmental Conditions	Input Power (System)	Tested by
RE $\geq$ 1G	23 deg. C, 68% RH	120Vac, 60Hz	Greg Lin
RE<1G	23 deg. C, 70% RH	120Vac, 60Hz	Randy Wu, Greg Lin
PLC	25 deg. C, 75% RH	120Vac, 60Hz	Edsion Lee
Power	25 deg. C, 60% RH	120Vac, 60Hz	Tim Chen

3.3 Duty Cycle of Test Signal

Duty cycle of test signal is 100%, duty factor is not required.



3.4 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

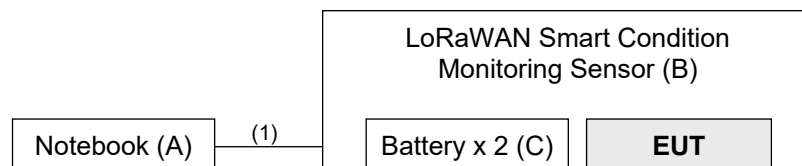
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	Lenovo	20J4 MD A003TW	PF-11H9AK	FCC DoC Approved	Provided by Lab
B.	LoRaWAN Smart Condition Monitoring Sensor	ADVANTECH	WISE-2410	NA	NA	Supplied by applicant
C.	Battery x 2	Tekcell	SB-AA11	NA	NA	-

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item A acted as a communication partner to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Micro USB Cable	1	2	Y	0	Provided by Lab

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards and references

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C (15.247)

ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.

References Test Guidance:

KDB 558074 D01 15.247 Meas Guidance v05r02

All test items have been performed as a reference to the above KDB test guidance.

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

Note:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver KEYSIGHT	N9038B	MY60180018	Feb. 18, 2022	Feb. 17, 2023
Spectrum Analyzer KEYSIGHT	N9020B	MY60110513	Dec. 24, 2021	Dec. 23, 2022
BILOG Antenna SCHWARZBECK	VULB9168	9168-1214	Oct. 27, 2021	Oct. 26, 2022
			Oct. 20, 2022	Oct. 19, 2023
HORN Antenna RF SPIN	DRH18-E	210101A18E	Nov. 14, 2021	Nov. 13, 2022
			Nov. 13, 2022	Nov. 12, 2023
HORN Antenna SCHWARZBECK	BBHA 9170	9170-1048	Nov. 14, 2021	Nov. 13, 2022
			Nov. 13, 2022	Nov. 12, 2023
Loop Antenna EMCI	EM-6879	269	Sep. 19, 2022	Sep. 18, 2023
Loop Antenna TESEQ	HLA 6121	45745	Jul. 27, 2022	Jul. 26, 2023
Preamplifier EMCI	EMC330N	980798	Jan. 17, 2022	Jan. 16, 2023
Preamplifier EMCI	EMC118A45SE	980809	Dec. 30, 2021	Dec. 29, 2022
Preamplifier EMCI	EMC184045SE	980786	Jan. 17, 2022	Jan. 16, 2023
RF signal cable EMCI	EMC104-SM-SM-(9000+3000+1000)	201244+ 201232+ 210103	Jan. 17, 2022	Jan. 16, 2023
RF signal cable EMCI	EMCCFD400-NM-NM-(9000+3000+500)	201251+ 201249+ 201248	Jan. 17, 2022	Jan. 16, 2023
RF signal cable EMCI	EMC101G-KM-KM-(5000+3000+2000)	201261+201258+ 201255	Jan. 17, 2022	Jan. 16, 2023
Software BV ADT	ADT_Radiated_V7.6.15.9.5	NA	NA	NA
Antenna Tower Max-Full	MFA-515BSN	NA	NA	NA
Turn Table Max-Full	MFT-201SS	NA	NA	NA
Turn Table Controller Max-Full	MF-7802BS	MF780208676	NA	NA
Wideband Power Sensor KEYSIGHT	N1923A	MY58020002	Jan. 17, 2022	Jan. 16, 2023
Peak Power Analyzer KEYSIGHT	8990B	MY51000485	Jan. 18, 2022	Jan. 17, 2023

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in WM Chamber 9.

4.1.3 Test Procedures

For Radiated emission below 30MHz

- 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, perpendicular, and ground-parallel 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 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) 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 detect 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:

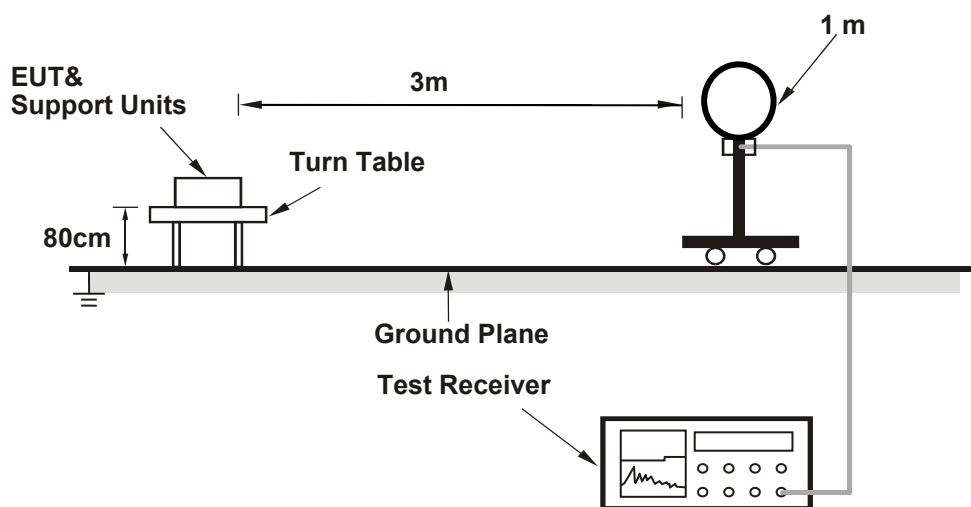
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) and Average detector (AV) at frequency above 1GHz.
3. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

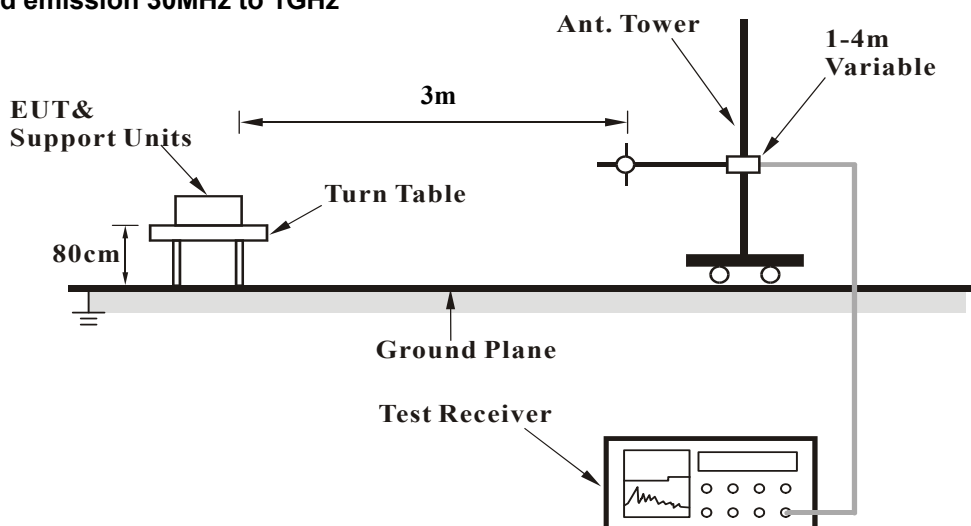
No deviation.

4.1.5 Test Setup

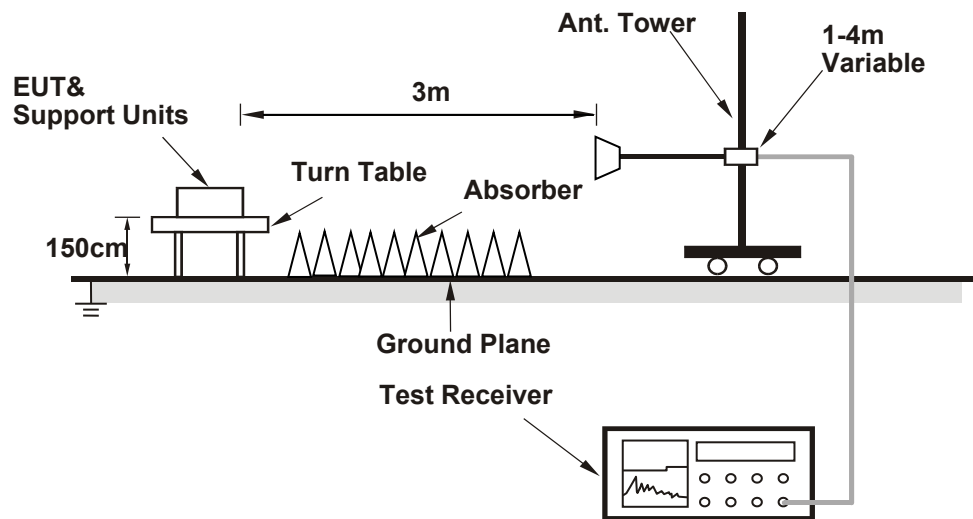
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

4.1.6 EUT Operating Conditions

- a. Set the EUT under transmission condition continuously at specific channel frequency.

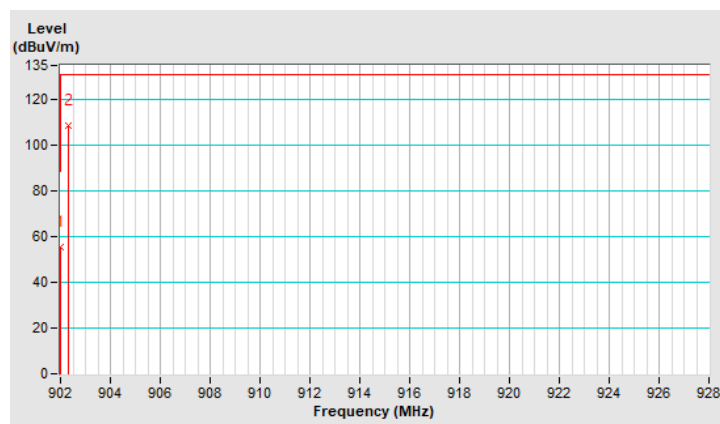
4.1.7 Test Results

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	902MHz ~ 928MHz		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	902.00	55.4 QP	88.9	-33.5	1.00 H	155	25.6	29.8
2	*902.30	108.9 QP			1.00 H	155	79.0	29.9

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value.
5. " * ": Fundamental frequency.

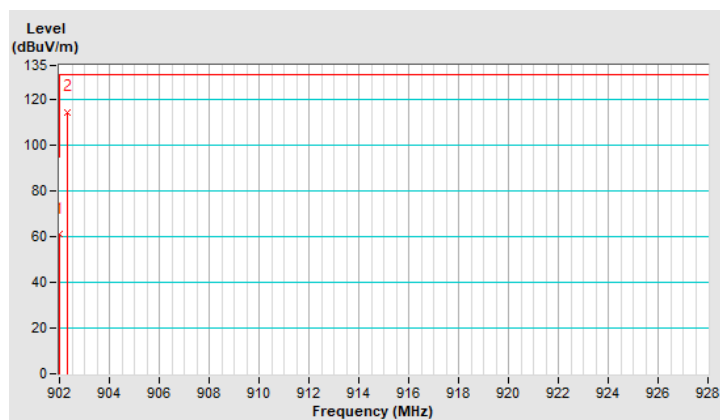


CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	902MHz ~ 928MHz		

Antenna Polarity & Test Distance : Vertical at 3 m								
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	902.00	61.2 QP	94.7	-33.5	1.18 V	310	31.4	29.8
2	*902.30	114.7 QP			1.18 V	310	84.8	29.9

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value.
5. " * ": Fundamental frequency.

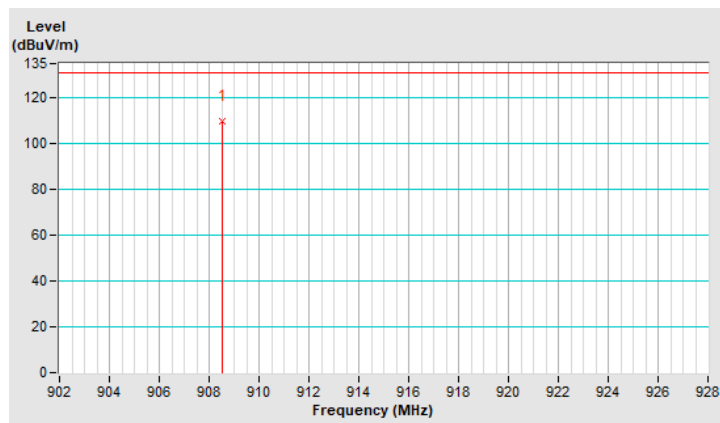


CHANNEL	TX Channel 31	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	902MHz ~ 928MHz		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*908.50	109.6 QP			1.00 H	153	79.5	30.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value.
5. " * " : Fundamental frequency.

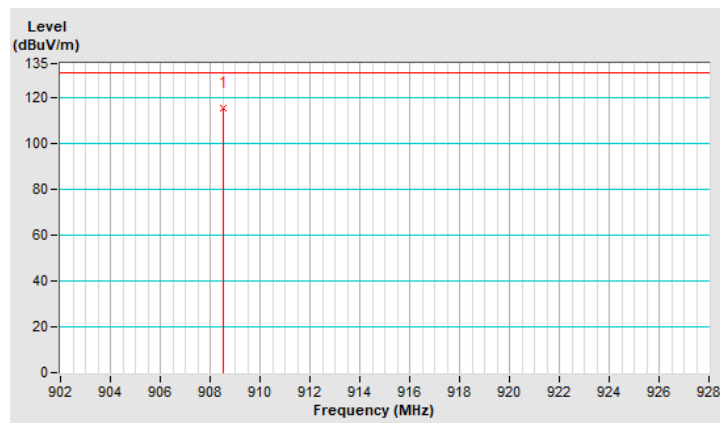


CHANNEL	TX Channel 31	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	902MHz ~ 928MHz		

Antenna Polarity & Test Distance : Vertical at 3 m								
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*908.50	115.5 QP			1.27 V	311	85.4	30.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value.
5. " * " : Fundamental frequency.

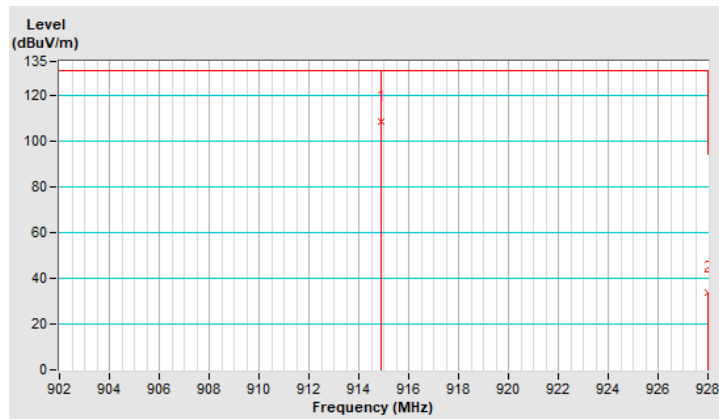


CHANNEL	TX Channel 63	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	902MHz ~ 928MHz		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*914.90	108.6 QP			1.00 H	156	78.4	30.2
2	928.00	34.0 QP	88.6	54.6	1.00 H	156	3.6	30.4

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value.
5. " * ": Fundamental frequency.

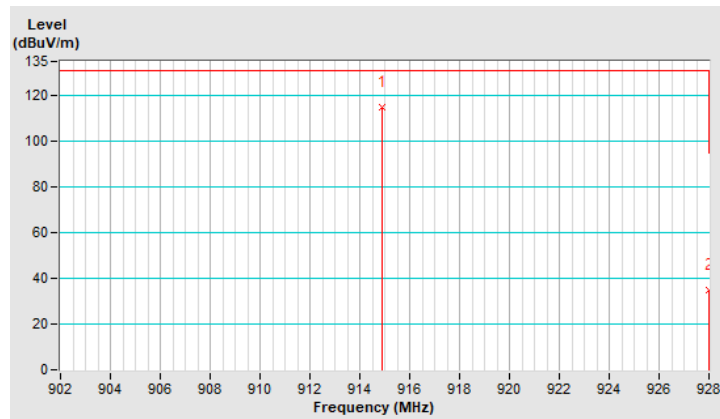


CHANNEL	TX Channel 63	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	902MHz ~ 928MHz		

Antenna Polarity & Test Distance : Vertical at 3 m								
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*914.90	114.8 QP			1.22 V	311	84.6	30.2
2	928.00	34.8 QP	94.8	-60.0	1.22 V	311	4.4	30.4

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value.
5. " * ": Fundamental frequency.



Above 1GHz Data:

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 10GHz		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2706.90	52.3 PK	74.0	-21.7	2.74 H	281	55.3	-3.0
2	2706.90	49.7 AV	54.0	-4.3	2.74 H	281	52.7	-3.0
3	7218.40	57.2 PK	74.0	-16.8	2.17 H	198	49.5	7.7
4	7218.40	50.1 AV	54.0	-3.9	2.17 H	198	42.4	7.7
5	8120.70	54.4 PK	74.0	-19.6	1.98 H	216	47.3	7.1
6	8120.70	43.9 AV	54.0	-10.1	1.98 H	216	36.8	7.1
Antenna Polarity & Test Distance : Vertical at 3 m								
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2706.90	52.3 PK	74.0	-21.7	1.48 V	243	55.3	-3.0
2	2706.90	49.4 AV	54.0	-4.6	1.48 V	243	52.4	-3.0
3	7218.40	56.7 PK	74.0	-17.3	2.94 V	353	49.0	7.7
4	7218.40	48.5 AV	54.0	-5.5	2.94 V	353	40.8	7.7
5	8120.70	54.0 PK	74.0	-20.0	2.02 V	72	46.9	7.1
6	8120.70	44.7 AV	54.0	-9.3	2.02 V	72	37.6	7.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value.
5. The EUT was tested by a test tool (provided by manufacturer), please refer to section 3.3 for duty cycle spectrum plot.

CHANNEL	TX Channel 31	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 10GHz		Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2725.50	52.6 PK	74.0	-21.4	2.62 H	291	55.5	-2.9
2	2725.50	50.3 AV	54.0	-3.7	2.62 H	291	53.2	-2.9
3	7268.00	57.5 PK	74.0	-16.5	2.19 H	201	49.6	7.9
4	7268.00	50.3 AV	54.0	-3.7	2.19 H	201	42.4	7.9
5	8176.50	53.9 PK	74.0	-20.1	1.93 H	215	46.6	7.3
6	8176.50	44.2 AV	54.0	-9.8	1.93 H	215	36.9	7.3
Antenna Polarity & Test Distance : Vertical at 3 m								
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2725.50	52.5 PK	74.0	-21.5	1.41 V	238	55.4	-2.9
2	2725.50	49.7 AV	54.0	-4.3	1.41 V	238	52.6	-2.9
3	7268.00	56.7 PK	74.0	-17.3	2.93 V	352	48.8	7.9
4	7268.00	48.7 AV	54.0	-5.3	2.93 V	352	40.8	7.9
5	8176.50	54.7 PK	74.0	-19.3	1.91 V	68	47.4	7.3
6	8176.50	45.6 AV	54.0	-8.4	1.91 V	68	38.3	7.3

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value.
5. The EUT was tested by a test tool (provided by manufacturer), please refer to section 3.3 for duty cycle spectrum plot.

CHANNEL	TX Channel 63	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 10GHz		Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2744.70	52.9 PK	74.0	-21.1	2.69 H	284	55.7	-2.8
2	2744.70	50.3 AV	54.0	-3.7	2.69 H	284	53.1	-2.8
3	7319.20	57.7 PK	74.0	-16.3	2.22 H	203	49.7	8.0
4	7319.20	50.7 AV	54.0	-3.3	2.22 H	203	42.7	8.0
5	8234.10	54.3 PK	74.0	-19.7	1.95 H	210	46.9	7.4
6	8234.10	44.1 AV	54.0	-9.9	1.95 H	210	36.7	7.4
Antenna Polarity & Test Distance : Vertical at 3 m								
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2744.70	52.7 PK	74.0	-21.3	1.44 V	236	55.5	-2.8
2	2744.70	49.9 AV	54.0	-4.1	1.44 V	236	52.7	-2.8
3	7319.20	57.1 PK	74.0	-16.9	2.87 V	357	49.1	8.0
4	7319.20	48.6 AV	54.0	-5.4	2.87 V	357	40.6	8.0
5	8234.10	54.6 PK	74.0	-19.4	1.92 V	60	47.2	7.4
6	8234.10	45.4 AV	54.0	-8.6	1.92 V	60	38.0	7.4

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value.
5. The EUT was tested by a test tool (provided by manufacturer), please refer to section 3.3 for duty cycle spectrum plot.

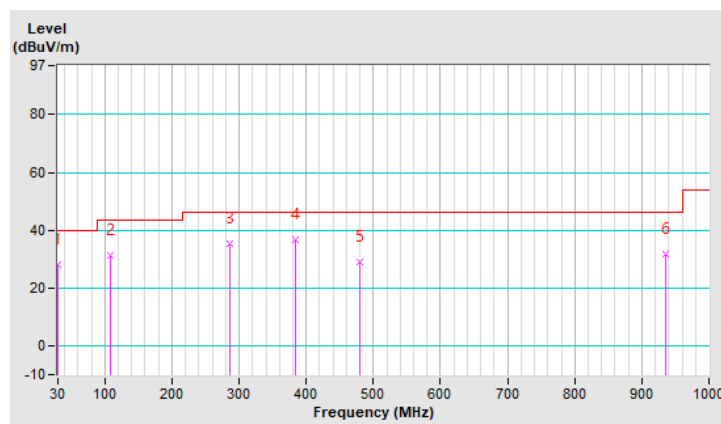
Below 1GHz Data:

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	30.00	28.2 QP	40.0	-11.8	1.25 H	44	42.6	-14.4
2	107.60	31.2 QP	43.5	-12.3	1.00 H	156	47.6	-16.4
3	287.10	35.2 QP	46.0	-10.8	1.50 H	62	48.0	-12.8
4	383.10	36.6 QP	46.0	-9.4	1.25 H	26	47.1	-10.5
5	479.10	28.8 QP	46.0	-17.2	1.50 H	293	37.0	-8.2
6	935.00	31.9 QP	46.0	-14.1	1.00 H	27	32.7	-0.8

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value.
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz :the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

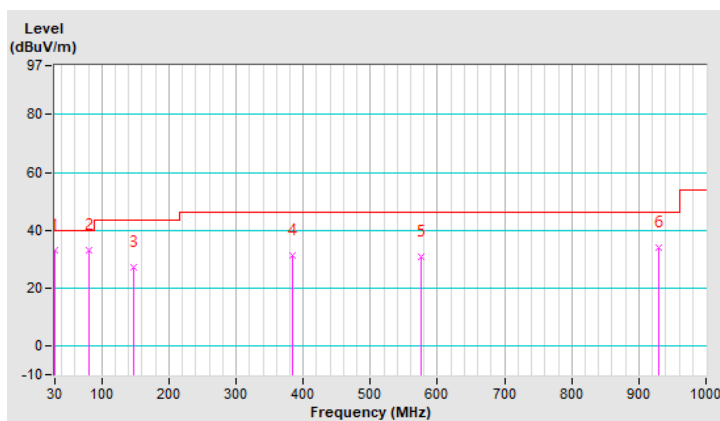


CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

Antenna Polarity & Test Distance : Vertical at 3 m								
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	30.00	33.2 QP	40.0	-6.8	1.25 V	316	47.6	-14.4
2	80.40	33.0 QP	40.0	-7.0	1.00 V	206	51.1	-18.1
3	148.30	27.1 QP	43.5	-16.4	1.50 V	319	40.3	-13.2
4	383.10	31.3 QP	46.0	-14.7	1.25 V	102	41.8	-10.5
5	575.10	30.8 QP	46.0	-15.2	1.00 V	79	37.1	-6.3
6	930.20	34.1 QP	46.0	-11.9	1.50 V	316	35.0	-0.9

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value.
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz :the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

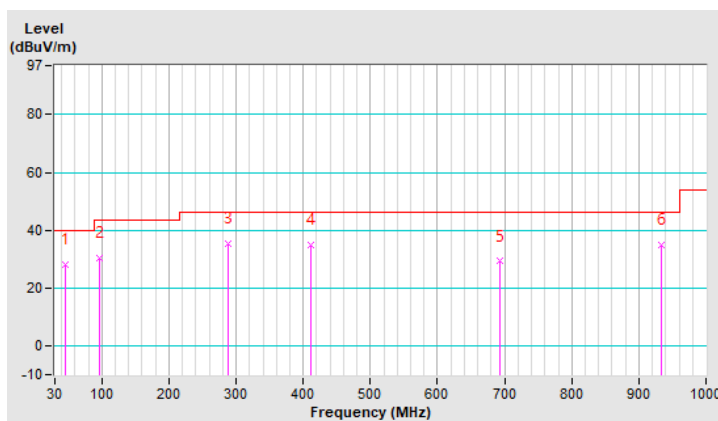


CHANNEL	TX Channel 31	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	46.50	28.0 QP	40.0	-12.0	1.25 H	182	41.1	-13.1
2	96.00	30.3 QP	43.5	-13.2	1.00 H	172	48.9	-18.6
3	288.00	35.4 QP	46.0	-10.6	1.50 H	56	48.2	-12.8
4	412.20	34.8 QP	46.0	-11.2	1.25 H	226	44.7	-9.9
5	693.50	29.2 QP	46.0	-16.8	1.00 H	258	33.3	-4.1
6	933.10	35.0 QP	46.0	-11.0	1.50 H	245	35.8	-0.8

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value.
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz :the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

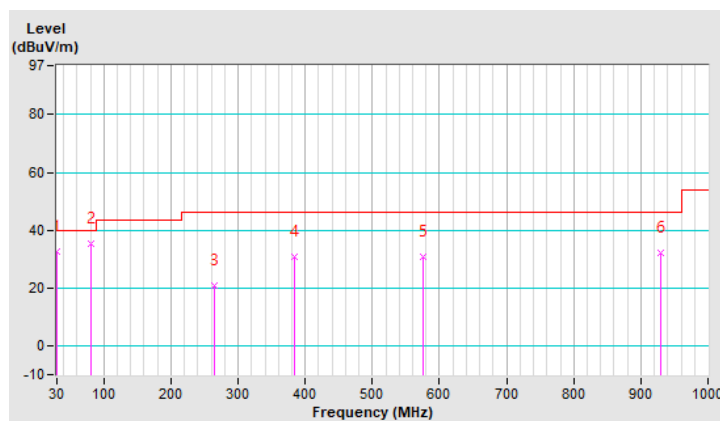


CHANNEL	TX Channel 31	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

Antenna Polarity & Test Distance : Vertical at 3 m								
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	30.00	32.4 QP	40.0	-7.6	1.25 V	342	46.8	-14.4
2	80.40	35.3 QP	40.0	-4.7	1.00 V	339	53.4	-18.1
3	263.80	20.9 QP	46.0	-25.1	1.50 V	100	34.8	-13.9
4	383.10	30.8 QP	46.0	-15.2	1.00 V	95	41.3	-10.5
5	575.10	30.6 QP	46.0	-15.4	1.00 V	68	36.9	-6.3
6	930.20	32.2 QP	46.0	-13.8	1.25 V	178	33.1	-0.9

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value.
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz :the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

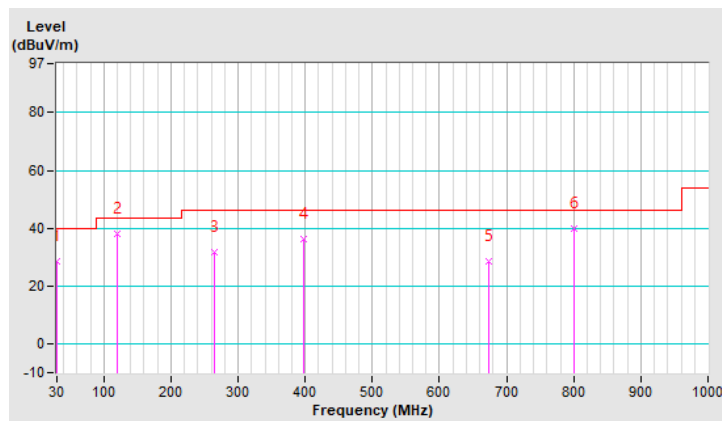


CHANNEL	TX Channel 63	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	30.00	28.7 QP	40.0	-11.3	1.25 H	127	43.1	-14.4
2	120.20	38.0 QP	43.5	-5.5	1.00 H	197	53.3	-15.3
3	263.80	31.7 QP	46.0	-14.3	1.00 H	213	45.6	-13.9
4	398.60	36.1 QP	46.0	-9.9	1.50 H	224	46.3	-10.2
5	673.10	28.4 QP	46.0	-17.6	1.00 H	255	33.1	-4.7
6	800.20	39.7 QP	46.0	-6.3	1.50 H	60	42.4	-2.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value.
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz :the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

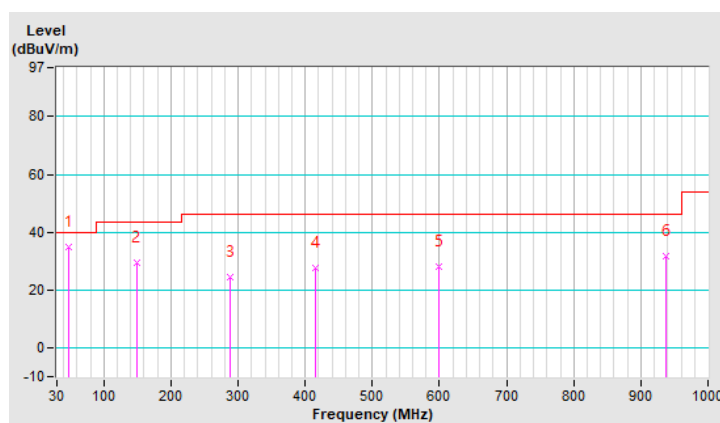


CHANNEL	TX Channel 63	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

Antenna Polarity & Test Distance : Vertical at 3 m								
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	48.40	34.9 QP	40.0	-5.1	1.25 V	275	47.9	-13.0
2	148.30	29.3 QP	43.5	-14.2	1.00 V	4	42.5	-13.2
3	288.00	24.3 QP	46.0	-21.7	1.50 V	98	37.1	-12.8
4	415.10	27.6 QP	46.0	-18.4	1.25 V	236	37.5	-9.9
5	599.40	28.2 QP	46.0	-17.8	1.00 V	72	33.6	-5.4
6	937.90	31.8 QP	46.0	-14.2	1.50 V	15	32.5	-0.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value.
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz :the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Dec. 03, 2021	Dec. 02, 2022
RF signal cable Woken	5D-FB	Cable-cond1-01	Jan. 15, 2022	Jan. 14, 2023
LISN/AMN ROHDE & SCHWARZ (EUT)	ENV216	101826	Mar. 14, 2022	Mar. 13, 2023
LISN/AMN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Sep. 12, 2022	Sep. 11, 2023
Software ADT	BV ADT_Conc_ V7.3.7.4	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The test was performed in HwaYa Shielded Room 1 (Conduction 1).

3. The VCCI Site Registration No. is C-12040.

4. Tested date: Oct. 07, 2022

4.2.3 Test Procedures

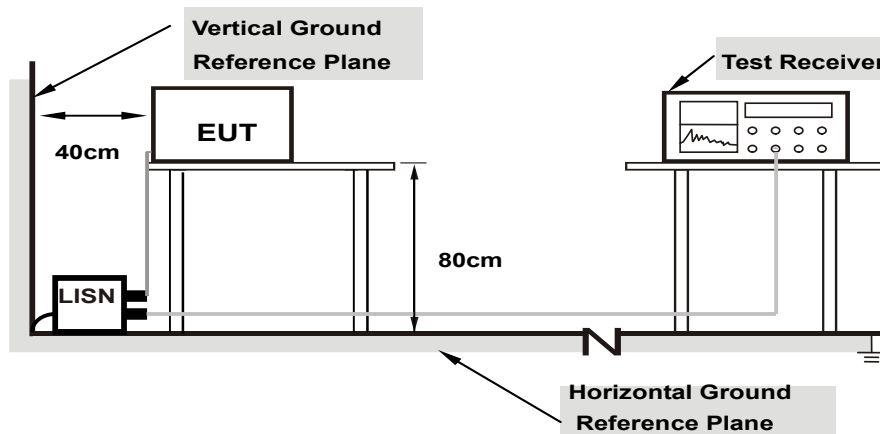
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

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

4.2.6 EUT Operating Conditions

Same as 4.1.6.

4.2.7 Test Results

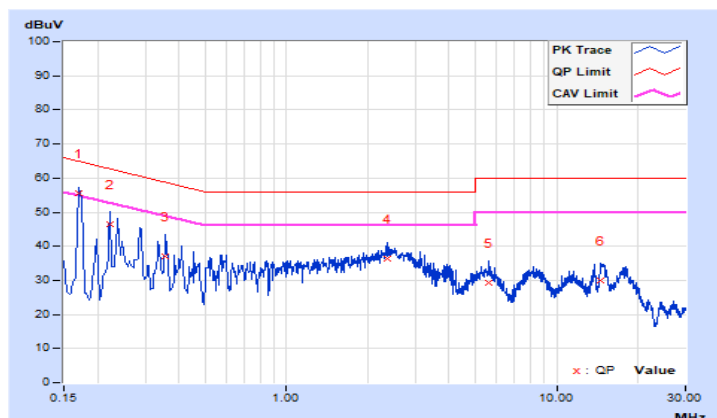
Worst-case data:

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.17000	9.63	45.96	32.32	55.59	41.95	64.96	54.96	-9.37	-13.01
2	0.22200	9.65	36.84	21.25	46.49	30.90	62.74	52.74	-16.25	-21.84
3	0.35800	9.68	27.20	10.39	36.88	20.07	58.77	48.77	-21.89	-28.70
4	2.36200	9.73	26.63	19.75	36.36	29.48	56.00	46.00	-19.64	-16.52
5	5.59000	9.77	19.53	13.70	29.30	23.47	60.00	50.00	-30.70	-26.53
6	14.57800	9.84	20.08	14.25	29.92	24.09	60.00	50.00	-30.08	-25.91

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

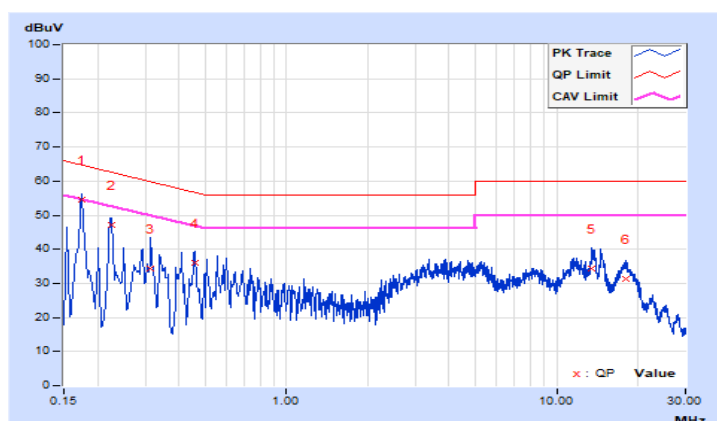


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.17400	9.63	45.06	32.49	54.69	42.12	64.77	54.77	-10.08	-12.65
2	0.22387	9.65	37.51	23.90	47.16	33.55	62.67	52.67	-15.51	-19.12
3	0.31400	9.67	24.60	5.53	34.27	15.20	59.86	49.86	-25.59	-34.66
4	0.45717	9.69	26.24	14.15	35.93	23.84	56.74	46.74	-20.81	-22.90
5	13.53400	9.85	24.42	17.14	34.27	26.99	60.00	50.00	-25.73	-23.01
6	18.15000	9.89	21.56	16.23	31.45	26.12	60.00	50.00	-28.55	-23.88

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

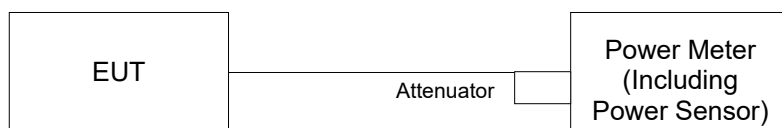


4.3 Conducted Output Power Measurement

4.3.1 Limits of Conducted Output Power Measurement

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

For Peak Power

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.

For Average Power

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.

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Condition

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.3.7 Test Results

For Peak Power

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Power Limit (dBm)	Pass / Fail
0	902.3	56.754	17.54	30.00	Pass
31	908.5	57.148	17.57	30.00	Pass
63	914.9	57.280	17.58	30.00	Pass

For Average Power

Channel	Frequency (MHz)	Output Power (mW)	Output Power (dBm)
0	902.3	56.105	17.49
31	908.5	56.234	17.50
63	914.9	56.105	17.49

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

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The address and road map of all our labs can be found in our web site also.

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