FCC Test Report

Report No.:	RFBCKS-WTW-P22051021
FCC ID:	TVE-3918T05646
Test Model:	FAP-431G, FAP-433G
Variant Model:	FortiAP 431Gxxxxxx, FAP-431Gxxxxxx, FORTIAP-431Gxxxxxx, FortiAP 433Gxxxxxx, FAP-433Gxxxxxx, FORTIAP-433Gxxxxxx (Where "x" can be used as "A-Z", or "0-9", or "-", or blank for software changes or marketing purposes only) (refer to item 3.1 for more details)
Received Date:	May 31, 2022
Test Date:	Aug. 26 ~ Nov. 01, 2022
Issued Date:	Nov. 14, 2022
Applicant:	Fortinet, Inc.
Address:	899 Kifer Rd. Sunnyvale CA. 94086 United States
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
Test Location (1):	No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, Taiwan
Test Location (2):	No. 70, Wenming Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)
FCC Registration / Designation Number(1):	788550 / TW0003
FCC Registration / Designation Number(2):	281270 / TW0032

Table of Contents

Release Control Record

Issue No.	Description	Date Issued
RFBCKS-WTW-P22051021	Original release	Nov. 14, 2022

1 Certificate of Conformity

Product:	Secured Wireless Access Point
Brand:	FORTINET
Test Model:	FAP-431G, FAP-433G
Variant Model:	FortiAP 431Gxxxxxx, FAP-431Gxxxxxx, FORTIAP-431Gxxxxxx, FortiAP 433Gxxxxxx, FAP-433Gxxxxxx, FORTIAP-433Gxxxxxx (Where "x" can be used as "A-Z", or "0-9", or "-", or blank for software changes or marketing purposes only) (refer to item 3.1 for more details)
Sample Status:	Engineering sample
Applicant:	Fortinet, Inc.
Test Date:	Aug. 26 ~ Nov. 01, 2022
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247) ANSI C63.10:2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by : Pettie Chen , **Date:** Nov. 14, 2022

Pettie Chen / Senior Specialist

Approved by : Jeremy Lin , **Date:** Nov. 14, 2022

Jeremy Lin / Project Engineer

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 -6.09dB at 0.58104MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -0.40dB at 2483.50MHz.
15.247(d)	Antenna Port Emission	Pass	Meet the requirement of limit.
15.247(a)(2)	6dB bandwidth	Pass	Meet the requirement of limit.
15.247(b)	Conducted power	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	Antenna connector is ipex(MHF) not a standard connector.

Note:

1. For 2.4G band compliance with rule 15.247(d) of the band-edge items, the test plots were recorded in Annex A. Test Procedures refer to report 4.1.3.
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	2.92 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	Secured Wireless Access Point
Brand	FORTINET
Test Model	FAP-431G, FAP-433G
Variant Model	FortiAP 431Gxxxxxx, FAP-431Gxxxxxx, FORTIAP-431Gxxxxxx, FortiAP 433Gxxxxxx, FAP-433Gxxxxxx, FORTIAP-433Gxxxxxx (Where "x" can be used as "A-Z", or "0-9", or “-", or blank for software changes or marketing purposes only) (refer to item 3.1 for more details)
Model Difference	Refer to note
Sample Status	Engineering sample
Power Supply rating	12Vdc from Adapter 55Vdc from PoE
Modulation Type	O-QPSK
Modulation Technology	DSSS
Transfer Rate	250 kbps
Operating Frequency	2405 ~ 2480MHz
Number of Channel	16
Output Power	Model: FAP-431G: 73.961mW Model: FAP-433G: 73.621mW
Antenna Type	Refer to note
Antenna Connector	Refer to note
Accessory Device	NA
Cable Supplied	NA

Note:

1. The following models are provided to this EUT. The model FAP-431G, FAP-433G were chosen for final test.

Brand	Test Model	Series Model	Difference
Fortinet	FAP-431G	FortiAP 431Gxxxxxx, FAP-431Gxxxxxx, FORTIAP-431Gxxxxxx (Where "x" can be used as "A-Z", or "0-9", or “-", or blank for software changes or marketing purposes only)	internal antenna
	FAP-433G	FortiAP 433Gxxxxxx, FAP-433Gxxxxxx, FORTIAP-433Gxxxxxx (Where "x" can be used as "A-Z", or "0-9", or “-", or blank for software changes or marketing purposes only)	external antenna

2. The EUT consumes power from the following adapter and POE.

Adapter (support units only)	
Brand	Asian Power Devices Inc.
Model	WA-48A12R
Input Power	100-240Vac~50-60Hz, 1.5A Max
Output Power	12.0Vdc, 4.0A, 48.0W
Power Line	1.47m cable without core attached on adapter

POE (support units only)	
Brand	Microsemi
Model	PD-9501-10GC/AC
Input Power	100-240Vac~50-60Hz, 1.5A Max
Output Power	55Vdc, 1.1A

3. The following antennas were provided to the EUT.

Item	RF Chain NO.	Brand	Model	Antenna Type	Connector	Gain(dBi)
ANT8	Radio 4 (BLE/Zigbee)	WNC	FortiAP-431G	PIFA	ipex(MHF)	3.8

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

4. The WLAN 2.4GHz, 5GHz, 6E, Zigbee and BT of the device can transmit simultaneously.
5. Spurious emission of the simultaneous operation (WLAN 2.4GHz, 5GHz, Zigbee, 6E and BT) has been evaluated and no non-compliance was found.

3.2 Description of Test Modes

16 channels are provided to this EUT:

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

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to				Description	
	RE≥1G	RE<1G	PLC	APCM	EUT Model	Power
A	√	√	√	√	FAP-431G	Power from adapter
B	-	√	√	-		Power from PoE
C	√	√	√	√	FAP-433G	Power from adapter
D	-	√	√	-		Power from PoE

Where RE≥1G: Radiated Emission above 1GHz & Bandedge Measurement RE<1G: Radiated Emission below 1GHz

PLC: Power Line Conducted Emission APCM: Antenna Port Conducted Measurement

Note:

1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-axis (For Model: FAP-431G), X-axis (For Model: FAP-433G).**
2. Radiated emission test (below 1GHz) and power line conducted emission test items chosen the worst maximum power.
3. "-": Means no effect.

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
A, C	11 to 26	11, 18, 26	O-QPSK

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
A, B, C, D	11 to 26	11	O-QPSK

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
A, B, C, D	11 to 26	11	O-QPSK

Antenna Port Conducted 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
A, C	11 to 26	11, 18, 26	O-QPSK

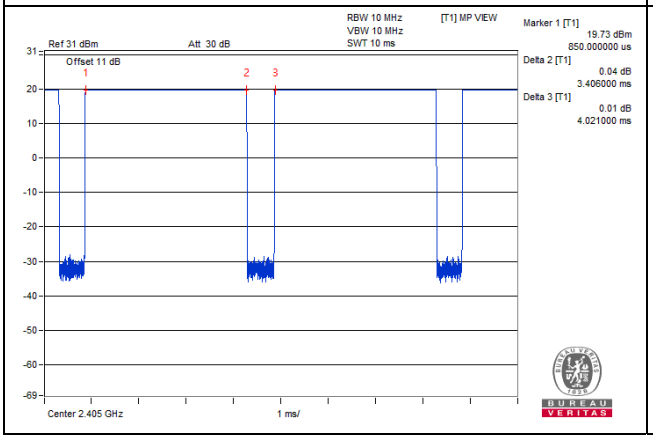
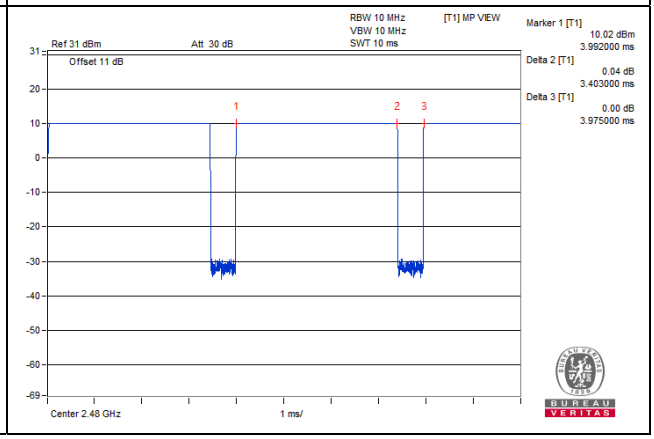
Test Condition:

Applicable to	Environmental Conditions	Input Power (System)	Tested by
RE≥1G	23 deg. C, 70% RH 24 deg. C, 65% RH	120Vac, 60Hz	Vincent Chen (Test Mode A) Randy Wu (Test Mode C)
RE<1G	23 deg. C, 72% RH	120Vac, 60Hz 55Vdc	Wade Huang (Test Mode A) Noah Chang (Test Mode B)
	25 deg. C, 77% RH 24 deg. C, 65% RH	120Vac, 60Hz 55Vdc	Randy Wu (Test Mode C, D)
PLC	25 deg. C, 75% RH	120Vac, 60Hz, 55Vdc	Edison Lee (Test Mode A, B) Rex Wang (Test Mode C, D)
APCM	25 deg. C, 60% RH	120Vac, 60Hz	Gary Lin (Test Mode A) Jisyong Wang (Test Mode C)

3.3 Duty Cycle of Test Signal

Duty cycle of test signal is > 98%, duty factor is not required.
Duty cycle of test signal is < 98%, duty factor is required.

Test Mode A: Duty cycle = 3.406/4.021 = 0.847, Duty factor = 10 * log(1/0.847) = 0.72
Test Mode C: Duty cycle = 3.403/3.975 = 0.856, Duty factor = 10 * log(1/0.856) = 0.67

Test Mode A	Test Mode C
	

3.4 Description of Support Units

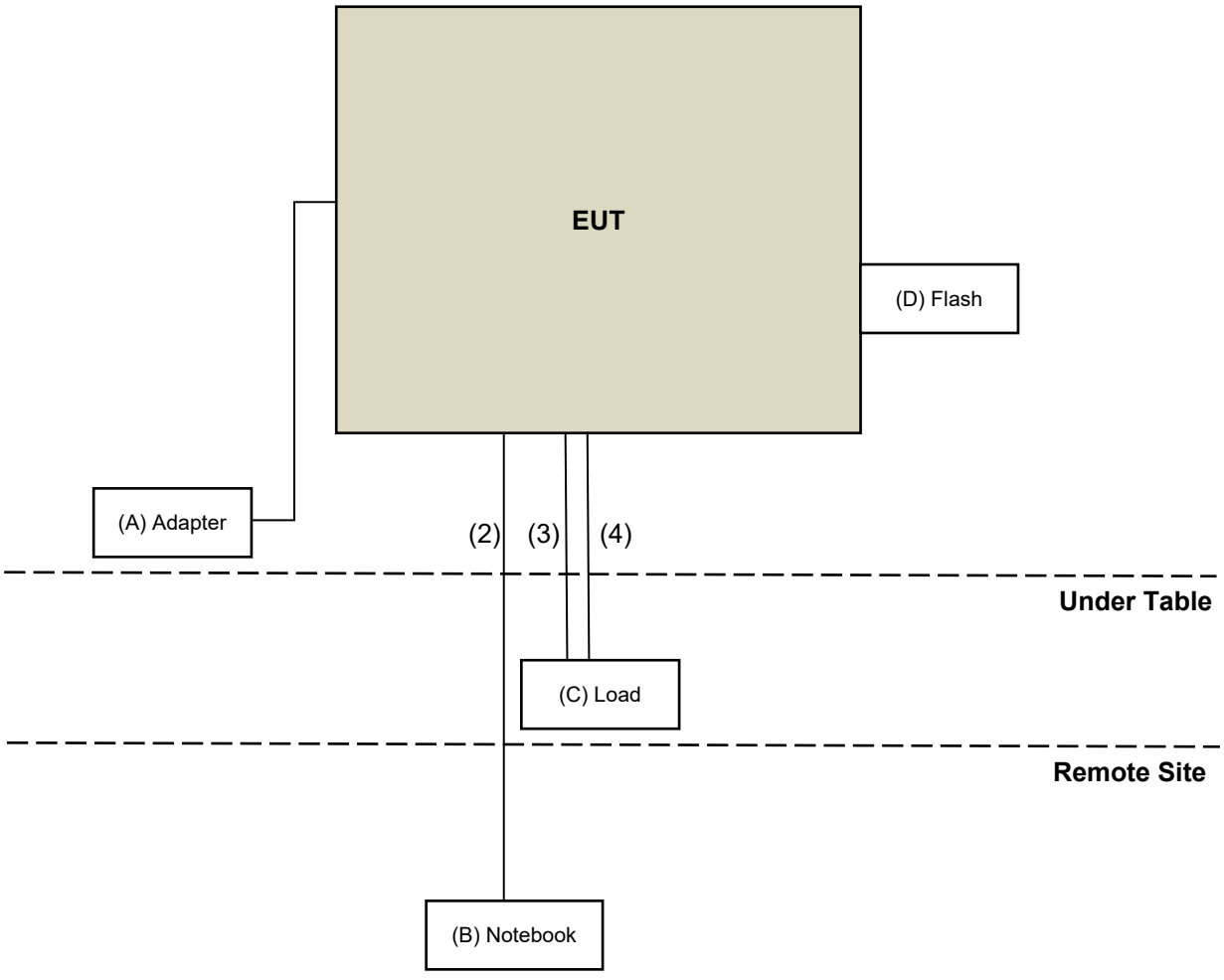
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Adapter	Asian Power Devices Inc.	WA-48A12R	NA	NA	Provided by client
B.	Notebook	Lenovo	20J4 MD A003TW	PF-11H9AK	FCC DoC Approved	-
C.	Load	NA	NA	NA	NA	-
D.	USB Flash	SanDisk	NA	NA	NA	-
E.	PoE	Microsemi	PD-9501-10GC/AC	NA	NA	Provided by client

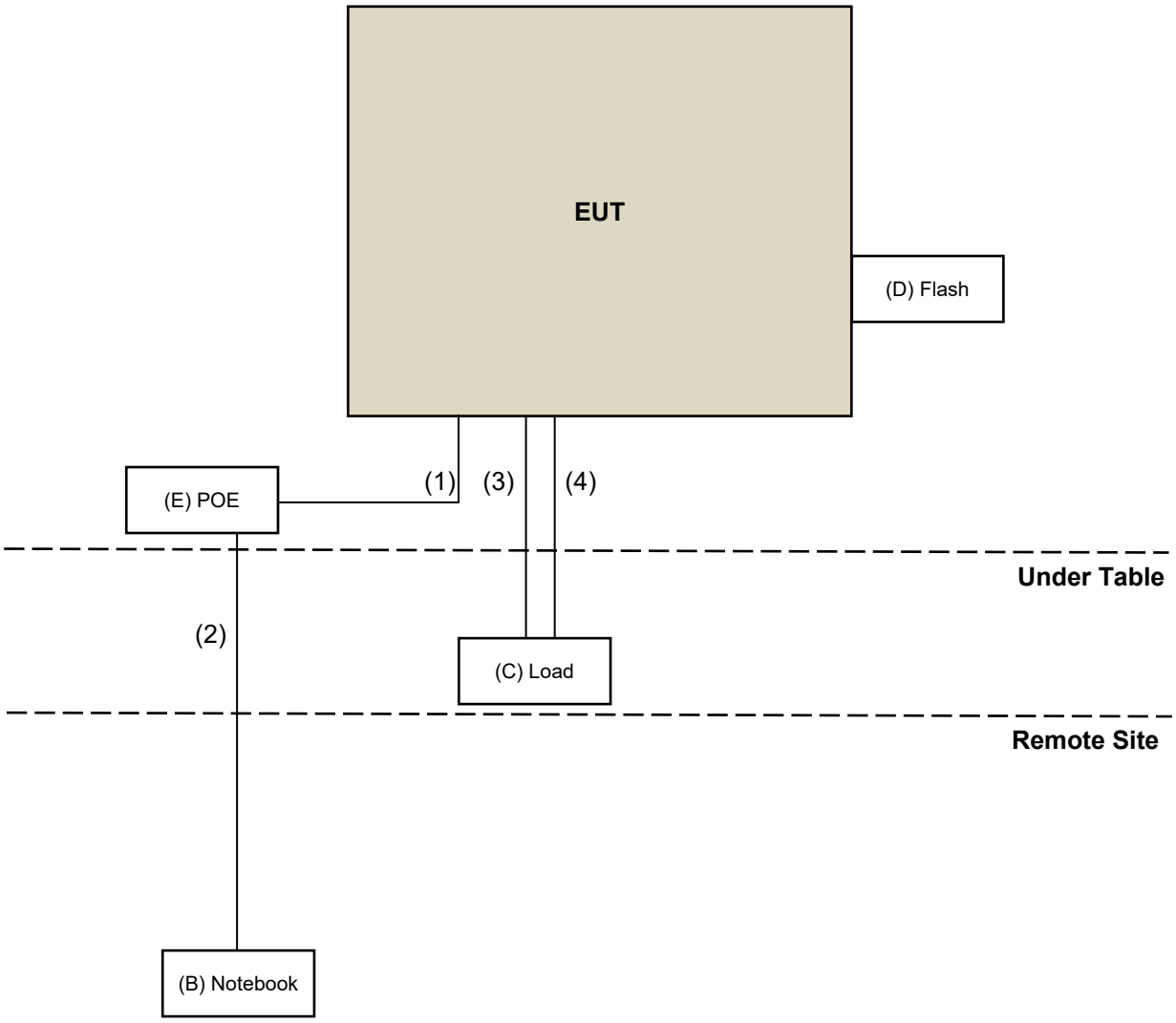
ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	LAN cable	1	1.5	N	0	RJ45, Cat5e
2.	LAN cable	1	10	N	0	RJ45, Cat5e
3.	LAN cable	1	1.5	N	0	RJ45, Cat5e
4.	LAN cable	1	1.5	N	0	RJ45, Cat5e

3.4.1 Configuration of System under Test

Mode A, C



Mode B, D



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 and references:

Test standard:
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.	Calibrated Date	Calibrated Until
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	N/A	N/A	N/A
Antenna Tower KaiTuo	N/A	N/A	N/A	N/A
Antenna Tower Controller KaiTuo	KT-2000	N/A	N/A	N/A
Turn Table Max-Full	MFT-151SS-0.5T	N/A	N/A	N/A
Turn Table Controller Max-Full	MF-7802BS	MF780208675	N/A	N/A
Test Receiver R&S	ESR3	102579	2022/7/1	2023/6/30
MXA Signal Analyzer KEYSIGHT	N9020B	MY60110462	2021/12/21	2022/12/20
Pre-amplifier EMCI	EMC001340	980269	2022/6/28	2023/6/27
RF Coaxial Cable EMCI	5D-NM-BM	140903+140902	2022/1/15	2023/1/14
Pre_Amplifier EMCI	EMC330N	980783	2022/1/17	2023/1/16
Bi-log Broadband Antenna Schwarzbeck	VULB9168	9168-995	2021/10/28 2022/10/20	2022/10/27 2023/10/19
RF Coaxial Cable EMCI	EMCCFD400-NM-NM-9000	201252	2022/1/17	2023/1/16
RF Coaxial Cable EMCI	EMCCFD400-NM-NM-3000	201250	2022/1/17	2023/1/16
RF Coaxial Cable EMCI	EMCCFD400-NM-NM-500	201245	2022/1/17	2023/1/16
Horn Antenna RFSPIN	DRH18-E	210104A18E	2021/11/14	2022/11/13
Pre_Amplifier EMCI	EMC118A45SE	980810	2021/12/30	2022/12/29
RF Coaxial Cable EMCI	EMC104-SM-SM-9000	201230	2022/1/17	2023/1/16
RF Coaxial Cable EMCI	EMC104-SM-SM-3000	201242	2022/1/17	2023/1/16
RF Coaxial Cable EMCI	EMC104-SM-SM-1000	210101	2022/1/17	2023/1/16
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY55190004/ MY55190007/MY55210005	2022/7/13	2023/7/10
Boresight Antenna Fixture	FBA-01	FBA-SIP01	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 WM Chamber 7.

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower Max-Full	MFT-151SS-0.5T	NA	NA	NA
Turn Table Max-Full	MF-7802BS	NA	NA	NA
Turn Table Controller Max-Full	MF-7802BS	MF780208674	NA	NA
Test Receiver R&S	ESR3+	102782	2021/12/10	2022/12/9
Spectrum Analyzer R&S	FSW43	101866	2022/1/14	2023/1/13
Pre-amplifier EMCI	EMC001340	980269	2022/6/28	2023/6/27
RF Coaxial Cable EMCI	5D-NM-BM	140903+140902	2022/1/15	2023/1/14
Pre_Amplifier EMCI	EMC330N	980782	2022/1/17	2023/1/16
Bi-log Broadband Antenna Schwarzbeck	VULB9168	9168-1213	2021/10/27	2022/10/26
			2022/10/20	2023/10/19
RF Coaxial Cable EMCI	EMCCFD400-NM-NM-500	201233	2022/1/17	2023/1/16
RF Coaxial Cable EMCI	EMCCFD400-NM-NM-3000	201235	2022/1/17	2023/1/16
RF Coaxial Cable EMCI	EMCCFD400-NM-NM-9000	201236	2022/1/17	2023/1/16
Horn Antenna RFSPIN	DRH18-E	210103A18E	2021/11/14	2022/11/13
Pre_Amplifier EMCI	EMC118A45SE	980808	2021/12/30	2022/12/29
RF Coaxial Cable EMCI	EMC104-SM-SM-1000	210102	2022/1/17	2023/1/16
RF Coaxial Cable EMCI	EMC104-SM-SM-3000	201231	2022/1/17	2023/1/16
RF Coaxial Cable EMCI	EMC104-SM-SM-9000	201243	2022/1/17	2023/1/16
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY55190004/ MY55190007/MY55210005	2022/7/13	2023/7/10
Boresight Antenna Fixture	FBA-01	FBA-SIP01	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 WM Chamber 8.

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:

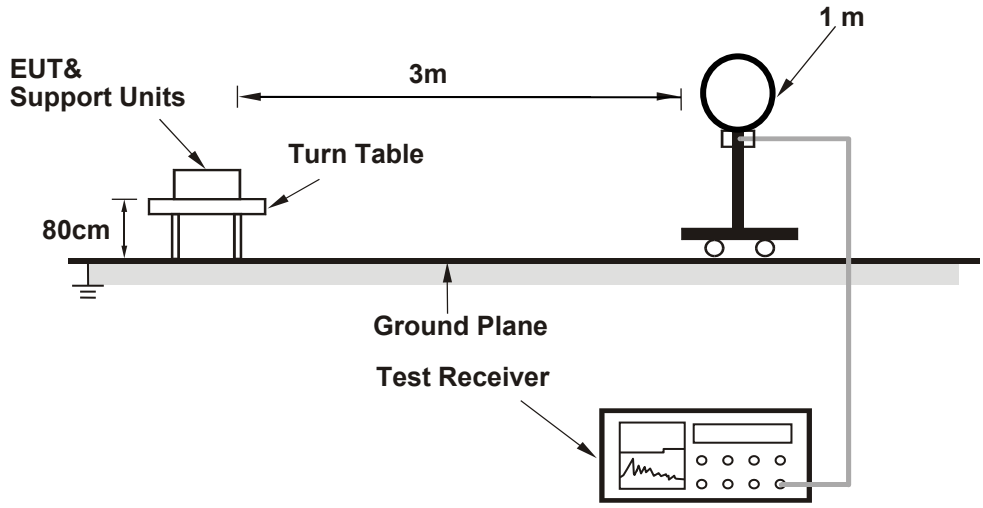
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz. (RBW = 1MHz, VBW = 1kHz)
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

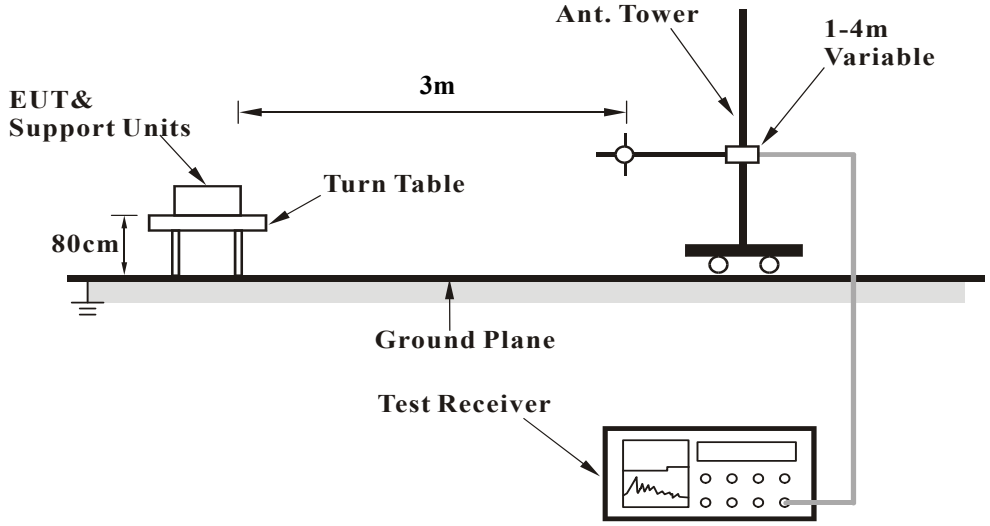
No deviation.

4.1.5 Test Setup

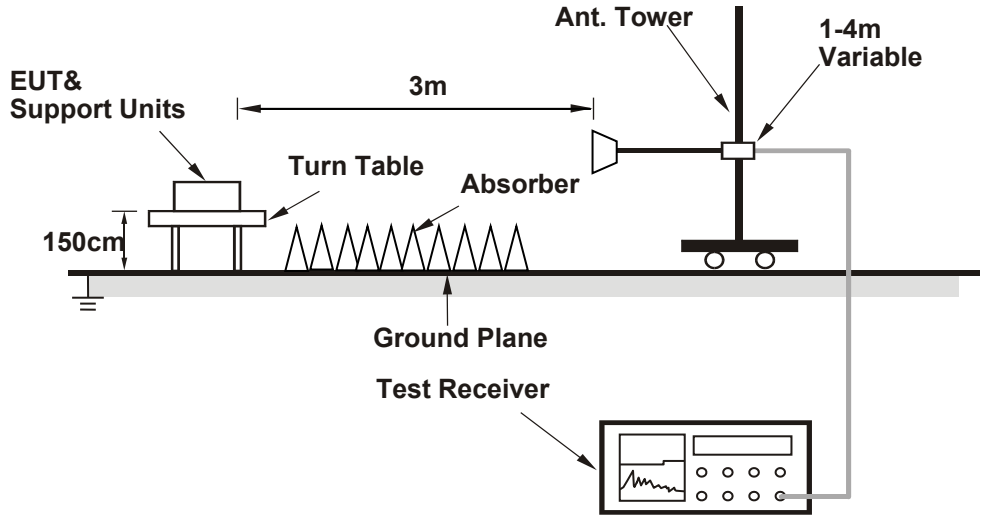
For Radiated emission below 30MHz



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. Placed the EUT on the testing table.

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

4.1.7 Test Results

Above 1 GHz Data:

RF Mode	TX Zigbee	Channel	CH 11：2405 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)
Test Mode	A		

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	2366.40	59.50 PK	74.00	-14.50	1.05 H	303	28.50	31.00
2	2366.40	51.40 AV	54.00	-2.60	1.05 H	303	20.40	31.00
3	*2405.00	115.10 PK			1.05 H	303	84.20	30.90
4	*2405.00	112.10 AV			1.05 H	303	81.20	30.90
5	4810.00	49.30 PK	74.00	-24.70	2.02 H	297	65.00	-15.70
6	4810.00	42.30 AV	54.00	-11.70	2.02 H	297	58.00	-15.70
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	2366.40	58.30 PK	74.00	-15.70	2.21 V	336	27.30	31.00
2	2366.40	49.80 AV	54.00	-4.20	2.21 V	336	18.80	31.00
3	*2405.00	112.60 PK			2.21 V	336	81.70	30.90
4	*2405.00	109.50 AV			2.21 V	336	78.60	30.90
5	4810.00	50.20 PK	74.00	-23.80	1.71 V	360	65.90	-15.70
6	4810.00	44.40 AV	54.00	-9.60	1.71 V	360	60.10	-15.70

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

RF Mode	TX Zigbee	Channel	CH 18：2440 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)
Test Mode	A		

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	*2440.00	114.50 PK			1.00 H	299	83.60	30.90
2	*2440.00	111.50 AV			1.00 H	299	80.60	30.90
3	4880.00	48.50 PK	74.00	-25.50	1.83 H	304	64.40	-15.90
4	4880.00	40.90 AV	54.00	-13.10	1.83 H	304	56.80	-15.90
5	7320.00	52.00 PK	74.00	-22.00	2.99 H	69	61.60	-9.60
6	7320.00	44.70 AV	54.00	-9.30	2.99 H	69	54.30	-9.60
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	*2440.00	113.70 PK			2.39 V	338	82.80	30.90
2	*2440.00	110.50 AV			2.39 V	338	79.60	30.90
3	4880.00	50.40 PK	74.00	-23.60	1.65 V	0	66.30	-15.90
4	4880.00	44.80 AV	54.00	-9.20	1.65 V	0	60.70	-15.90
5	7320.00	49.70 PK	74.00	-24.30	1.28 V	0	59.30	-9.60
6	7320.00	41.50 AV	54.00	-12.50	1.28 V	0	51.10	-9.60

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

RF Mode	TX Zigbee	Channel	CH 26：2480 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)
Test Mode	A		

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	*2480.00	105.20 PK			1.76 H	47	74.40	30.80
2	*2480.00	102.20 AV			1.76 H	47	71.40	30.80
3	2483.50	63.60 PK	74.00	-10.40	1.76 H	47	32.80	30.80
4	**2483.50**	**53.60 AV**	**54.00**	**-0.40**	**1.76 H**	**47**	**22.80**	**30.80**
5	4960.00	46.70 PK	74.00	-27.30	1.99 H	55	62.60	-15.90
6	4960.00	38.60 AV	54.00	-15.40	1.99 H	55	54.50	-15.90
7	7440.00	46.60 PK	74.00	-27.40	2.48 H	20	56.10	-9.50
8	7440.00	36.20 AV	54.00	-17.80	2.48 H	20	45.70	-9.50
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	*2480.00	103.60 PK			2.81 V	344	72.80	30.80
2	*2480.00	100.90 AV			2.81 V	344	70.10	30.80
3	2483.50	63.40 PK	74.00	-10.60	2.81 V	344	32.60	30.80
4	2483.50	52.20 AV	54.00	-1.80	2.81 V	344	21.40	30.80
5	4960.00	49.50 PK	74.00	-24.50	1.70 V	4	65.40	-15.90
6	4960.00	43.10 AV	54.00	-10.90	1.70 V	4	59.00	-15.90
7	7440.00	46.20 PK	74.00	-27.80	1.73 V	336	55.70	-9.50
8	7440.00	36.00 AV	54.00	-18.00	1.73 V	336	45.50	-9.50

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

RF Mode	TX Zigbee	Channel	CH 11：2405 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)
Test Mode	C		

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	2366.40	59.10 PK	74.00	-14.90	1.22 H	333	27.08	32.02
2	2366.40	51.40 AV	54.00	-2.60	1.22 H	333	19.38	32.02
3	*2405.00	114.80 PK			1.22 H	333	82.77	32.03
4	*2405.00	111.20 AV			1.22 H	333	79.17	32.03
5	4810.00	49.20 PK	74.00	-24.80	2.21 H	282	46.05	3.15
6	4810.00	42.10 AV	54.00	-11.90	2.21 H	282	38.95	3.15
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	2366.40	58.10 PK	74.00	-15.90	2.20 V	314	26.00	32.10
2	2366.40	49.20 AV	54.00	-4.80	2.20 V	314	17.10	32.10
3	*2405.00	112.50 PK			2.20 V	314	80.50	32.00
4	*2405.00	109.40 AV			2.20 V	314	77.40	32.00
5	4810.00	50.10 PK	74.00	-23.90	1.88 V	331	46.90	3.20
6	4810.00	44.10 AV	54.00	-9.90	1.88 V	331	40.90	3.20

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

RF Mode	TX Zigbee	Channel	CH 18：2440 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)
Test Mode	C		

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	*2440.00	114.10 PK			1.22 H	214	82.10	32.00
2	*2440.00	111.20 AV			1.22 H	214	79.20	32.00
3	4880.00	48.30 PK	74.00	-25.70	1.66 H	333	45.10	3.20
4	4880.00	40.20 AV	54.00	-13.80	1.66 H	333	37.00	3.20
5	7320.00	52.30 PK	74.00	-21.70	2.26 H	36	43.60	8.70
6	7320.00	44.20 AV	54.00	-9.80	2.26 H	36	35.50	8.70
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	*2440.00	113.50 PK			2.23 V	314	81.50	32.00
2	*2440.00	110.10 AV			2.23 V	314	78.10	32.00
3	4880.00	50.20 PK	74.00	-23.80	1.66 V	12	47.00	3.20
4	4880.00	44.10 AV	54.00	-9.90	1.66 V	12	40.90	3.20
5	7320.00	49.10 PK	74.00	-24.90	1.11 V	19	40.40	8.70
6	7320.00	41.00 AV	54.00	-13.00	1.11 V	19	32.30	8.70

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

RF Mode	TX Zigbee	Channel	CH 26：2480 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)
Test Mode	C		

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	*2480.00	105.30 PK			1.77 H	55	73.30	32.00
2	*2480.00	102.40 AV			1.77 H	55	70.40	32.00
3	2483.50	63.20 PK	74.00	-10.80	1.77 H	55	31.20	32.00
4	2483.50	53.40 AV	54.00	-0.60	1.77 H	55	21.40	32.00
5	4960.00	46.20 PK	74.00	-27.80	1.88 H	66	43.00	3.20
6	4960.00	38.40 AV	54.00	-15.60	1.88 H	66	35.20	3.20
7	7440.00	46.20 PK	74.00	-27.80	2.44 H	21	37.50	8.70
8	7440.00	36.10 AV	54.00	-17.90	2.44 H	21	27.40	8.70
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	*2480.00	103.50 PK			2.77 V	311	71.50	32.00
2	*2480.00	100.50 AV			2.77 V	311	68.50	32.00
3	2483.50	63.50 PK	74.00	-10.50	2.77 V	311	31.50	32.00
4	2483.50	52.10 AV	54.00	-1.90	2.77 V	311	20.10	32.00
5	4960.00	49.30 PK	74.00	-24.70	1.88 V	2	46.10	3.20
6	4960.00	43.10 AV	54.00	-10.90	1.88 V	2	39.90	3.20
7	7440.00	55.20 PK	74.00	-18.80	1.77 V	331	46.50	8.70
8	7440.00	45.10 AV	54.00	-8.90	1.77 V	331	36.40	8.70

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

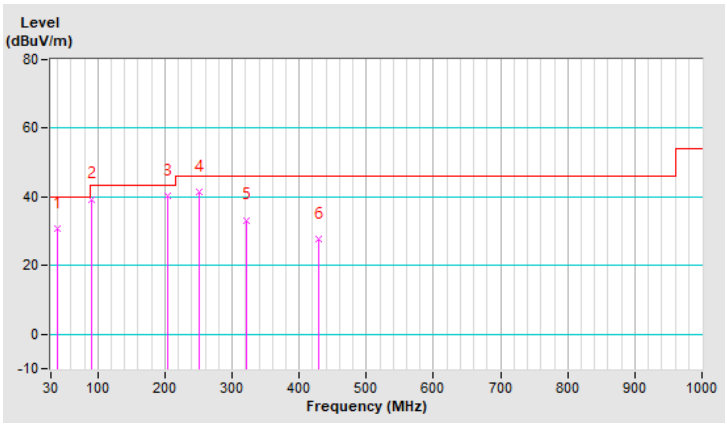
Below 1GHz worst-case data:

RF Mode	TX Zigbee	Channel	CH 11：2405 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)
Test Mode	A		

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	40.67	30.90 QP	40.00	-9.10	1.99 H	215	44.40	-13.50
2	91.11	39.40 QP	43.50	-4.10	1.99 H	252	58.50	-19.10
3	204.60	40.50 QP	43.50	-3.00	1.99 H	18	57.40	-16.90
4	250.19	41.60 QP	46.00	-4.40	1.49 H	12	56.30	-14.70
5	321.97	33.30 QP	46.00	-12.70	1.01 H	211	45.60	-12.30
6	428.67	27.60 QP	46.00	-18.40	1.99 H	216	37.30	-9.70

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 of frequency range 30MHz ~ 1000MHz.
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.

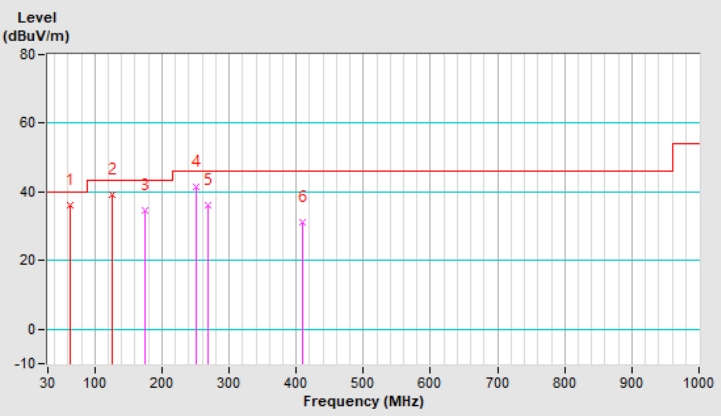


RF Mode	TX Zigbee	Channel	CH 11：2405 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)
Test Mode	A		

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	62.49	36.20 QP	40.00	-3.80	1.01 V	267	50.60	-14.40
2	125.00	39.30 QP	43.50	-4.20	1.01 V	161	54.20	-14.90
3	175.50	34.80 QP	43.50	-8.70	1.01 V	57	49.10	-14.30
4	250.19	41.30 QP	46.00	-4.70	1.99 V	330	56.00	-14.70
5	268.62	36.30 QP	46.00	-9.70	1.01 V	48	50.30	-14.00
6	410.24	31.30 QP	46.00	-14.70	1.01 V	156	41.50	-10.20

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 of frequency range 30MHz ~ 1000MHz.
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.

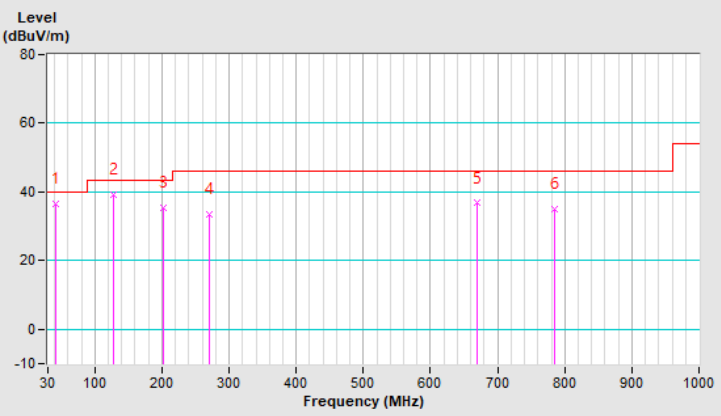


RF Mode	TX Zigbee	Channel	CH 11：2405 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)
Test Mode	B		

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	41.25	36.50 QP	40.00	-3.50	1.50 H	202	49.90	-13.40
2	127.00	39.30 QP	43.50	-4.20	1.50 H	7	54.10	-14.80
3	201.51	35.50 QP	43.50	-8.00	1.01 H	264	52.20	-16.70
4	270.39	33.60 QP	46.00	-12.40	1.01 H	2	47.10	-13.50
5	669.64	36.70 QP	46.00	-9.30	1.01 H	184	41.30	-4.60
6	784.91	34.90 QP	46.00	-11.10	1.01 H	91	37.40	-2.50

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 of frequency range 30MHz ~ 1000MHz.
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.

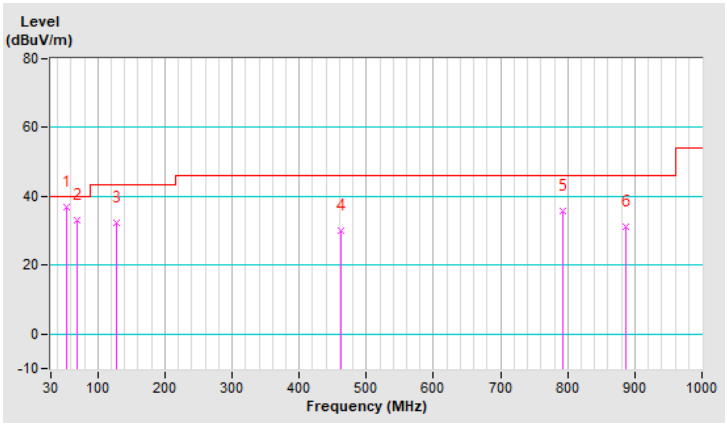


RF Mode	TX Zigbee	Channel	CH 11：2405 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)
Test Mode	B		

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	52.49	36.80 QP	40.00	-3.20	1.00 V	337	50.00	-13.20
2	69.36	33.20 QP	40.00	-6.80	1.49 V	268	48.70	-15.50
3	127.00	32.30 QP	43.50	-11.20	2.00 V	216	47.10	-14.80
4	461.58	30.20 QP	46.00	-15.80	1.00 V	316	38.60	-8.40
5	793.35	35.90 QP	46.00	-10.10	1.49 V	2	38.40	-2.50
6	887.54	31.30 QP	46.00	-14.70	1.00 V	193	32.50	-1.20

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 of frequency range 30MHz ~ 1000MHz.
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.

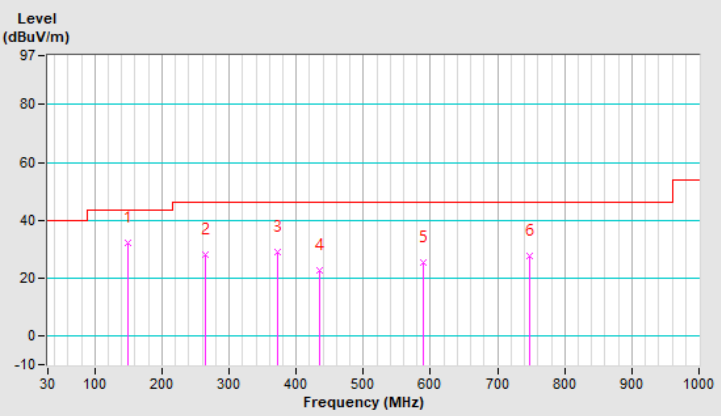


RF Mode	TX Zigbee	Channel	CH 11：2405 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)
Test Mode	C		

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	148.34	32.10 QP	43.50	-11.40	1.00 H	103	45.30	-13.20
2	264.74	28.00 QP	46.00	-18.00	1.00 H	80	41.70	-13.70
3	371.44	29.10 QP	46.00	-16.90	1.49 H	204	39.70	-10.60
4	434.49	22.50 QP	46.00	-23.50	1.49 H	185	31.50	-9.00
5	589.69	25.40 QP	46.00	-20.60	1.00 H	21	31.00	-5.60
6	746.83	27.60 QP	46.00	-18.40	1.00 H	360	30.70	-3.10

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 of frequency range 30MHz ~ 1000MHz.
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.

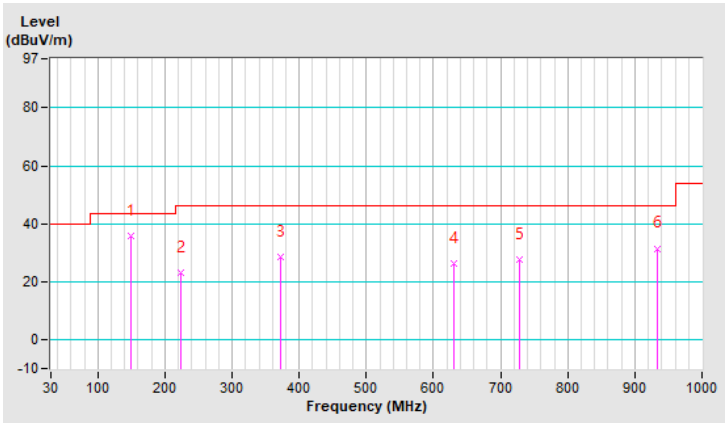


RF Mode	TX Zigbee	Channel	CH 11：2405 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)
Test Mode	C		

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	148.34	35.90 QP	43.50	-7.60	1.01 V	254	49.10	-13.20
2	223.03	23.20 QP	46.00	-22.80	1.50 V	280	39.60	-16.40
3	371.44	28.60 QP	46.00	-17.40	1.01 V	303	39.20	-10.60
4	629.46	26.20 QP	46.00	-19.80	1.01 V	245	31.20	-5.00
5	728.40	27.50 QP	46.00	-18.50	1.01 V	41	31.10	-3.60
6	933.07	31.50 QP	46.00	-14.50	1.01 V	320	32.10	-0.60

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 of frequency range 30MHz ~ 1000MHz.
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.

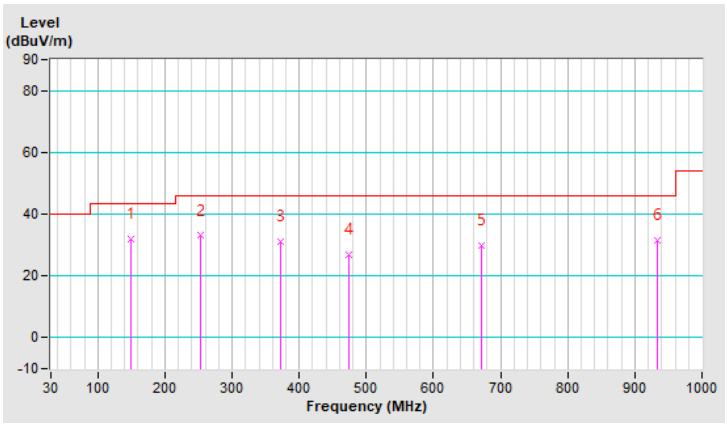


RF Mode	TX Zigbee	Channel	CH 11：2405 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)
Test Mode	D		

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	148.34	31.90 QP	43.50	-11.60	1.99 H	257	45.10	-13.20
2	253.10	33.00 QP	46.00	-13.00	1.00 H	282	47.10	-14.10
3	371.44	31.10 QP	46.00	-14.90	1.00 H	166	41.70	-10.60
4	473.29	26.80 QP	46.00	-19.20	1.99 H	18	34.90	-8.10
5	672.14	29.90 QP	46.00	-16.10	1.99 H	225	34.40	-4.50
6	934.04	31.60 QP	46.00	-14.40	1.00 H	150	32.20	-0.60

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 of frequency range 30MHz ~ 1000MHz.
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.

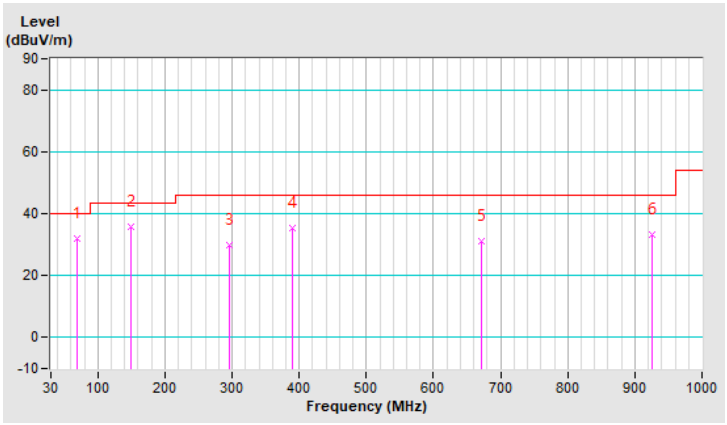


RF Mode	TX Zigbee	Channel	CH 11：2405 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)
Test Mode	D		

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	68.80	32.00 QP	40.00	-8.00	1.00 V	192	47.20	-15.20
2	148.34	35.70 QP	43.50	-7.80	1.00 V	154	48.90	-13.20
3	296.75	30.00 QP	46.00	-16.00	1.00 V	147	42.50	-12.50
4	388.90	35.50 QP	46.00	-10.50	1.00 V	22	45.70	-10.20
5	672.14	31.10 QP	46.00	-14.90	1.49 V	178	35.60	-4.50
6	925.31	33.30 QP	46.00	-12.70	1.49 V	178	34.10	-0.80

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 of frequency range 30MHz ~ 1000MHz.
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
DC-LISN SCHWARZBECK MESS-ELETRONIK	NNBM 8126G	8126G-069	2021/11/10	2022/11/9
LISN R&S	ESH3-Z5	100220	2021/11/25	2022/11/24
		100311	2022/9/12	2023/9/11
LISN ROHDE & SCHWARZ	ENV216	101826	2022/3/14	2023/3/13
RF Coaxial Cable WOKEN	5D-FB	Cable-cond1-01	2022/1/15	2023/1/14
Software BVADT	BVADT_Cond_ V7.3.7.4	N/A	N/A	N/A
Test Receiver ROHDE & SCHWARZ	ESCI	100613	2021/12/3	2022/12/2

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.

4.2.3 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/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

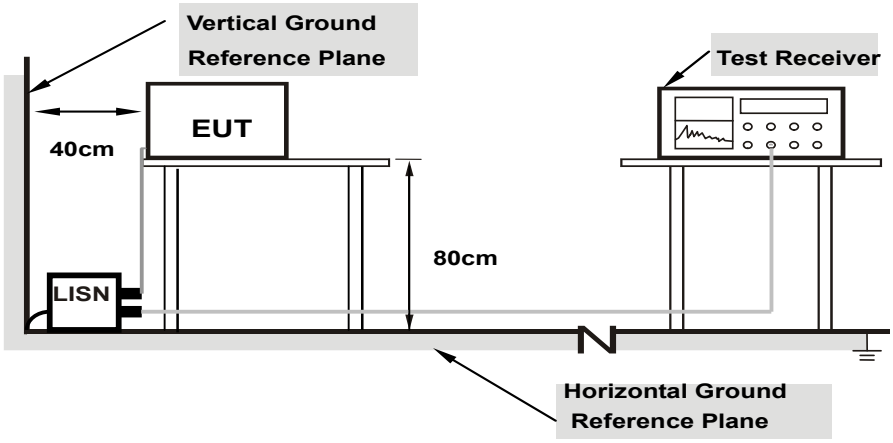
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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

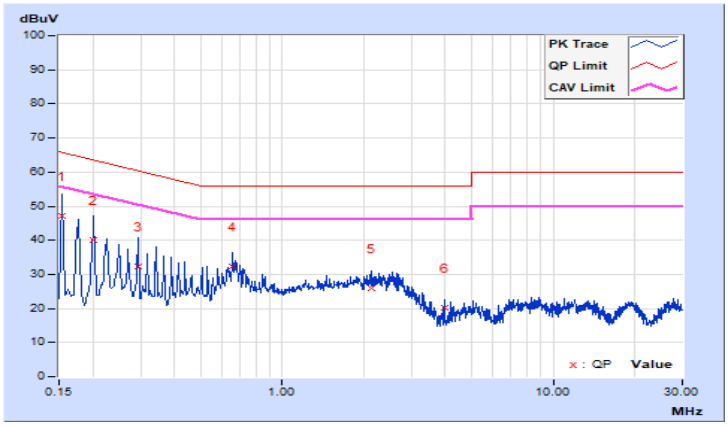
Worst-case data:

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	A		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15400	9.68	37.54	20.15	47.22	29.83	65.78	55.78	-18.56	-25.95
2	0.20200	9.72	30.38	13.16	40.10	22.88	63.53	53.53	-23.43	-30.65
3	0.29400	9.76	22.59	10.33	32.35	20.09	60.41	50.41	-28.06	-30.32
4	0.65800	9.82	22.60	16.67	32.42	26.49	56.00	46.00	-23.58	-19.51
5	2.12200	9.90	16.17	12.49	26.07	22.39	56.00	46.00	-29.93	-23.61
6	3.96200	9.95	10.11	0.82	20.06	10.77	56.00	46.00	-35.94	-35.23

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.

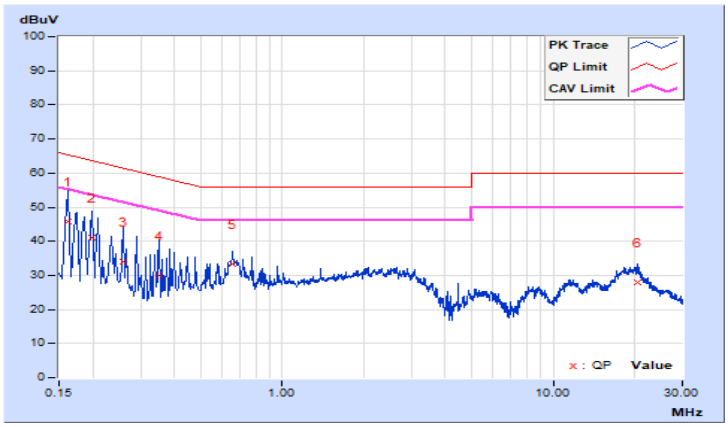


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	A		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16200	9.69	36.01	19.16	45.70	28.85	65.36	55.36	-19.66	-26.51
2	0.19800	9.72	31.51	16.08	41.23	25.80	63.69	53.69	-22.46	-27.89
3	0.25800	9.75	24.21	11.48	33.96	21.23	61.50	51.50	-27.54	-30.27
4	0.35000	9.79	20.31	8.39	30.10	18.18	58.96	48.96	-28.86	-30.78
5	0.65800	9.83	23.45	18.14	33.28	27.97	56.00	46.00	-22.72	-18.03
6	20.36600	10.20	17.64	14.10	27.84	24.30	60.00	50.00	-32.16	-25.70

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.

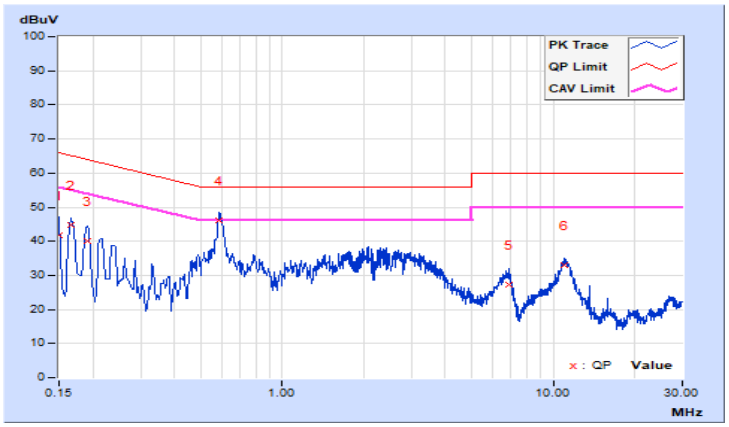


Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	B		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.62	32.26	19.23	41.88	28.85	66.00	56.00	-24.12	-27.15
2	0.16600	9.63	35.22	20.05	44.85	29.68	65.16	55.16	-20.31	-25.48
3	0.19000	9.64	30.43	14.50	40.07	24.14	64.04	54.04	-23.97	-29.90
4	0.58565	9.69	36.48	29.83	46.17	39.52	56.00	46.00	-9.83	-6.48
5	6.86200	9.78	17.61	13.19	27.39	22.97	60.00	50.00	-32.61	-27.03
6	11.03000	9.82	23.10	16.56	32.92	26.38	60.00	50.00	-27.08	-23.62

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.

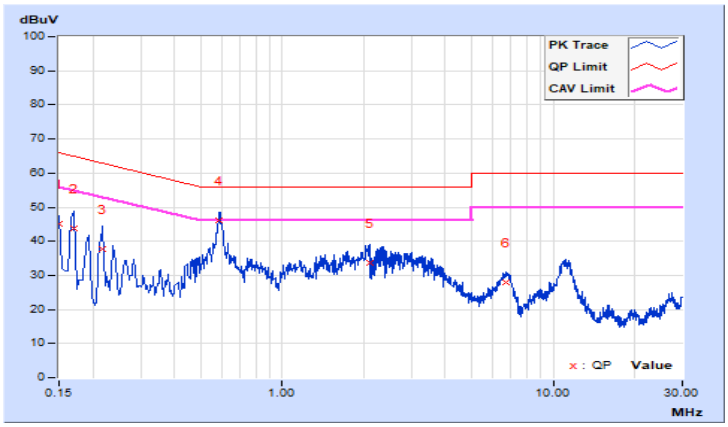


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	B		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.62	35.55	19.46	45.17	29.08	66.00	56.00	-20.83	-26.92
2	0.17000	9.63	34.17	18.64	43.80	28.27	64.96	54.96	-21.16	-26.69
3	0.21800	9.64	28.22	15.29	37.86	24.93	62.89	52.89	-25.03	-27.96
4	0.58565	9.69	36.55	29.90	46.24	39.59	56.00	46.00	-9.76	-6.41
5	2.09800	9.73	23.98	16.28	33.71	26.01	56.00	46.00	-22.29	-19.99
6	6.73800	9.78	18.20	13.84	27.98	23.62	60.00	50.00	-32.02	-26.38

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.

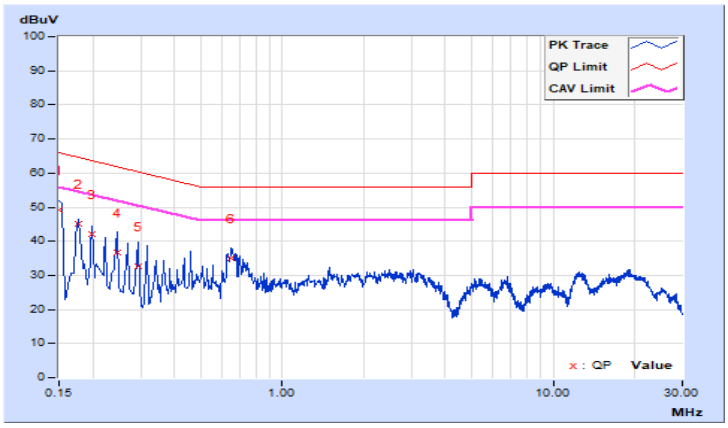


Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	C		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.68	39.34	24.74	49.02	34.42	66.00	56.00	-16.98	-21.58
2	0.17800	9.70	35.34	20.62	45.04	30.32	64.58	54.58	-19.54	-24.26
3	0.19800	9.72	32.35	18.24	42.07	27.96	63.69	53.69	-21.62	-25.73
4	0.24600	9.74	27.04	15.47	36.78	25.21	61.89	51.89	-25.11	-26.68
5	0.29400	9.76	23.03	10.52	32.79	20.28	60.41	50.41	-27.62	-30.13
6	0.64600	9.82	25.18	19.94	35.00	29.76	56.00	46.00	-21.00	-16.24

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.

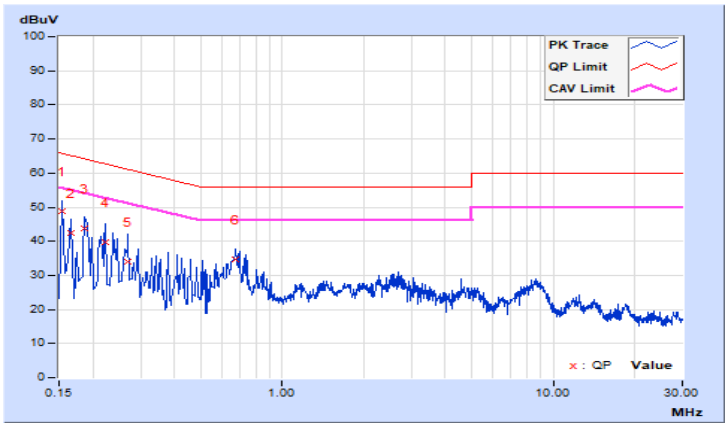


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	C		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15400	9.68	39.20	22.58	48.88	32.26	65.78	55.78	-16.90	-23.52
2	0.16600	9.69	32.84	17.63	42.53	27.32	65.16	55.16	-22.63	-27.84
3	0.18600	9.71	34.20	16.55	43.91	26.26	64.21	54.21	-20.30	-27.95
4	0.22200	9.73	29.87	14.43	39.60	24.16	62.74	52.74	-23.14	-28.58
5	0.26992	9.75	24.24	12.46	33.99	22.21	61.12	51.12	-27.13	-28.91
6	0.66987	9.83	24.69	18.56	34.52	28.39	56.00	46.00	-21.48	-17.61

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.

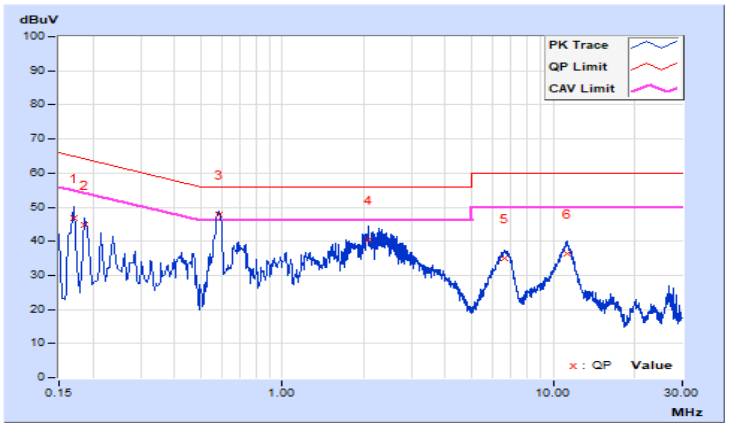


Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	D		

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.17000	9.70	37.26	22.49	46.96	32.19	64.96	54.96	-18.00	-22.77
2	0.18600	9.71	34.91	21.08	44.62	30.79	64.21	54.21	-19.59	-23.42
3	**0.58104**	**9.81**	**38.08**	**30.10**	**47.89**	**39.91**	**56.00**	**46.00**	**-8.11**	**-6.09**
4	2.09000	9.90	30.58	22.46	40.48	32.36	56.00	46.00	-15.52	-13.64
5	6.64600	10.00	25.13	22.15	35.13	32.15	60.00	50.00	-24.87	-17.85
6	11.34600	10.07	26.35	20.45	36.42	30.52	60.00	50.00	-23.58	-19.48

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.

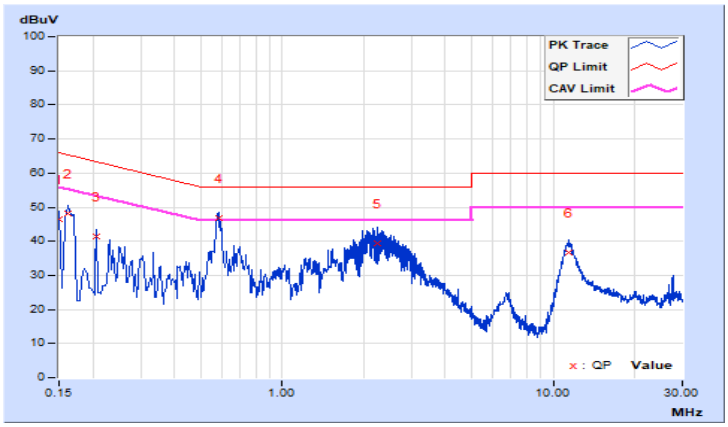


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	D		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.68	36.88	22.27	46.56	31.95	66.00	56.00	-19.44	-24.05
2	0.16200	9.69	38.48	22.43	48.17	32.12	65.36	55.36	-17.19	-23.24
3	0.20600	9.72	31.77	16.38	41.49	26.10	63.37	53.37	-21.88	-27.27
4	0.58200	9.83	37.13	29.12	46.96	38.95	56.00	46.00	-9.04	-7.05
5	2.24600	9.93	29.49	18.94	39.42	28.87	56.00	46.00	-16.58	-17.13
6	11.36600	10.08	26.62	20.30	36.70	30.38	60.00	50.00	-23.30	-19.62

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.

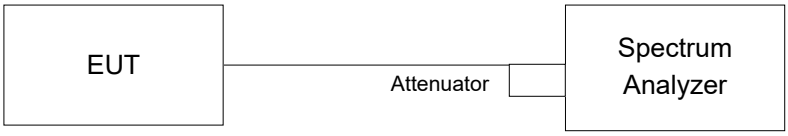


4.3 6dB Bandwidth Measurement

4.3.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

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

a. Set resolution bandwidth (RBW) = 100kHz.

b. Set the video bandwidth (VBW) ≥ 3 x RBW, Detector = peak.

c. Trace mode = max hold.

d. Sweep = auto couple.

e. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

4.3.5 Deviation fromTest Standard

No deviation.

4.3.6 EUT Operating Conditions

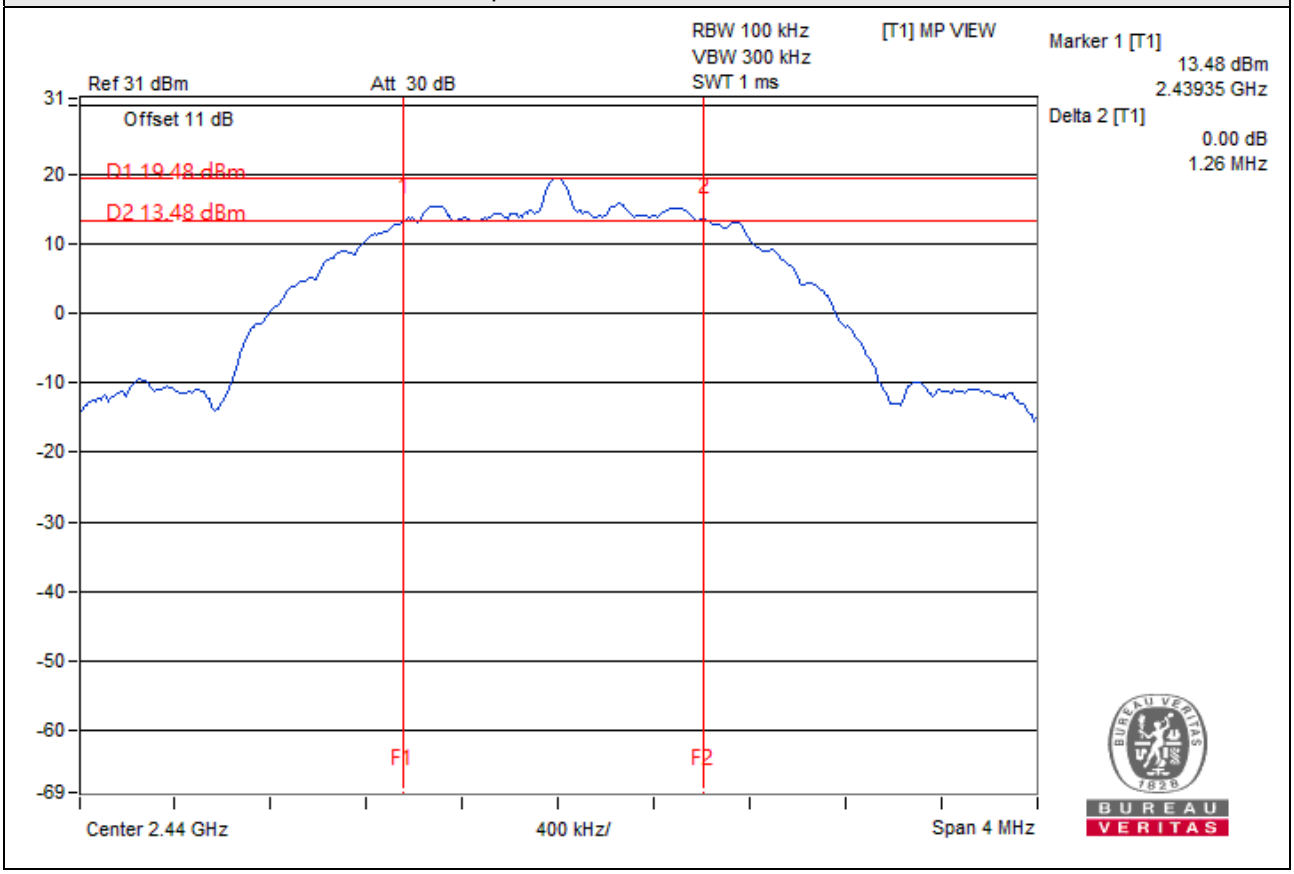
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.3.7 Test Result

Test Mode A

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
11	2405	1.28	0.5	Pass
18	2440	1.26	0.5	Pass
26	2480	1.28	0.5	Pass

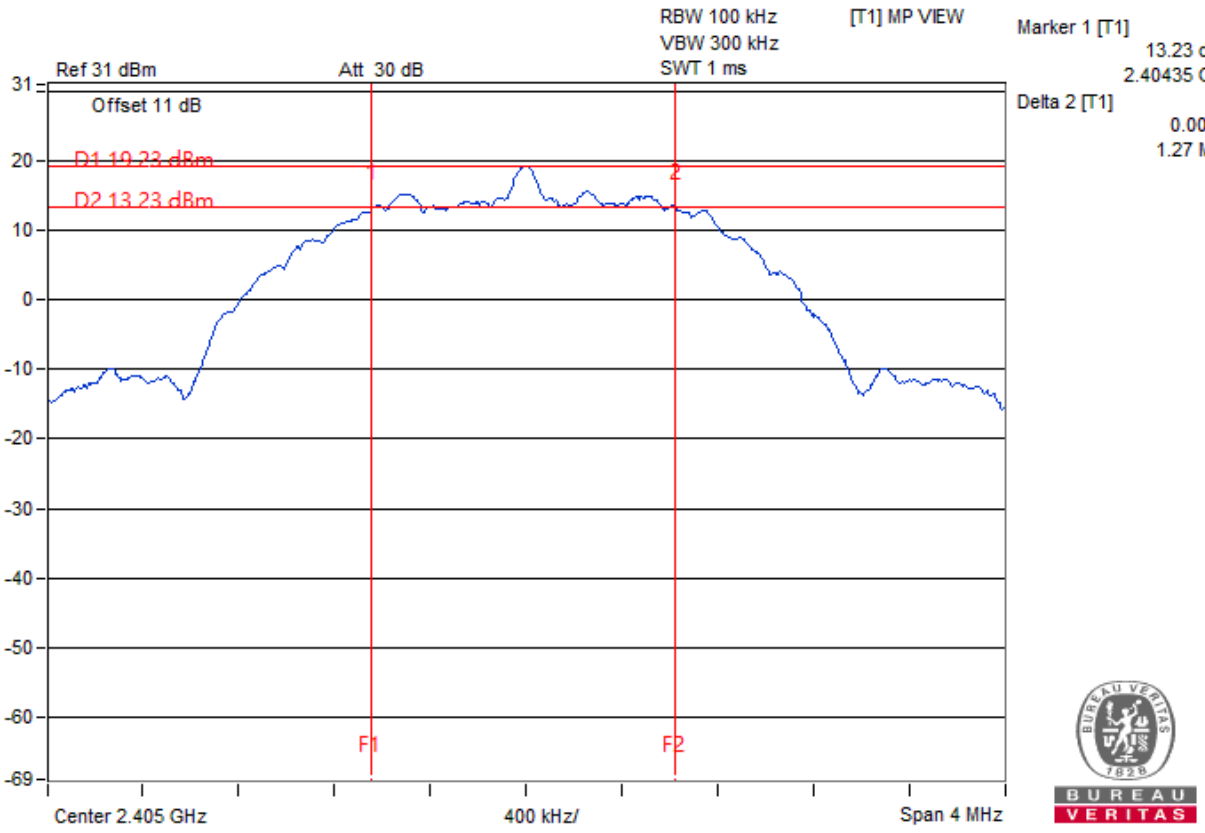
Spectrum Plot of Worst Value



Test Mode C

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
11	2405	1.27	0.5	Pass
18	2440	1.28	0.5	Pass
26	2480	1.28	0.5	Pass

Spectrum Plot of Worst Value



4.4 Conducted Output Power Measurement

4.4.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30dBm)

4.4.2 Test Setup

4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedures

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.

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Conditions

Same as item 4.3.6.

4.4.7 Test Results

Test Mode A

For Peak Power

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
11	2405	73.961	18.69	30.00	Pass
18	2440	72.111	18.58	30.00	Pass
26	2480	8.185	9.13	30.00	Pass

For Average Power

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
11	2405	73.621	18.67
18	2440	71.779	18.56
26	2480	8.091	9.08

Test Mode C

For Peak Power

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
11	2405	73.621	18.67	30.00	Pass
18	2440	71.779	18.56	30.00	Pass
26	2480	8.128	9.10	30.00	Pass

For Average Power

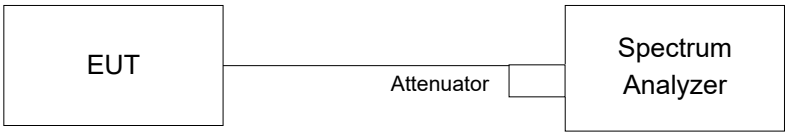
Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
11	2405	72.946	18.63
18	2440	71.121	18.52
26	2480	7.998	9.03

4.5 Power Spectral Density Measurement

4.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm per 3kHz.

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedure

a. Set analyzer center frequency to DTS channel center frequency.

b. Set the span to 1.5 times the DTS bandwidth.

c. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.

d. Set the VBW ≥ 3 × RBW.

e. Detector = peak.

f. Sweep time = auto couple.

g. Trace mode = max hold.

h. Allow trace to fully stabilize.

i. Use the peak marker function to determine the maximum amplitude level within the RBW.

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Condition

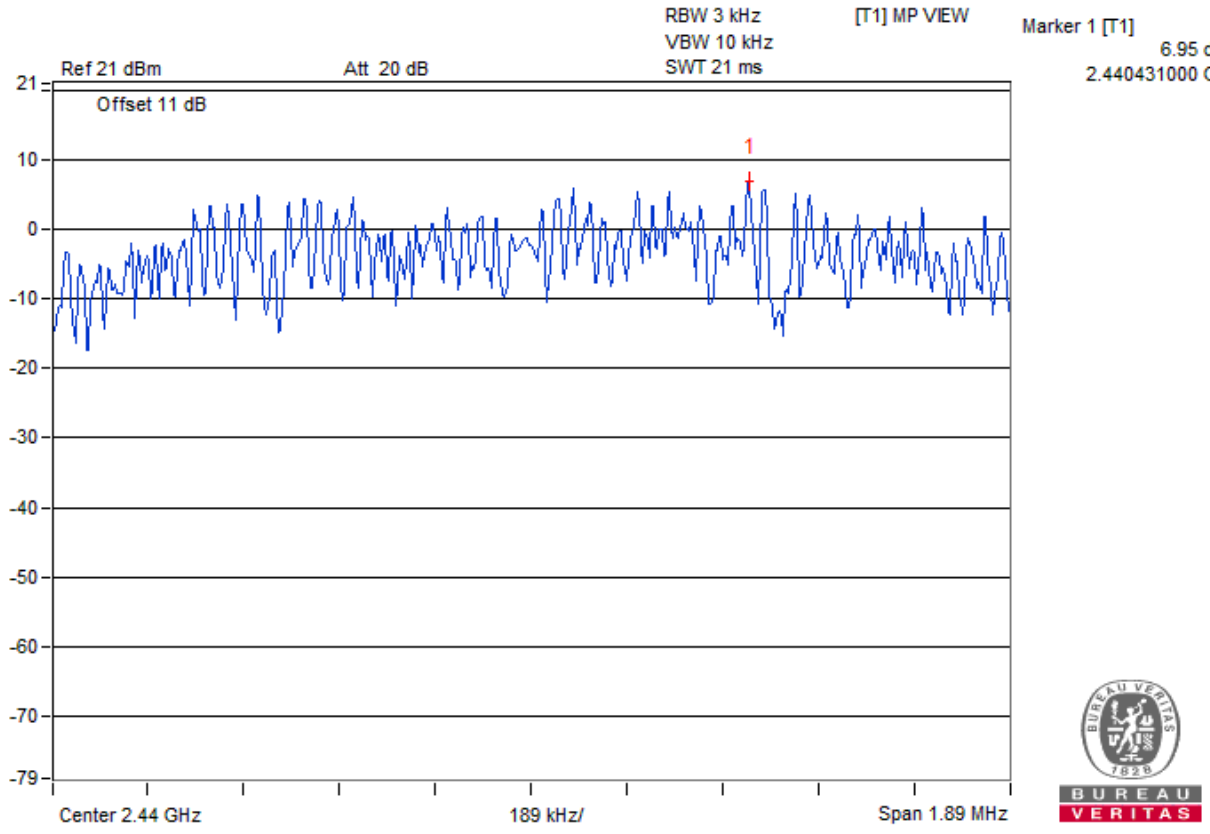
Same as item 4.3.6

4.5.7 Test Results

Test Mode A

Channel	Freq. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass / Fail
11	2405	6.91	8.00	Pass
18	2440	6.95	8.00	Pass
26	2480	-2.36	8.00	Pass

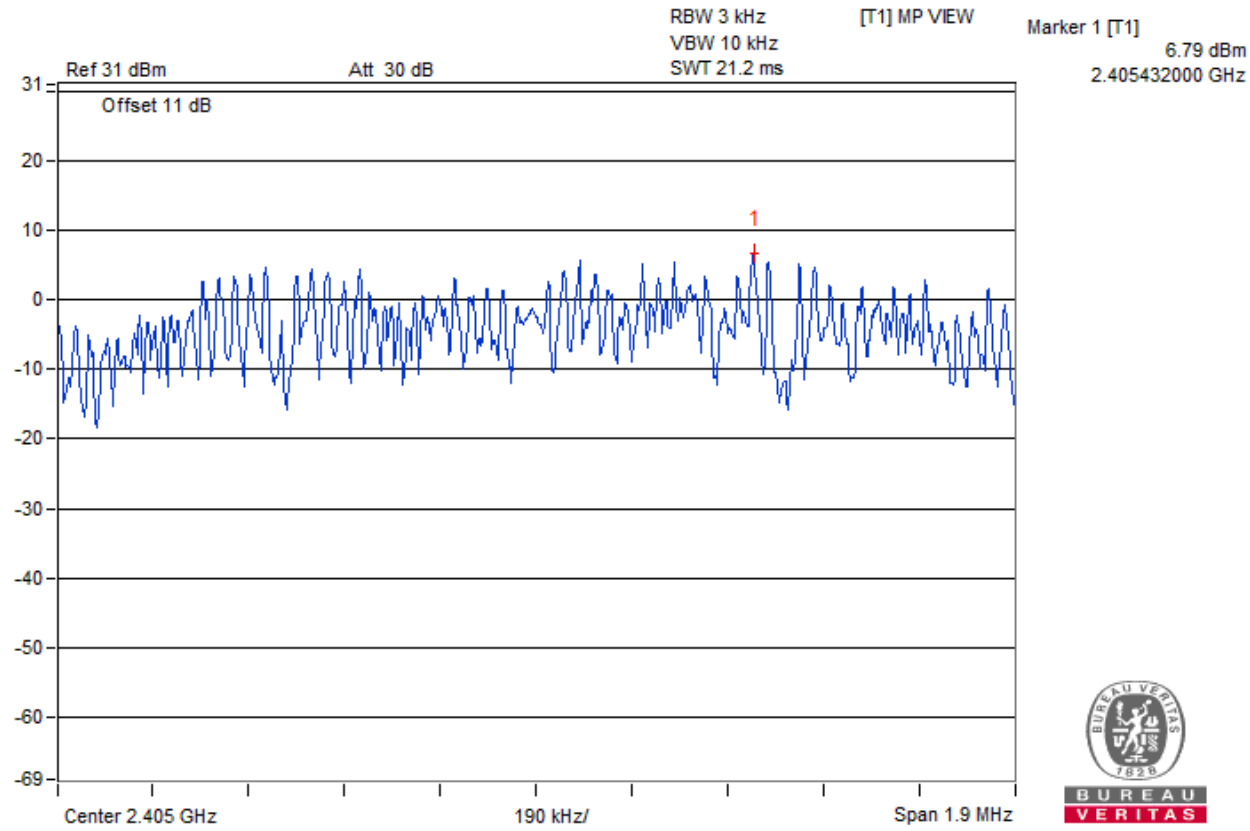
Spectrum Plot of Worst Value



Test Mode C

Channel	Freq. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass / Fail
11	2405	6.79	8.00	Pass
18	2440	6.68	8.00	Pass
26	2480	-2.72	8.00	Pass

Spectrum Plot of Worst Value

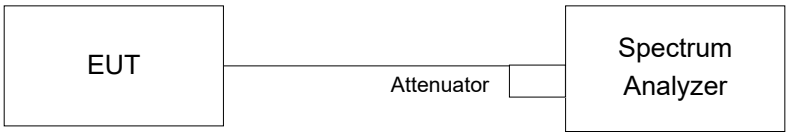


4.6 Conducted Out of Band Emission Measurement

4.6.1 Limits of Conducted Out of Band Emission Measurement

Below 20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

4.6.2 Test Setup



4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.6.4 Test Procedure

MEASUREMENT PROCEDURE REF

a. Set the RBW = 100 kHz.
b. Set the VBW ≥ 300 kHz.
c. Detector = peak.
d. Sweep time = auto couple.
e. Trace mode = max hold.
f. Allow trace to fully stabilize.
g. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOBE

a. Set RBW = 100 kHz.
b. Set VBW ≥ 300 kHz.
c. Detector = peak.
d. Sweep = auto couple.
e. Trace Mode = max hold.
f. Allow trace to fully stabilize.
g. Use the peak marker function to determine the maximum amplitude level.

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

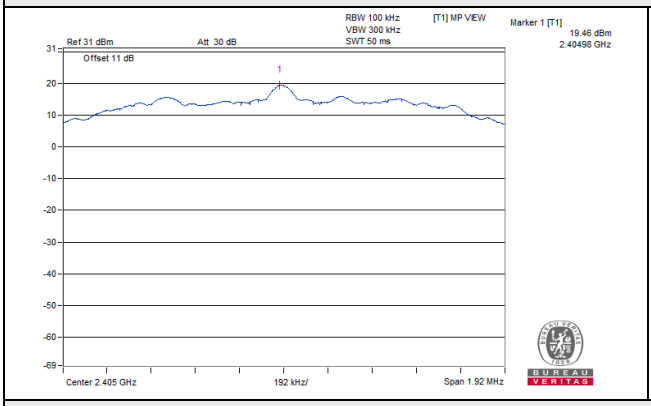
Same as item 4.3.6

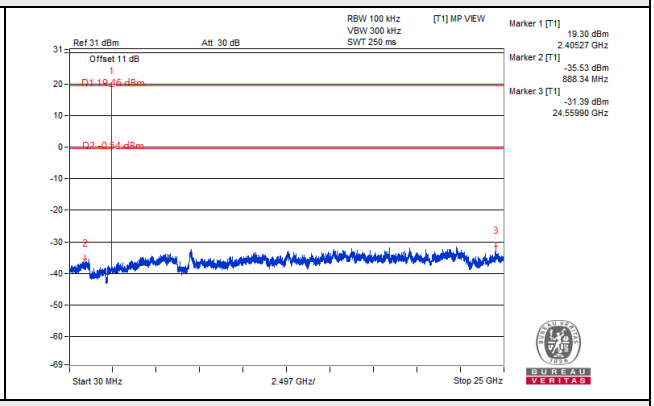
4.6.7 Test Results

The conducted emission test is performed on each TX port of operating mode without summing or adding 10log (N) since the limit is relative emission limit.
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

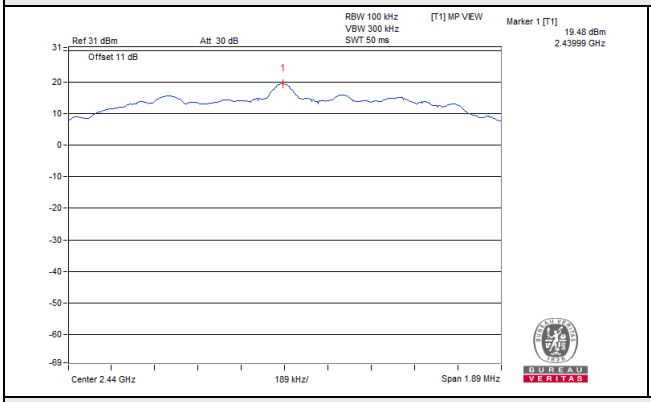
Test Mode A

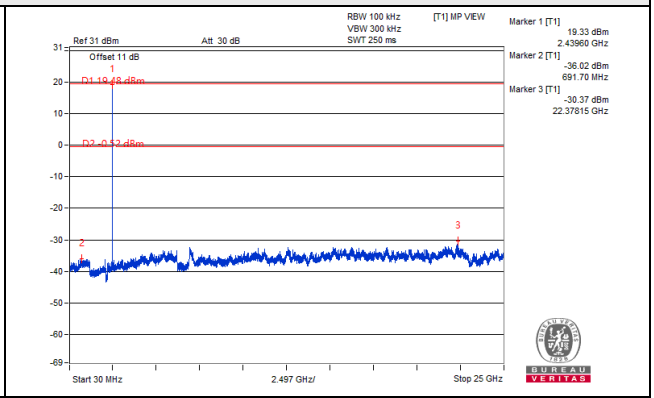
CH 11



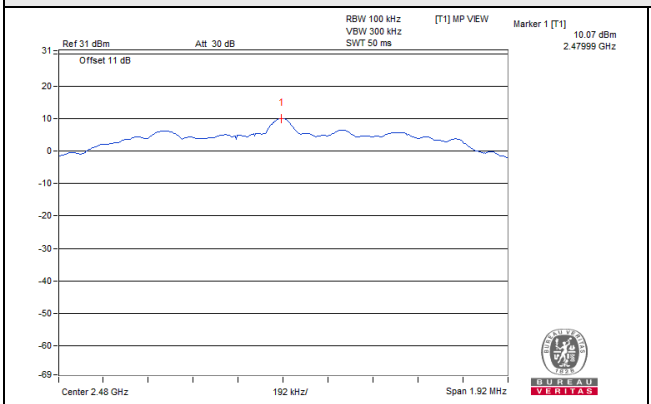


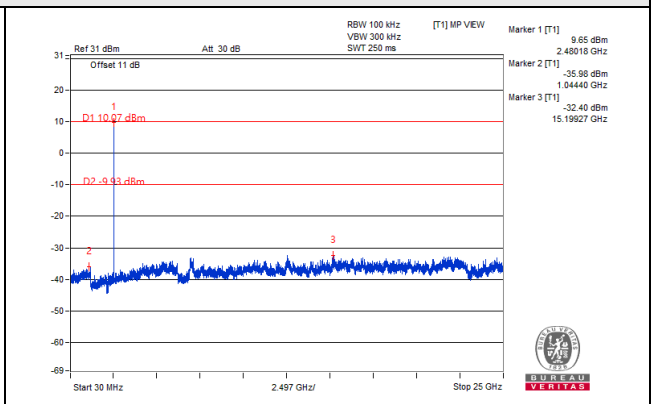
CH 18



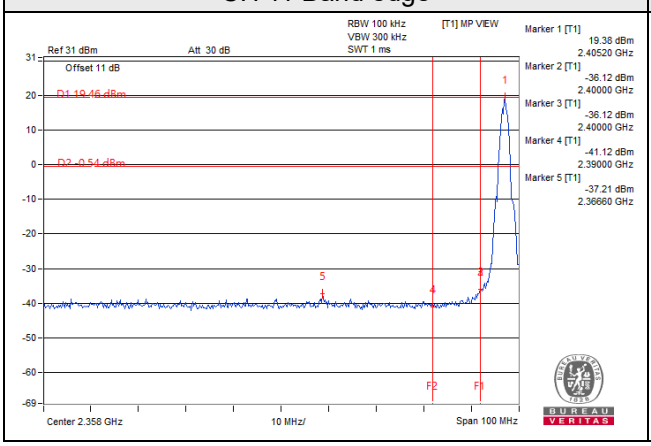


CH 26

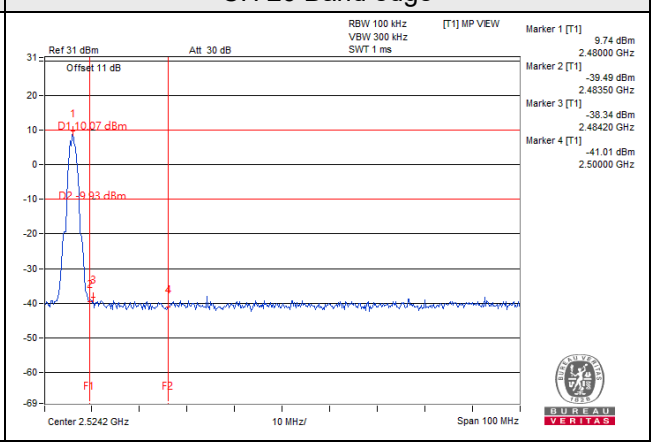




CH 11 Band edge

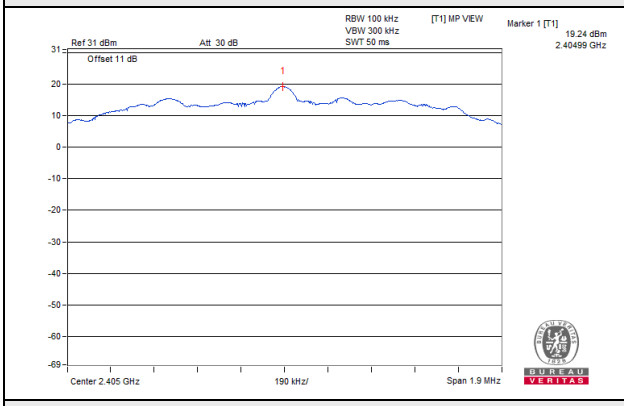


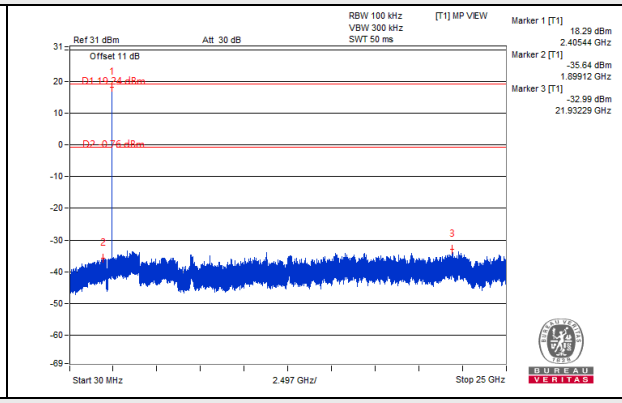
CH 26 Band edge



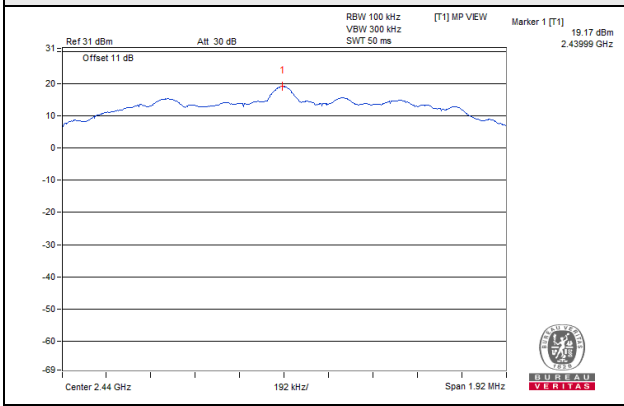
Test Mode C

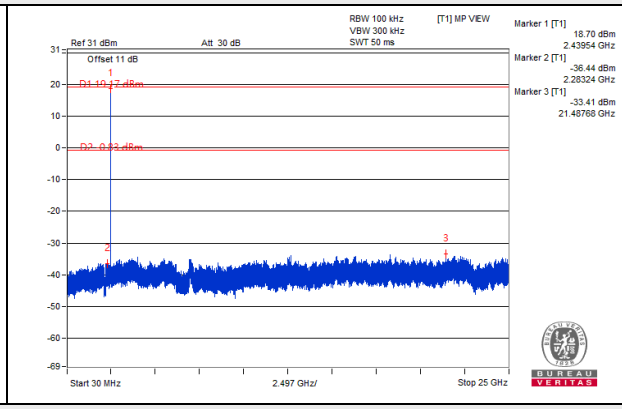
CH 11



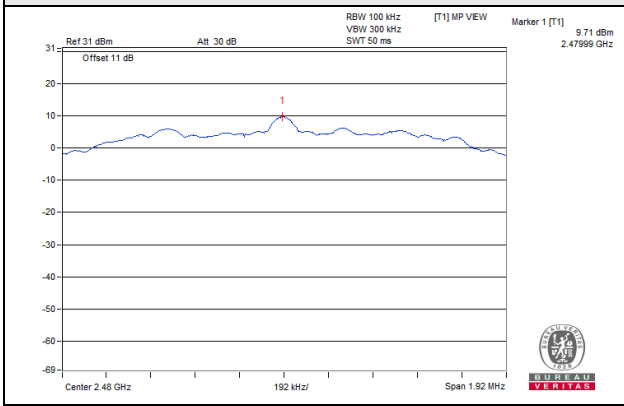


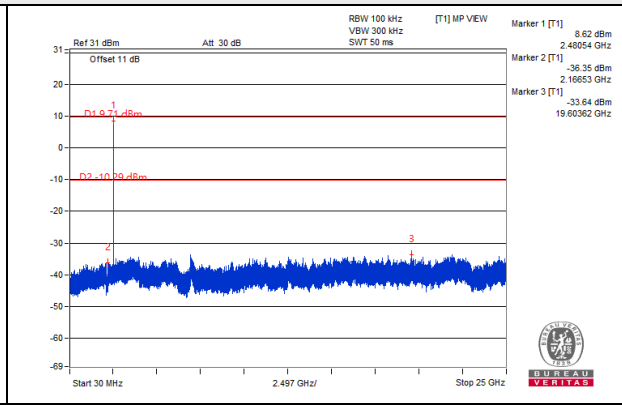
CH 18



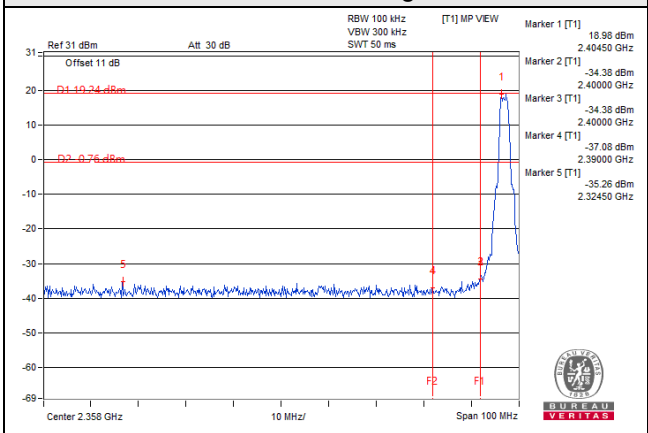


CH 26

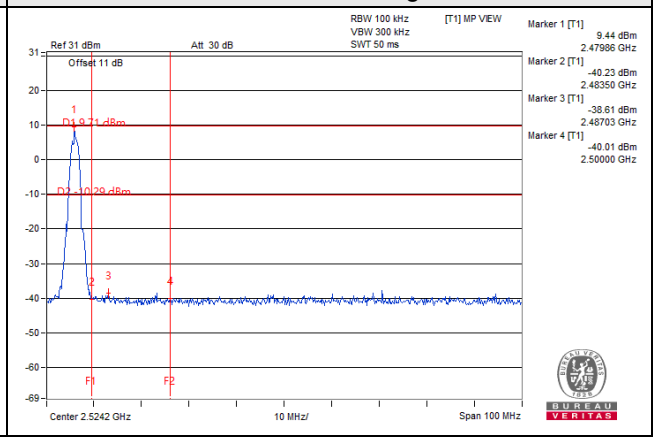




CH 11 Band edge



CH 26 Band edge

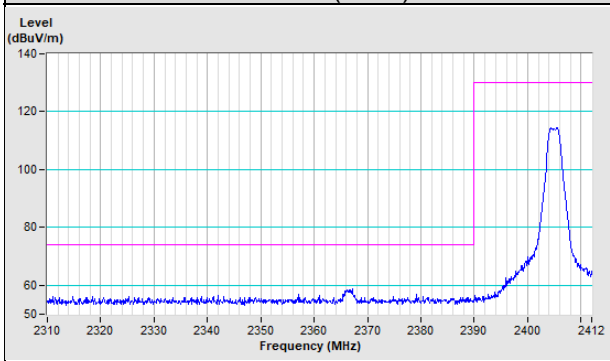


Annex A - Band Edge Measurement

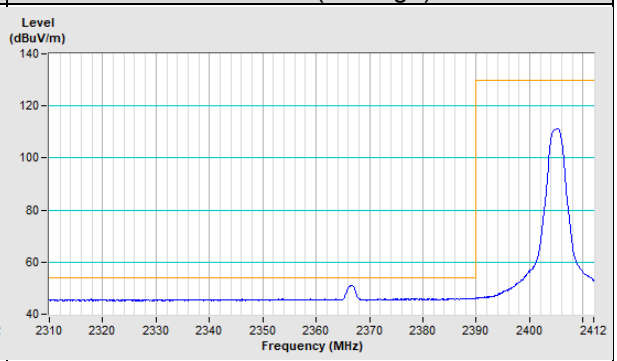
Test Mode A

Zigbee Channel 11

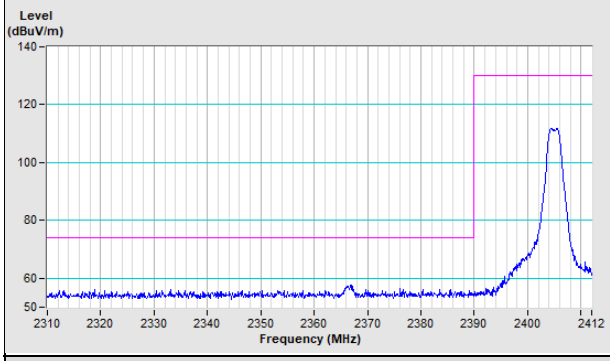
Horizontal (Peak)



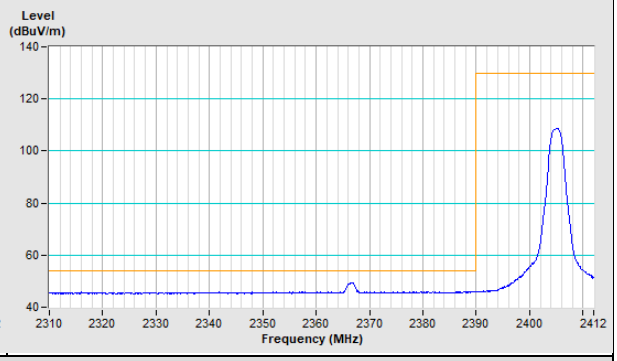
Horizontal (Average)



Vertical (Peak)

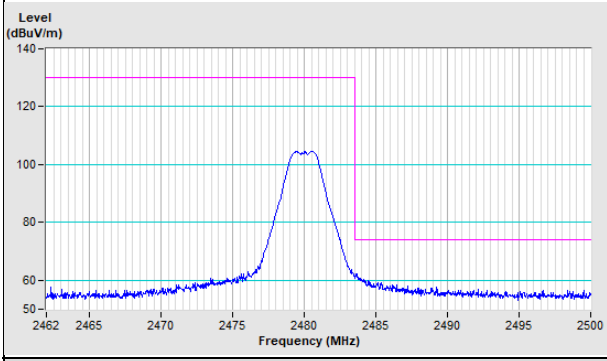


Vertical (Average)

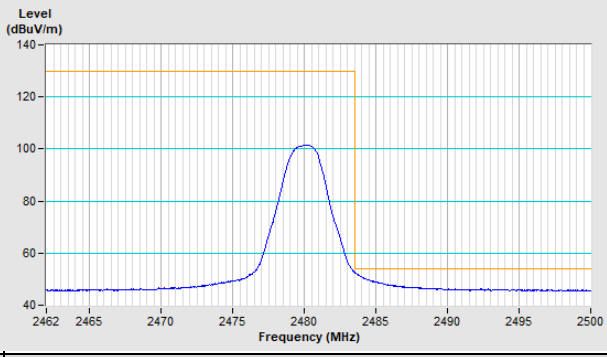


Zigbee Channel 26

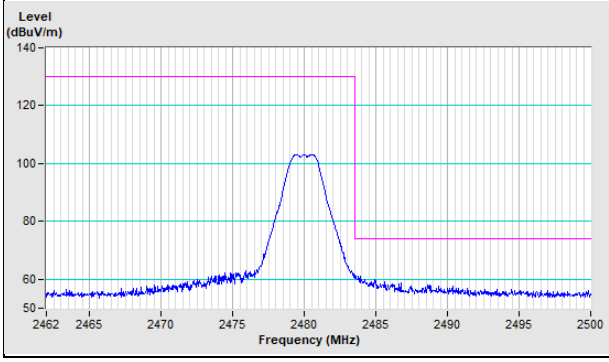
Horizontal (Peak)



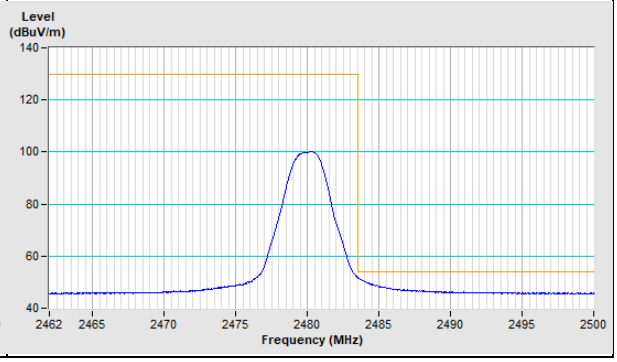
Horizontal (Average)



Vertical (Peak)



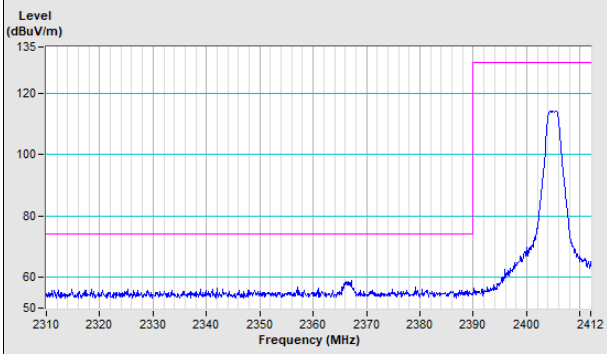
Vertical (Average)



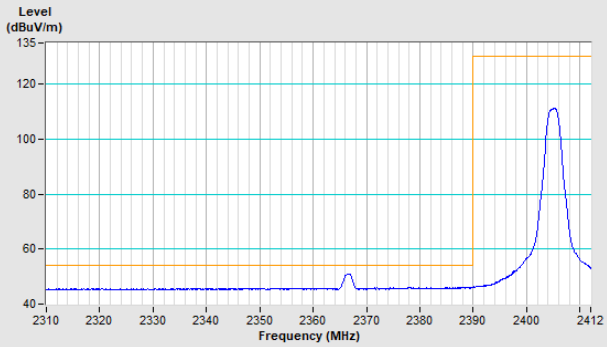
Test Mode C

Zigbee Channel 11

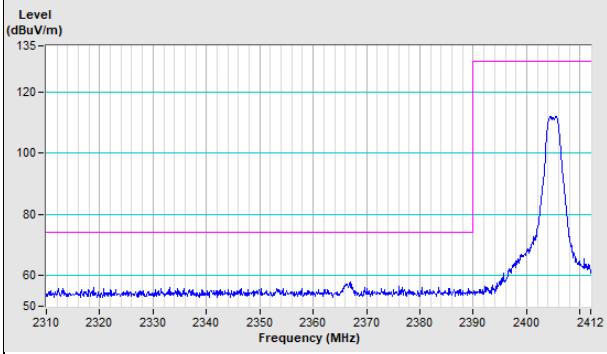
Horizontal (Peak)



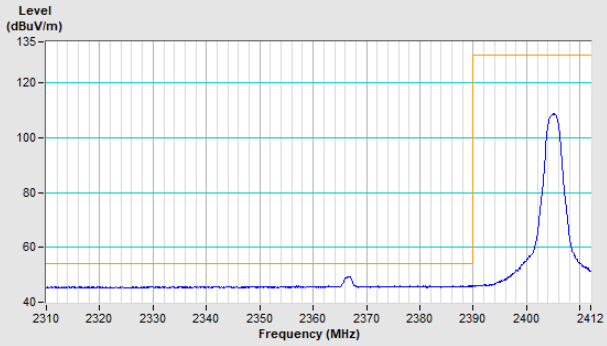
Horizontal (Average)



Vertical (Peak)

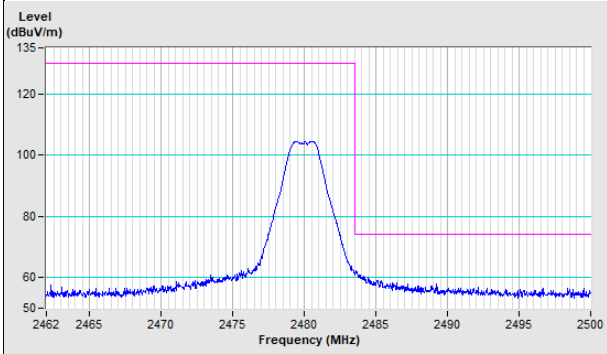


Vertical (Average)

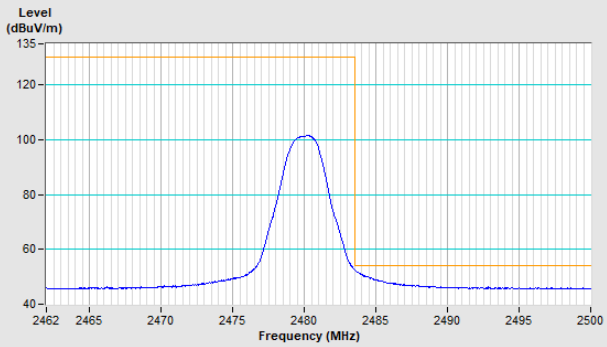


Zigbee Channel 26

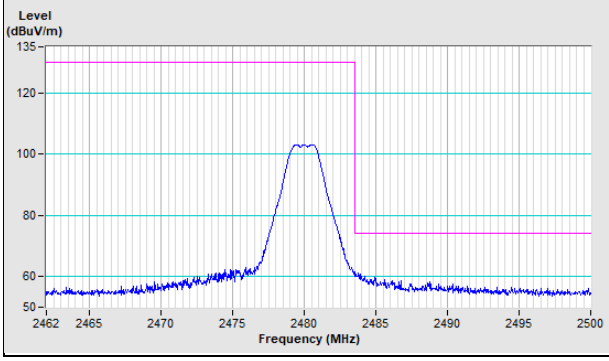
Horizontal (Peak)



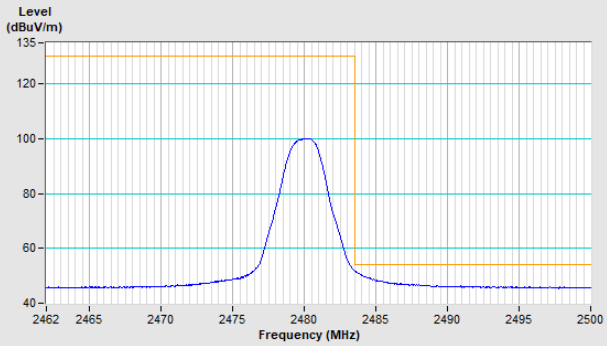
Horizontal (Average)



Vertical (Peak)



Vertical (Average)



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.

If you have any comments, please feel free to contact us at the following:

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Email: service.adt@tw.bureauveritas.com
Web Site: www.bureauveritas-adt.com

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

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