FCC Test Report

Report No.:	RF190912E02E
FCC ID:	2AHBN-AP33
Test Model:	AP32E
Series Model:	AP32, AP33
Received Date:	Mar. 17, 2020
Test Date:	May 22 to June 15, 2020
Issued Date:	June 29, 2020
Applicant:	Juniper Networks, Inc.
Address:	1133 Innovation Way Sunnyvale, CA 94089 USA
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
Lab Address:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
Test Location:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
FCC Registration / Designation Number:	723255 / TW2022

Table of Contents

Release Control Record

Issue No.	Description	Date Issued
RF190912E02E	Original release.	June 29, 2020

1 Certificate of Conformity

Product:	Wi-Fi & BLE Array AP
Brand:	Mist
Test Model:	AP32E
Series Model:	AP32, AP33
Sample Status:	ENGINEERING SAMPLE
Applicant:	Juniper Networks, Inc.
Test Date:	May 22 to June 15, 2020
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 EMC characteristics under the conditions specified in this report.

Prepared by : _____ , **Date:** June 29, 2020

Claire Kuan / Specialist

Approved by : _____ , **Date:** June 29, 2020

Clark Lin / Technical Manager

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 -7.09dB at 0.42734MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -0.1dB at 2390.00MHz, 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 and RPSMA Plug not a standard connector.

Note:
1. For 2.4GHz 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	1.9 dB
Conducted emissions	-	2.5 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.1 dB
	30MHz ~ 1GHz	5.4 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	5.0 dB
	18GHz ~ 40GHz	5.3 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT (2.4GHz)

Product	Wi-Fi & BLE Array AP
Brand	Mist
Test Model	AP32E
Series Model	AP32, AP33
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	55Vdc from PoE
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode and VHT (20/40) mode in 2.4GHz
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11b: up to 11 Mbps 802.11g: up to 54 Mbps 802.11n: up to 600 Mbps
Operating Frequency	2.412 ~ 2.462 GHz
Number of Channel	802.11b, 802.11g, 802.11n (HT20), VHT20, 802.11ax (HE20): 11 802.11n (HT40), VHT40, 802.11ax (HE40): 7
Output Power	**CDD Mode:** 344.448 mW **Beamforming Mode:** 207.506 mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. This report is prepared for FCC Class II permissive change. The difference compared with the Report No.: RF190912E02A design is as the following information:
   - Add DFS band <5250~5350 MHz & 5470~5725 MHz> by software.
   - Add external antenna (Model: ATS-OP-245-810-4RPSP-36) for model AP32E (New antenna only used for WLAN Radio, Scanning Radio and Bluetooth are no impact).
2. According to above condition, all test has to be performed. And all data are verified to meet the requirements. This report is record DTS-WLAN band test, NII (U-NII-1 and U-NII-3) band test is record in Report No.: RF190912E02E-1 and NII (U-NII-2A and U-NII-2C) band test is record in Report No.: RF190912E02C-1.
3. All models are listed as below.

Brand	Model	Difference
Mist	AP32	for marketing request 1) Internal antenna. 2) BT with omnidirectional antenna.
	AP33	for marketing request 1) Internal antenna. 2) BT with directional antenna.
	AP32E	for marketing request 1) External antenna. 2) BT with omnidirectional antenna.
Note: Output power is same for all three models except for the AP32E model collocate new antenna (ATS-OP-245-810-4RPSP-36), and only antenna configurations are different.		

4. There are WLAN and Bluetooth technology used for the EUT. The EUT has four radios as following table:

Radio 1	Radio 2	Radio 3	Radio 4
WLAN - 2.4GHz	(Scanning Radio) WLAN 2.4GHz + 5GHz	WLAN - 5GHz	Bluetooth

5. Simultaneously transmission condition.

Condition	Technology			
1	WLAN - 2.4GHz	(Scanning Radio) WLAN 2.4GHz + 5GHz	WLAN - 5GHz	Bluetooth
Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.				

6. The EUT power needs to be supplied from a PoE adapter (only for test, not for sale), the information is as below table:

Brand	Model No.	Spec.
PowerDsine	PD-9001GR/AC	Input: 100-240Vac, 50/60Hz, 0.67A Output: 55Vdc, 0.6A

7. The antennas provided to the EUT, please refer to the following table:

Model: AP32						
Antenna No.	Brand	Model	Antenna Net Gain (dBi)	Frequency Range	Antenna Type	Connector Type
Int Dual Ant 3 (WiFi 5G+BT)	-	-	5 6	2.4~2.4835GHz 5.15~5.85GHz	PIFA	Ipex
Int WiFi Dual Ant 1	-	-	4.5 5.4	2.4~2.4835GHz 5.15~5.85GHz	PIFA	Ipex
Int WiFi Dual Ant 0	-	-	4.6 5.7	2.4~2.4835GHz 5.15~5.85GHz	PIFA	Ipex
Int WiFi 5G Ant 2	-	-	5.8	5.15~5.85GHz	PIFA	Ipex
Scanning Ant	-	-	5 6	2.4~2.4835GHz 5.15~5.85GHz	PIFA	Ipex
Model: AP32E						
Original						
Antenna No.	Brand	Model	Antenna Net Gain (dBi)	Frequency Range	Antenna Type	Connector Type
Ext WiFi Dual Ant (2.4+5G)	AccelTex	ATS-OO-245-46-6RPSP-36	4 6	2.4~2.4835GHz 5.15~5.85GHz	omnidirectional	RPSMA Plug
Ext WiFi Dual Ant (2.4+5G)			4 6	2.4~2.4835GHz 5.15~5.85GHz	omnidirectional	RPSMA Plug
Ext WiFi Dual Ant (5G)			4 6	2.4~2.4835GHz 5.15~5.85GHz	omnidirectional	RPSMA Plug
Ext WiFi Dual Ant (5G)			4 6	2.4~2.4835GHz 5.15~5.85GHz	omnidirectional	RPSMA Plug
Ext WiFi Dual Ant (Scanning)			4 6	2.4~2.4835GHz (Scanning) 5.15~5.85GHz (Scanning)	omnidirectional	RPSMA Plug
Int Scanning Ant	-	-	5 6	2.4~2.4835GHz (Scanning) 5.15~5.85GHz (Scanning)	PIFA	Ipex
Int BT Ant	-	-	5	2.4~2.4835GHz	PIFA	Ipex

Newly						
Antenna No.	Brand	Model	Antenna Net Gain (dBi)	Frequency Range	Antenna Type	Connector Type
Ext WiFi PATCH Ant (2.4+5G)	AccelTex	ATS-OP-245-810-4RPSP-36	8 10	2.4~2.4835GHz 5.15~5.85GHz	PATCH	RPSMA Plug
Ext WiFi PATCH Ant (2.4+5G)			8 10	2.4~2.4835GHz 5.15~5.85GHz	PATCH	RPSMA Plug
Ext WiFi PATCH Ant (5G)			8 10	2.4~2.4835GHz 5.15~5.85GHz	PATCH	RPSMA Plug
Ext WiFi PATCH Ant (5G)			8 10	2.4~2.4835GHz 5.15~5.85GHz	PATCH	RPSMA Plug
Model: AP33						
Antenna No.	Brand	Model	Antenna Net Gain (dBi)	Frequency Range	Antenna Type	Connector Type
Int WiFi Dual Ant 0	-	-	3.7 6	2.4~2.4835GHz 5.15~5.85GHz	PIFA	Ipex
Int WiFi Dual Ant 1	-	-	4.6 6	2.4~2.4835GHz 5.15~5.85GHz	PIFA	Ipex
Int WiFi 5G Ant 2	-	-	6	5.15~5.85GHz	PIFA	Ipex
Int WiFi 5G Ant 3	-	-	5.9	5.15~5.85GHz	PIFA	Ipex
Scanning Ant	-	-	5 6	2.4~2.4835GHz 5.15~5.85GHz	PIFA	Ipex
BT Slot_Direct Antenna	-	-	6	2.402~2.480GHz	Slot_Direct	Ipex
BT Array Antenna	-	-	Beam 1 :3.9 Beam 2 :3.9 Beam 3 :4.7 Beam 4 :4.4 Beam 5 :4.8 Beam 6 :5.1 Beam 7 :5.1 Beam 8 :4.2	2.402~2.480GHz	Array Antenna	Ipex
Note: The max. antenna gain was selected for the final test of Antenna Port Conducted test items.						

8. The newly external antenna for WLAN 2.4G only support 2Tx configuration / for WLAN 5G only support 4Tx configuration.

9. The EUT incorporates a MIMO function.

MODULATION MODE	Radio 1 - 2.4GHz Band		Radio 2 - 2.4GHz Band	
	TX & RX CONFIGURATION		TX & RX CONFIGURATION	
802.11b	2TX	2RX	1TX	1RX
802.11g	2TX	2RX	1TX	1RX
802.11n (HT20)	2TX	2RX	1TX	1RX
802.11n (HT40)	2TX	2RX	1TX	1RX
VHT20	2TX	2RX	1TX	1RX
VHT40	2TX	2RX	1TX	1RX
802.11ax (HE20)	2TX	2RX	1TX	1RX
802.11ax (HE40)	2TX	2RX	1TX	1RX
MODULATION MODE	**Radio 3 - 5GHz Band**		**Radio 2 - 5GHz Band**	
	TX & RX CONFIGURATION		**TX & RX CONFIGURATION**	
802.11a	4TX	4RX	1TX	1RX
802.11n (HT20)	4TX	4RX	1TX	1RX
802.11n (HT40)	4TX	4RX	1TX	1RX
802.11ac (VHT20)	4TX	4RX	1TX	1RX
802.11ac (VHT40)	4TX	4RX	1TX	1RX
802.11ac (VHT80)	4TX	4RX	1TX	1RX
802.11ax (HE20)	4TX	4RX	1TX	1RX
802.11ax (HE40)	4TX	4RX	1TX	1RX
802.11ax (HE80)	4TX	4RX	1TX	1RX

Note:
1. All of modulation mode support beamforming function except 802.11a/b/g modulation mode.
2. The EUT support Beamforming and non-beamforming mode, therefore both mode were investigated and the worst case scenario was identified. The worst case data were presented in test report.
3. The modulation and bandwidth are similar for 802.11n mode for 20MHz (40MHz), VHT mode for 20MHz (40MHz) and 802.11ax mode for 20MHz (40MHz), therefore the manufacturer will control the power for 802.11n/VHT mode is the same as the 802.11ax or more lower than it and investigated worst case to representative mode in test report. (Final test mode refer to section 3.2.1)

10. The EUT was pre-tested under the following modes:

➢ **For Radiated Emission (Above 1GHz) test**

Pre-test Mode	Test item	Mode	Ant. Polarity (with ATS-OP-245-810-4RPSP-36 Ant.)	Remark
1	RSE above 1GHz	2Tx	Y-Z	-
2	**RSE above 1GHz**	**2Tx**	**X-Z**	**Worst-Test Results Mode 1**

➢ **For Radiated Emission (Below 1GHz) test**

Pre-test Mode	Test item	Mode	Ant. Polarity (with ATS-OP-245-810-4RPSP-36 Ant.)	Remark
1	RSE below 1GHz	2Tx	Y-Z	-
2	**RSE below 1GHz**	**2Tx**	**X-Z**	**Worst-Test Results Mode 1**

11. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 Description of Test Modes

11 channels are provided for 802.11b, 802.11g and 802.11n (HT20), VHT20, 802.11ax (HE20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437		

7 channels are provided for 802.11n (HT40), VHT40, 802.11ax (HE40):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
3	2422	7	2442
4	2427	8	2447
5	2432	9	2452
6	2437		

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	√	√	Model: AP32E with 2TX

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

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.

CDD Mode					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	Data Rate Parameter
802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1Mb/s
802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6Mb/s
802.11ax (HE20)	1 to 11	1, 6, 11	OFDMA	BPSK	MCS0
802.11ax (HE40)	3 to 9	3, 6, 9	OFDMA	BPSK	MCS0

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.

CDD Mode					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	Data Rate Parameter
802.11b	1 to 11	6	DSSS	DBPSK	1Mb/s

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.

CDD Mode					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	Data Rate Parameter
802.11b	1 to 11	6	DSSS	DBPSK	1Mb/s

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.

CDD Mode					
MODE	**AVAILABLE CHANNEL**	**TESTED CHANNEL**	**MODULATION TECHNOLOGY**	**MODULATION TYPE**	**Data Rate Parameter**
802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1Mb/s
802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6Mb/s
VHT20 (output power only)	1 to 11	1, 6, 11	OFDM	BPSK	MCS0
VHT40 (output power only)	3 to 9	3, 6, 9	OFDM	BPSK	MCS0
802.11ax (HE20)	1 to 11	1, 6, 11	OFDMA	BPSK	MCS0
802.11ax (HE40)	3 to 9	3, 6, 9	OFDMA	BPSK	MCS0
Beamforming Mode (output power only)					
MODE	**AVAILABLE CHANNEL**	**TESTED CHANNEL**	**MODULATION TECHNOLOGY**	**MODULATION TYPE**	**Data Rate Parameter**
VHT20	1 to 11	1, 6, 11	OFDM	BPSK	MCS0
VHT40	3 to 9	3, 6, 9	OFDM	BPSK	MCS0
802.11ax (HE20)	1 to 11	1, 6, 11	OFDMA	BPSK	MCS0
802.11ax (HE40)	3 to 9	3, 6, 9	OFDMA	BPSK	MCS0

Test Condition:

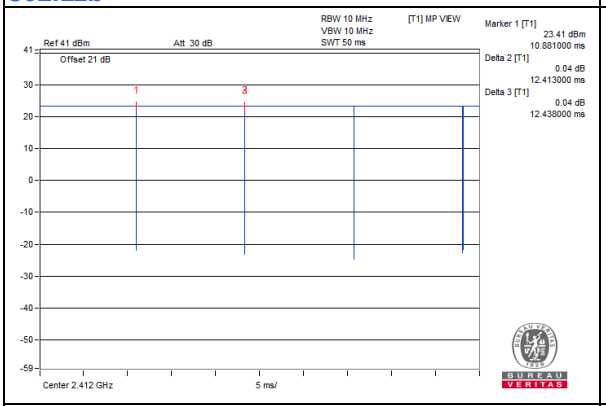
APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (System)	TESTED BY
RE≥1G	24deg. C, 68%RH	120Vac, 60Hz	Tom Yang
RE<1G	22deg. C, 68%RH	120Vac, 60Hz	Ryan Du
PLC	21deg. C, 60%RH	120Vac, 60Hz	Nick Lo
APCM	25deg. C, 60%RH	120Vac, 60Hz	Jyunchun Lin

3.3 Duty Cycle of Test Signal

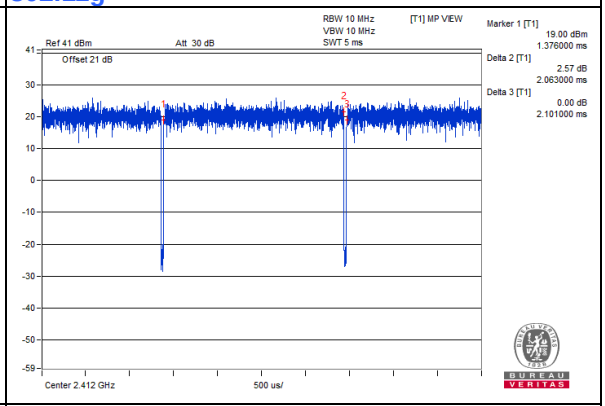
If duty cycle of test signal is ≥ 98 %, duty factor is not required.
If duty cycle of test signal is < 98%, duty factor shall be considered.

802.11b: Duty cycle = 12.413 ms/12.438 ms = 0.998
802.11g: Duty cycle = 2.063 ms/2.101 ms = 0.982
802.11ax (HE20): Duty cycle = 1.487 ms/1.522 ms = 0.977, Duty factor = 10 * log (1/Duty cycle) = 0.1 dB
802.11ax (HE40): Duty cycle = 0.77 ms/0.811 ms = 0.949, Duty factor = 10 * log (1/Duty cycle) = 0.23 dB

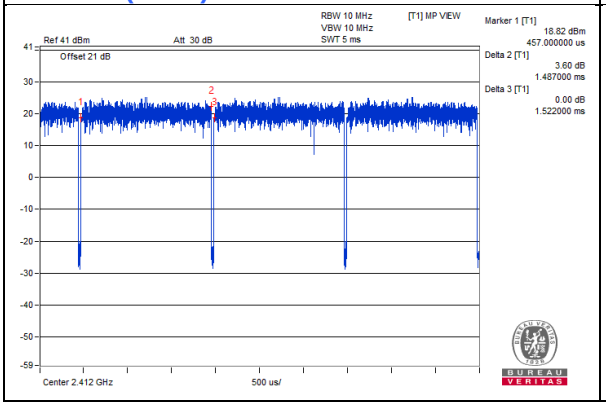
802.11b



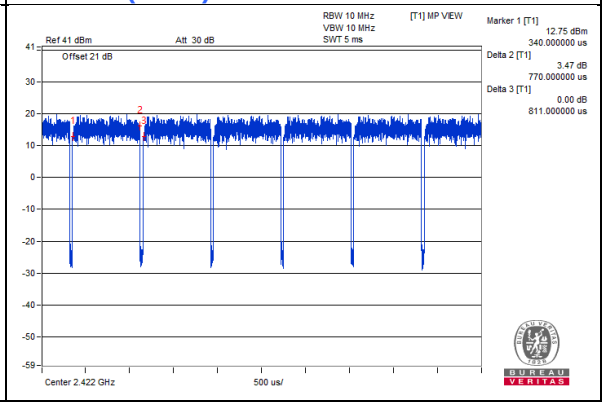
802.11g



802.11ax (HE20)



802.11ax (HE40)



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.	Laptop	DELL	E5430	HYV4VY1	FCC DoC	Provided by Lab
B.	Laptop	DELL	E6420	B92T3R1	FCC DoC	Provided by Lab
C.	PoE Adapter	PowerDsine	PD-9001GR/AC	NA	NA	Supplied by client
D.	Ipod	Apple	MC749TA/A	CC4DN25WDFDM	NA	Provided by Lab

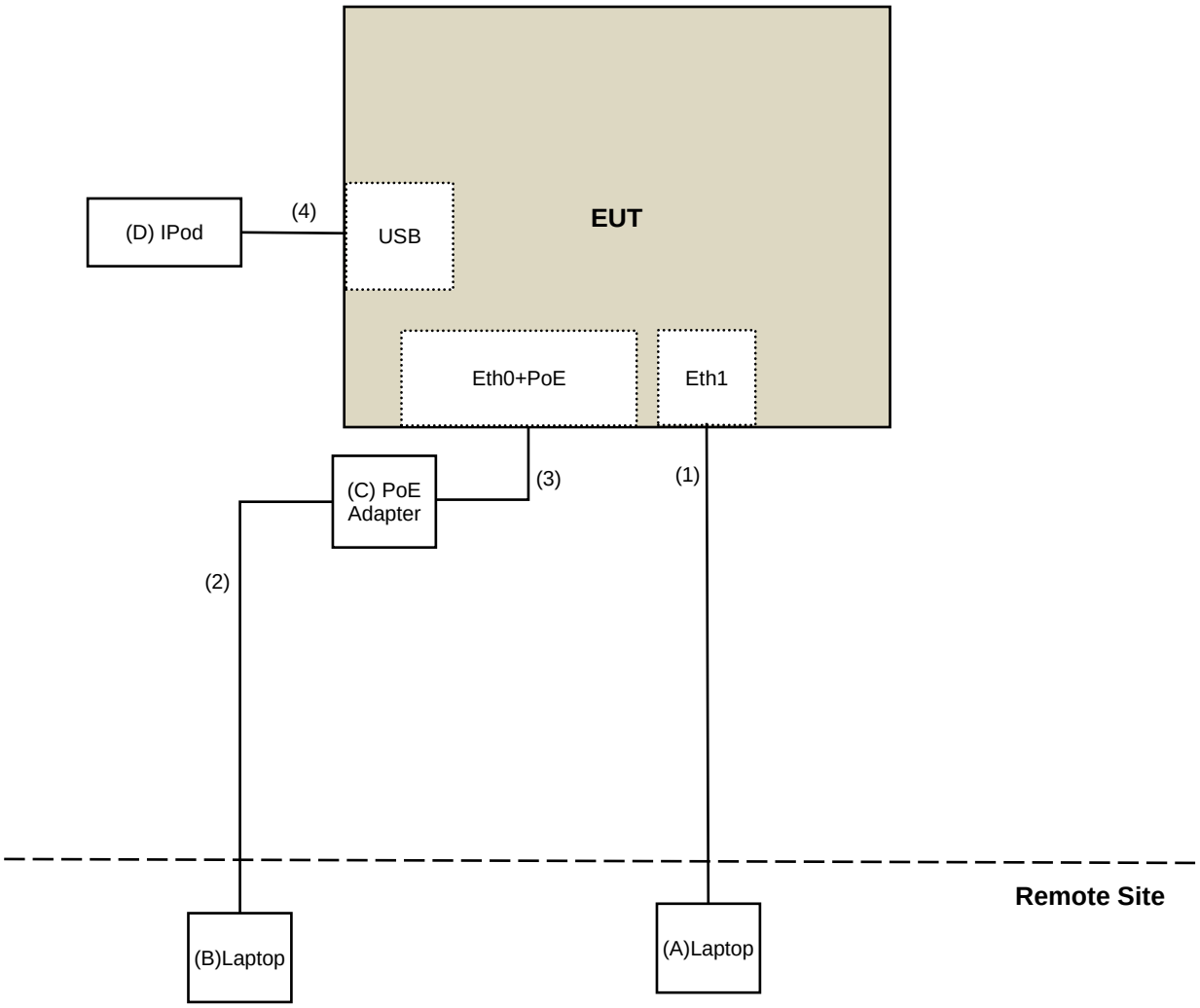
Note:

1. All power cords of the above support units are non-shielded (1.8m).

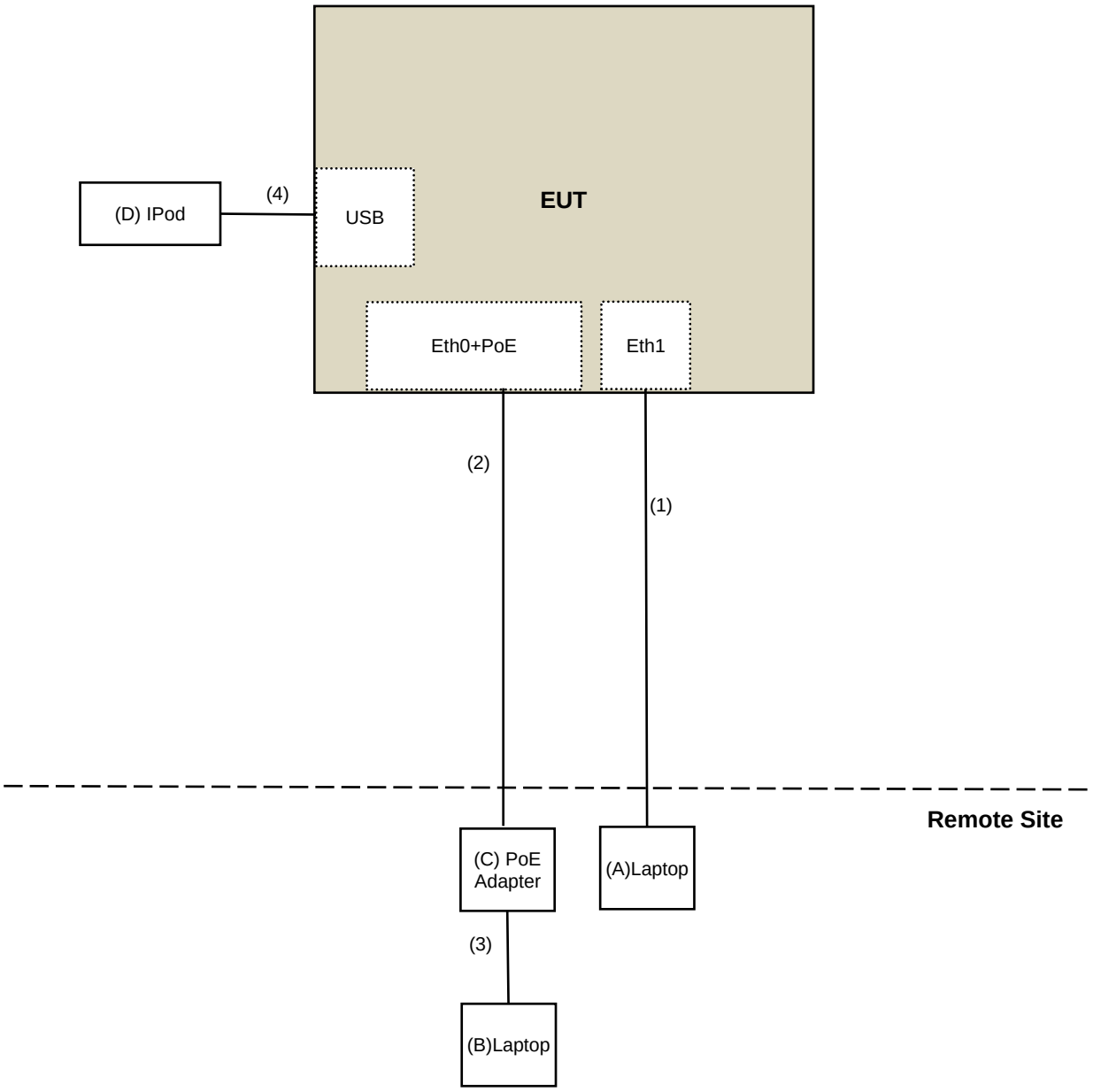
ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	RJ-45 Cable	1	10	No	0	Provided by Lab
2.	RJ-45 Cable	1	10	No	0	Provided by Lab
3.	RJ-45 Cable	1	1.5	No	0	Provided by Lab
4.	USB Cable	1	0.1	Yes	0	Provided by Lab

3.4.1 Configuration of System under Test

For conducted emission test:



For other test items:



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
KDB 662911 D01 Multiple Transmitter Output v02r01

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 30dB 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

For radiated emission test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Keysight	N9038A	MY54450088	July 03, 2019	July 02, 2020
Pre-Amplifier EMCI	EMC001340	980142	May 25, 2020	May 24, 2021
Loop Antenna Electro-Metrics	EM-6879	264	Feb. 18, 2020	Feb. 17, 2021
RF Cable	NA	LOOPCAB-001	Jan. 08, 2020	Jan. 07, 2021
RF Cable	NA	LOOPCAB-002	Jan. 08, 2020	Jan. 07, 2021
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-05	Apr. 28, 2020	Apr. 27, 2021
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Nov. 11, 2019	Nov. 10, 2020
RF Cable	8D	966-3-1	Mar. 17, 2020	Mar. 16, 2021
RF Cable	8D	966-3-2	Mar. 17, 2020	Mar. 16, 2021
RF Cable	8D	966-3-3	Mar. 17, 2020	Mar. 16, 2021
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-3-01	Sep. 26, 2019	Sep. 25, 2020
Horn_Antenna SCHWARZBECK	BBHA9120-D	9120D-406	Nov. 24, 2019	Nov. 23, 2020
Pre-Amplifier EMCI	EMC12630SE	980384	Jan. 15, 2020	Jan. 14, 2021
RF Cable	EMC104-SM-SM-1200	160922	Jan. 15, 2020	Jan. 14, 2021
RF Cable	EMC104-SM-SM-2000	180601	June 10, 2019	June 09, 2020
RF Cable	EMC104-SM-SM-6000	180602	June 10, 2019	June 09, 2020
Spectrum Analyzer Keysight	N9030A	MY54490679	July 17, 2019	July 16, 2020
Pre-Amplifier EMCI	EMC184045SE	980387	Jan. 15, 2020	Jan. 14, 2021
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170519	Nov. 24, 2019	Nov. 23, 2020
RF Cable	EMC102-KM-KM-1200	160924	Jan. 15, 2020	Jan. 14, 2021
RF Cable	EMC-KM-KM-4000	200214	Mar. 11, 2020	Mar. 10, 2021
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
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 966 Chamber No. 3.
3. Tested Date: May 30 to June 09, 2020

For Band-edge test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Keysight	N9038A	MY54450088	July 03, 2019	July 02, 2020
Horn_Antenna SCHWARZBECK	BBHA9120-D	9120D-406	Nov. 24, 2019	Nov. 23, 2020
Pre-Amplifier EMCI	EMC12630SE	980384	Jan. 15, 2020	Jan. 14, 2021
RF Cable	EMC104-SM-SM-1200	160922	Jan. 15, 2020	Jan. 14, 2021
RF Cable	EMC104-SM-SM-2000	180601	June 10, 2019	June 09, 2020
RF Cable	EMC104-SM-SM-6000	180602	June 10, 2019	June 09, 2020
Spectrum Analyzer Keysight	N9030A	MY54490679	July 17, 2019	July 16, 2020
Pre-Amplifier EMCI	EMC184045SE	980387	Jan. 15, 2020	Jan. 14, 2021
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170519	Nov. 24, 2019	Nov. 23, 2020
RF Cable	EMC102-KM-KM-1200	160924	Jan. 15, 2020	Jan. 14, 2021
RF Cable	EMC-KM-KM-4000	200214	Mar. 11, 2020	Mar. 10, 2021
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
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 966 Chamber No. 3.
3. Tested Date: May 22, 2020

For other test items:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSV40	100964	May 29, 2020	May 28, 2021
Power meter Anritsu	ML2495A	1529002	July 26, 2019	July 25, 2020
Power sensor Anritsu	MA2411B	1339443	July 26, 2019	July 25, 2020
Fixed Attenuator Mini-Circuits	MDCS18N-10	MDCS18N-10-01	Apr. 14, 2020	Apr. 13, 2021
Software	ADT_RF Test Software V6.6.5.4	NA	NA	NA

NOTE: 1. The test was performed in Oven room 2.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. Tested Date: June 15, 2020

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 detects 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:

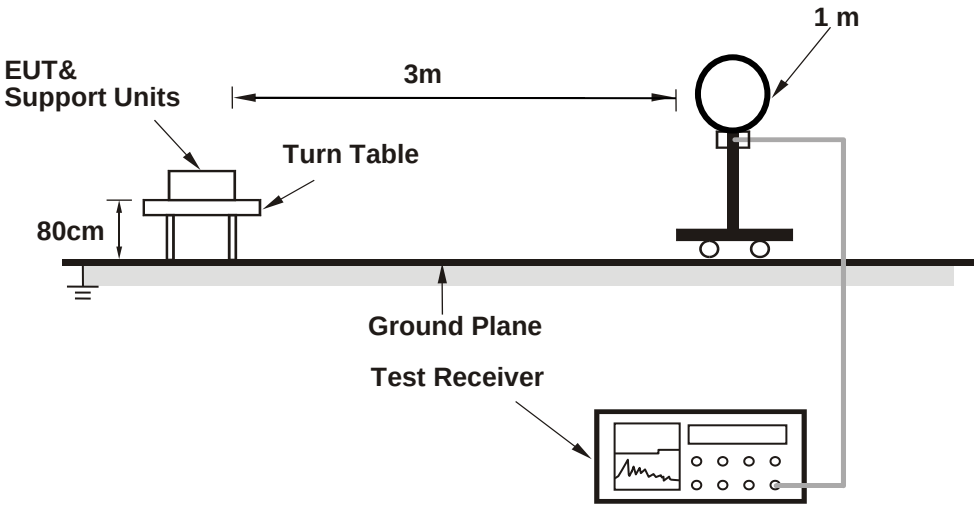
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

4.1.4 Deviation from Test Standard

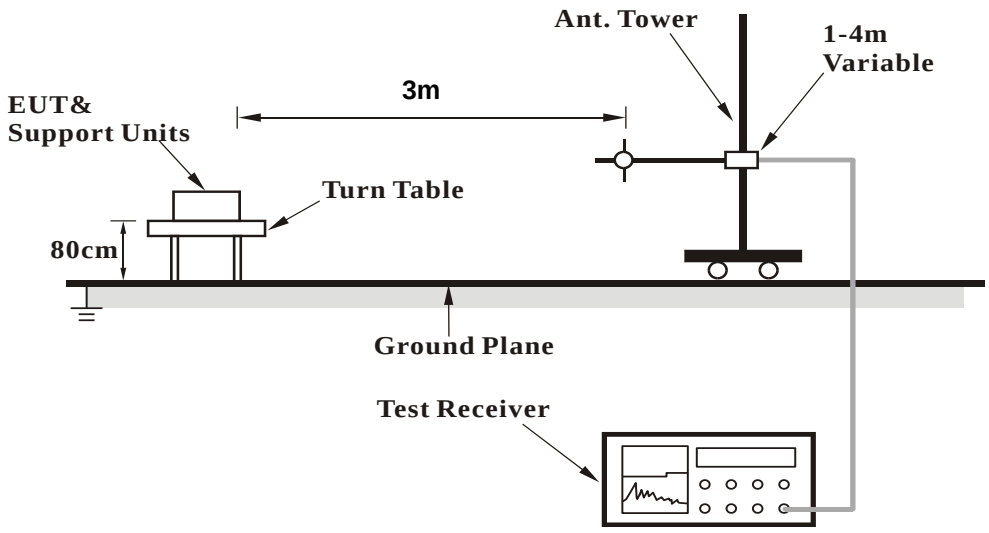
No deviation.

4.1.5 Test Setup

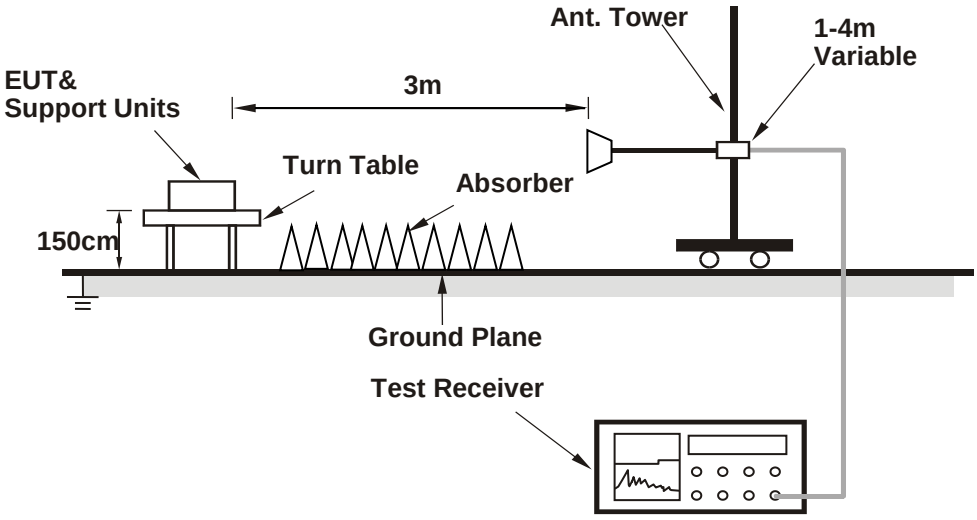
For Radiated emission below 30MHz



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. Connected the EUT with the Laptop which is placed on remote site.
b. Controlling software (accessMTool_REL_3_1_0_3) has been activated to set the EUT under transmission condition continuously.

4.1.7 Test Results

Above 1GHz Data:

802.11b

Channel	TX Channel 1	**Detector Function**	Peak (PK) Average (AV)
Frequency Range	1GHz ~ 25GHz		

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	2390.00	61.1 PK	74.0	-12.9	1.44 H	345	63.0	-1.9
2	**2390.00**	**53.9 AV**	**54.0**	**-0.1**	**1.44 H**	**345**	**55.8**	**-1.9**
3	*2412.00	115.4 PK			1.44 H	345	117.3	-1.9
4	*2412.00	112.5 AV			1.44 H	345	114.4	-1.9
5	4824.00	49.2 PK	74.0	-24.8	2.77 H	10	46.3	2.9
6	4824.00	45.9 AV	54.0	-8.1	2.77 H	10	43.0	2.9
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	2390.00	60.3 PK	74.0	-13.7	1.87 V	1	62.2	-1.9
2	2390.00	49.2 AV	54.0	-4.8	1.87 V	1	51.1	-1.9
3	*2412.00	114.9 PK			1.87 V	1	116.8	-1.9
4	*2412.00	112.0 AV			1.87 V	1	113.9	-1.9
5	4824.00	49.0 PK	74.0	-25.0	2.21 V	358	46.1	2.9
6	4824.00	46.1 AV	54.0	-7.9	2.21 V	358	43.2	2.9

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

Channel	TX Channel 6	Detector Function	Peak (PK) Average (AV)
Frequency Range	1GHz ~ 25GHz		

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	2390.00	62.1 PK	74.0	-11.9	1.42 H	343	64.0	-1.9
2	2390.00	53.6 AV	54.0	-0.4	1.42 H	343	55.5	-1.9
3	*2437.00	117.2 PK			1.42 H	343	119.2	-2.0
4	*2437.00	114.7 AV			1.42 H	343	116.7	-2.0
5	2483.50	61.8 PK	74.0	-12.2	1.42 H	343	63.7	-1.9
6	2483.50	52.3 AV	54.0	-1.7	1.42 H	343	54.2	-1.9
7	4874.00	49.2 PK	74.0	-24.8	2.75 H	2	46.4	2.8
8	4874.00	46.4 AV	54.0	-7.6	2.75 H	2	43.6	2.8
9	7311.00	52.4 PK	74.0	-21.6	2.54 H	10	43.5	8.9
10	7311.00	47.8 AV	54.0	-6.2	2.54 H	10	38.9	8.9
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	2390.00	60.6 PK	74.0	-13.4	1.91 V	7	62.5	-1.9
2	2390.00	49.5 AV	54.0	-4.5	1.91 V	7	51.4	-1.9
3	*2437.00	117.0 PK			1.91 V	7	119.0	-2.0
4	*2437.00	114.2 AV			1.91 V	7	116.2	-2.0
5	2483.50	59.3 PK	74.0	-14.7	1.91 V	7	61.2	-1.9
6	2483.50	48.6 AV	54.0	-5.4	1.91 V	7	50.5	-1.9
7	4874.00	49.8 PK	74.0	-24.2	2.26 V	349	47.0	2.8
8	4874.00	47.2 AV	54.0	-6.8	2.26 V	349	44.4	2.8
9	7311.00	52.9 PK	74.0	-21.1	1.43 V	306	44.0	8.9
10	7311.00	48.7 AV	54.0	-5.3	1.43 V	306	39.8	8.9

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

Channel	TX Channel 11	Detector Function	Peak (PK) Average (AV)
Frequency Range	1GHz ~ 25GHz		

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	*2462.00	114.7 PK			1.58 H	340	116.6	-1.9
2	*2462.00	112.1 AV			1.58 H	340	114.0	-1.9
3	2483.50	65.0 PK	74.0	-9.0	1.58 H	340	66.9	-1.9
4	2483.50	53.5 AV	54.0	-0.5	1.58 H	340	55.4	-1.9
5	4924.00	49.1 PK	74.0	-24.9	2.69 H	13	46.4	2.7
6	4924.00	45.8 AV	54.0	-8.2	2.69 H	13	43.1	2.7
7	7386.00	50.7 PK	74.0	-23.3	2.53 H	14	41.7	9.0
8	7386.00	46.6 AV	54.0	-7.4	2.53 H	14	37.6	9.0
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	*2462.00	113.8 PK			2.59 V	350	115.7	-1.9
2	*2462.00	111.4 AV			2.59 V	350	113.3	-1.9
3	2483.50	60.1 PK	74.0	-13.9	2.59 V	350	62.0	-1.9
4	2483.50	49.1 AV	54.0	-4.9	2.59 V	350	51.0	-1.9
5	4924.00	49.4 PK	74.0	-24.6	2.18 V	355	46.7	2.7
6	4924.00	46.3 AV	54.0	-7.7	2.18 V	355	43.6	2.7
7	7386.00	51.2 PK	74.0	-22.8	1.44 V	321	42.2	9.0
8	7386.00	47.1 AV	54.0	-6.9	1.44 V	321	38.1	9.0

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.

802.11g

Channel	TX Channel 1	Detector Function	Peak (PK) Average (AV)
Frequency Range	1GHz ~ 25GHz		

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	2390.00	73.8 PK	74.0	-0.2	1.43 H	348	75.7	-1.9
2	2390.00	48.3 AV	54.0	-5.7	1.43 H	348	50.2	-1.9
3	*2412.00	112.4 PK			1.43 H	348	114.3	-1.9
4	*2412.00	102.3 AV			1.43 H	348	104.2	-1.9
5	4824.00	51.1 PK	74.0	-22.9	2.74 H	12	48.2	2.9
6	4824.00	39.5 AV	54.0	-14.5	2.74 H	12	36.6	2.9
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	2390.00	71.2 PK	74.0	-2.8	1.89 V	8	73.1	-1.9
2	2390.00	47.5 AV	54.0	-6.5	1.89 V	8	49.4	-1.9
3	*2412.00	111.5 PK			1.89 V	8	113.4	-1.9
4	*2412.00	102.0 AV			1.89 V	8	103.9	-1.9
5	4824.00	51.4 PK	74.0	-22.6	2.11 V	348	48.5	2.9
6	4824.00	39.8 AV	54.0	-14.2	2.11 V	348	36.9	2.9

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

Channel	TX Channel 6	Detector Function	Peak (PK) Average (AV)
Frequency Range	1GHz ~ 25GHz		

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	2390.00	68.9 PK	74.0	-5.1	1.59 H	347	70.8	-1.9
2	2390.00	53.4 AV	54.0	-0.6	1.59 H	347	55.3	-1.9
3	*2437.00	116.3 PK			1.59 H	347	118.3	-2.0
4	*2437.00	106.4 AV			1.59 H	347	108.4	-2.0
5	**2483.50**	**73.9 PK**	**74.0**	**-0.1**	**1.59 H**	**347**	**75.8**	**-1.9**
6	**2483.50**	**53.9 AV**	**54.0**	**-0.1**	**1.59 H**	**347**	**55.8**	**-1.9**
7	4874.00	53.5 PK	74.0	-20.5	2.77 H	10	50.7	2.8
8	4874.00	40.2 AV	54.0	-13.8	2.77 H	10	37.4	2.8
9	7311.00	53.7 PK	74.0	-20.3	2.55 H	11	44.8	8.9
10	7311.00	41.3 AV	54.0	-12.7	2.55 H	11	32.4	8.9
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	2390.00	67.8 PK	74.0	-6.2	1.90 V	6	69.7	-1.9
2	2390.00	50.9 AV	54.0	-3.1	1.90 V	6	52.8	-1.9
3	*2437.00	116.7 PK			1.90 V	6	118.7	-2.0
4	*2437.00	106.6 AV			1.90 V	6	108.6	-2.0
5	2483.50	71.2 PK	74.0	-2.8	1.90 V	6	73.1	-1.9
6	2483.50	51.5 AV	54.0	-2.5	1.90 V	6	53.4	-1.9
7	4874.00	52.9 PK	74.0	-21.1	2.13 V	360	50.1	2.8
8	4874.00	40.9 AV	54.0	-13.1	2.13 V	360	38.1	2.8
9	7311.00	53.5 PK	74.0	-20.5	1.44 V	308	44.6	8.9
10	7311.00	41.8 AV	54.0	-12.2	1.44 V	308	32.9	8.9

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

Channel	TX Channel 11	Detector Function	Peak (PK) Average (AV)
Frequency Range	1GHz ~ 25GHz		

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	*2462.00	111.1 PK			1.62 H	342	113.0	-1.9
2	*2462.00	101.5 AV			1.62 H	342	103.4	-1.9
3	**2483.50**	**73.9 PK**	**74.0**	**-0.1**	**1.62 H**	**342**	**75.8**	**-1.9**
4	2483.50	49.1 AV	54.0	-4.9	1.62 H	342	51.0	-1.9
5	4924.00	51.7 PK	74.0	-22.3	2.76 H	4	49.0	2.7
6	4924.00	40.1 AV	54.0	-13.9	2.76 H	4	37.4	2.7
7	7386.00	52.8 PK	74.0	-21.2	2.60 H	20	43.8	9.0
8	7386.00	40.6 AV	54.0	-13.4	2.60 H	20	31.6	9.0
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	*2462.00	110.4 PK			1.96 V	359	112.3	-1.9
2	*2462.00	100.6 AV			1.96 V	359	102.5	-1.9
3	2483.50	72.3 PK	74.0	-1.7	1.96 V	359	74.2	-1.9
4	2483.50	46.5 AV	54.0	-7.5	1.96 V	359	48.4	-1.9
5	4924.00	51.6 PK	74.0	-22.4	2.11 V	348	48.9	2.7
6	4924.00	39.9 AV	54.0	-14.1	2.11 V	348	37.2	2.7
7	7386.00	52.7 PK	74.0	-21.3	1.44 V	320	43.7	9.0
8	7386.00	40.8 AV	54.0	-13.2	1.44 V	320	31.8	9.0

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.

802.11ax (HE20)

Channel	TX Channel 1	Detector Function	Peak (PK) Average (AV)
Frequency Range	1GHz ~ 25GHz		

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	2390.00	73.7 PK	74.0	-0.3	1.41 H	342	75.6	-1.9
2	2390.00	52.1 AV	54.0	-1.9	1.41 H	342	54.0	-1.9
3	*2412.00	113.9 PK			1.41 H	342	115.8	-1.9
4	*2412.00	102.0 AV			1.41 H	342	103.9	-1.9
5	4824.00	51.5 PK	74.0	-22.5	2.68 H	18	48.6	2.9
6	4824.00	40.0 AV	54.0	-14.0	2.68 H	18	37.1	2.9
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	2390.00	71.1 PK	74.0	-2.9	1.96 V	4	73.0	-1.9
2	2390.00	49.7 AV	54.0	-4.3	1.96 V	4	51.6	-1.9
3	*2412.00	111.7 PK			1.96 V	4	113.6	-1.9
4	*2412.00	101.1 AV			1.96 V	4	103.0	-1.9
5	4824.00	51.1 PK	74.0	-22.9	2.15 V	356	48.2	2.9
6	4824.00	39.5 AV	54.0	-14.5	2.15 V	356	36.6	2.9

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

Channel	TX Channel 6	Detector Function	Peak (PK) Average (AV)
Frequency Range	1GHz ~ 25GHz		

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	2390.00	68.5 PK	74.0	-5.5	1.42 H	343	70.4	-1.9
2	2390.00	52.6 AV	54.0	-1.4	1.42 H	343	54.5	-1.9
3	*2437.00	118.6 PK			1.42 H	343	120.6	-2.0
4	*2437.00	105.2 AV			1.42 H	343	107.2	-2.0
5	2483.50	71.4 PK	74.0	-2.6	1.42 H	343	73.3	-1.9
6	2483.50	53.7 AV	54.0	-0.3	1.42 H	343	55.6	-1.9
7	4874.00	53.9 PK	74.0	-20.1	2.81 H	12	51.1	2.8
8	4874.00	40.4 AV	54.0	-13.6	2.81 H	12	37.6	2.8
9	7311.00	53.8 PK	74.0	-20.2	2.58 H	19	44.9	8.9
10	7311.00	41.3 AV	54.0	-12.7	2.58 H	19	32.4	8.9
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	2390.00	71.7 PK	74.0	-2.3	1.93 V	18	73.6	-1.9
2	2390.00	50.1 AV	54.0	-3.9	1.93 V	18	52.0	-1.9
3	*2437.00	118.9 PK			1.93 V	18	120.9	-2.0
4	*2437.00	104.9 AV			1.93 V	18	106.9	-2.0
5	2483.50	71.6 PK	74.0	-2.4	1.93 V	18	73.5	-1.9
6	2483.50	51.0 AV	54.0	-3.0	1.93 V	18	52.9	-1.9
7	4874.00	53.5 PK	74.0	-20.5	2.15 V	352	50.7	2.8
8	4874.00	41.2 AV	54.0	-12.8	2.15 V	352	38.4	2.8
9	7311.00	53.5 PK	74.0	-20.5	1.46 V	316	44.6	8.9
10	7311.00	41.9 AV	54.0	-12.1	1.46 V	316	33.0	8.9

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

Channel	TX Channel 11	Detector Function	Peak (PK) Average (AV)
Frequency Range	1GHz ~ 25GHz		

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	*2462.00	113.2 PK			1.34 H	345	115.1	-1.9
2	*2462.00	101.2 AV			1.34 H	345	103.1	-1.9
3	2483.50	73.5 PK	74.0	-0.5	1.34 H	345	75.4	-1.9
4	2483.50	52.7 AV	54.0	-1.3	1.34 H	345	54.6	-1.9
5	4924.00	51.5 PK	74.0	-22.5	2.73 H	9	48.8	2.7
6	4924.00	39.8 AV	54.0	-14.2	2.73 H	9	37.1	2.7
7	7386.00	53.3 PK	74.0	-20.7	2.62 H	7	44.3	9.0
8	7386.00	41.1 AV	54.0	-12.9	2.62 H	7	32.1	9.0
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	*2462.00	112.2 PK			1.97 V	0	114.1	-1.9
2	*2462.00	100.2 AV			1.97 V	0	102.1	-1.9
3	2483.50	71.5 PK	74.0	-2.5	1.97 V	0	73.4	-1.9
4	2483.50	51.3 AV	54.0	-2.7	1.97 V	0	53.2	-1.9
5	4924.00	51.0 PK	74.0	-23.0	2.17 V	345	48.3	2.7
6	4924.00	39.5 AV	54.0	-14.5	2.17 V	345	36.8	2.7
7	7386.00	52.8 PK	74.0	-21.2	1.39 V	305	43.8	9.0
8	7386.00	41.2 AV	54.0	-12.8	1.39 V	305	32.2	9.0

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.

802.11ax (HE40)

Channel	TX Channel 3	Detector Function	Peak (PK) Average (AV)
Frequency Range	1GHz ~ 25GHz		

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	2390.00	67.7 PK	74.0	-6.3	1.42 H	342	69.6	-1.9
2	2390.00	53.7 AV	54.0	-0.3	1.42 H	342	55.6	-1.9
3	*2422.00	109.8 PK			1.42 H	342	111.7	-1.9
4	*2422.00	97.4 AV			1.42 H	342	99.3	-1.9
5	4844.00	50.9 PK	74.0	-23.1	2.74 H	6	48.0	2.9
6	4844.00	39.4 AV	54.0	-14.6	2.74 H	6	36.5	2.9
7	7266.00	53.6 PK	74.0	-20.4	2.59 H	13	44.8	8.8
8	7266.00	41.5 AV	54.0	-12.5	2.59 H	13	32.7	8.8
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	2390.00	65.4 PK	74.0	-8.6	1.89 V	358	67.3	-1.9
2	2390.00	52.5 AV	54.0	-1.5	1.89 V	358	54.4	-1.9
3	*2422.00	109.1 PK			1.89 V	358	111.0	-1.9
4	*2422.00	96.8 AV			1.89 V	358	98.7	-1.9
5	4844.00	50.5 PK	74.0	-23.5	2.14 V	342	47.6	2.9
6	4844.00	39.2 AV	54.0	-14.8	2.14 V	342	36.3	2.9
7	7266.00	52.5 PK	74.0	-21.5	1.34 V	301	43.7	8.8
8	7266.00	41.2 AV	54.0	-12.8	1.34 V	301	32.4	8.8

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

Channel	TX Channel 6	Detector Function	Peak (PK) Average (AV)
Frequency Range	1GHz ~ 25GHz		

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	2390.00	67.7 PK	74.0	-6.3	1.25 H	348	69.6	-1.9
2	2390.00	53.6 AV	54.0	-0.4	1.25 H	348	55.5	-1.9
3	*2437.00	111.1 PK			1.25 H	348	113.1	-2.0
4	*2437.00	98.9 AV			1.25 H	348	100.9	-2.0
5	2483.50	70.1 PK	74.0	-3.9	1.25 H	348	72.0	-1.9
6	2483.50	51.6 AV	54.0	-2.4	1.25 H	348	53.5	-1.9
7	4874.00	53.8 PK	74.0	-20.2	2.78 H	3	51.0	2.8
8	4874.00	40.4 AV	54.0	-13.6	2.78 H	3	37.6	2.8
9	7311.00	53.7 PK	74.0	-20.3	2.57 H	14	44.8	8.9
10	7311.00	41.0 AV	54.0	-13.0	2.57 H	14	32.1	8.9
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	2390.00	66.0 PK	74.0	-8.0	2.07 V	12	67.9	-1.9
2	2390.00	52.3 AV	54.0	-1.7	2.07 V	12	54.2	-1.9
3	*2437.00	110.5 PK			2.07 V	12	112.5	-2.0
4	*2437.00	98.1 AV			2.07 V	12	100.1	-2.0
5	2483.50	68.1 PK	74.0	-5.9	2.07 V	12	70.0	-1.9
6	2483.50	50.2 AV	54.0	-3.8	2.07 V	12	52.1	-1.9
7	4874.00	53.0 PK	74.0	-21.0	2.20 V	345	50.2	2.8
8	4874.00	40.9 AV	54.0	-13.1	2.20 V	345	38.1	2.8
9	7311.00	53.0 PK	74.0	-21.0	1.47 V	313	44.1	8.9
10	7311.00	41.5 AV	54.0	-12.5	1.47 V	313	32.6	8.9

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

Channel	TX Channel 9	Detector Function	Peak (PK) Average (AV)
Frequency Range	1GHz ~ 25GHz		

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	*2452.00	110.1 PK			1.35 H	344	112.0	-1.9
2	*2452.00	98.0 AV			1.35 H	344	99.9	-1.9
3	2483.50	73.5 PK	74.0	-0.5	1.35 H	344	75.4	-1.9
4	2483.50	50.8 AV	54.0	-3.2	1.35 H	344	52.7	-1.9
5	4904.00	51.6 PK	74.0	-22.4	2.68 H	7	48.9	2.7
6	4904.00	39.8 AV	54.0	-14.2	2.68 H	7	37.1	2.7
7	7356.00	54.2 PK	74.0	-19.8	2.61 H	2	45.3	8.9
8	7356.00	41.9 AV	54.0	-12.1	2.61 H	2	33.0	8.9
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	*2452.00	106.8 PK			2.07 V	1	108.7	-1.9
2	*2452.00	96.1 AV			2.07 V	1	98.0	-1.9
3	2483.50	72.9 PK	74.0	-1.1	2.07 V	1	74.8	-1.9
4	2483.50	49.6 AV	54.0	-4.4	2.07 V	1	51.5	-1.9
5	4904.00	50.8 PK	74.0	-23.2	2.14 V	357	48.1	2.7
6	4904.00	39.4 AV	54.0	-14.6	2.14 V	357	36.7	2.7
7	7356.00	52.6 PK	74.0	-21.4	1.36 V	312	43.7	8.9
8	7356.00	41.1 AV	54.0	-12.9	1.36 V	312	32.2	8.9

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

Below 1GHz Data:

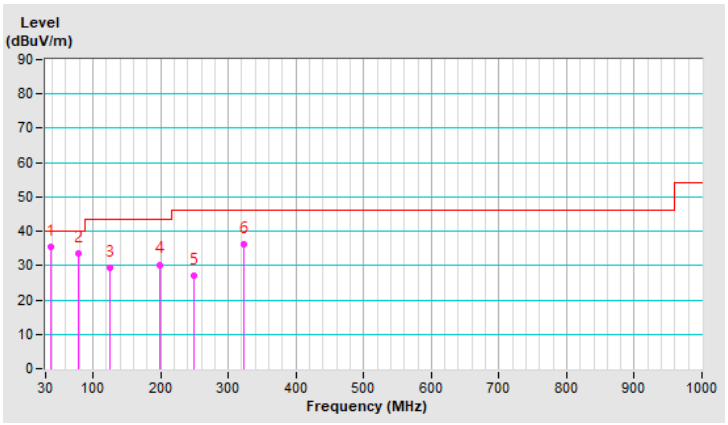
802.11b

CHANNEL	TX Channel 6	**DETECTOR FUNCTION**	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	**FREQ. (MHz)**	**EMISSION LEVEL (dBuV/m)**	**LIMIT (dBuV/m)**	**MARGIN (dB)**	**ANTENNA HEIGHT (m)**	**TABLE ANGLE (Degree)**	**RAW VALUE (dBuV)**	**CORRECTION FACTOR (dB/m)**
1	36.86	35.6 QP	40.0	-4.4	2.00 H	241	44.1	-8.5
2	78.32	33.6 QP	40.0	-6.4	2.00 H	187	45.8	-12.2
3	124.99	29.5 QP	43.5	-14.0	2.00 H	134	38.5	-9.0
4	198.39	30.3 QP	43.5	-13.2	2.00 H	198	40.7	-10.4
5	249.99	26.9 QP	46.0	-19.1	1.50 H	221	35.3	-8.4
6	323.43	36.3 QP	46.0	-9.7	1.50 H	266	41.8	-5.5

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 of frequency range 30MHz~1000MHz.
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.

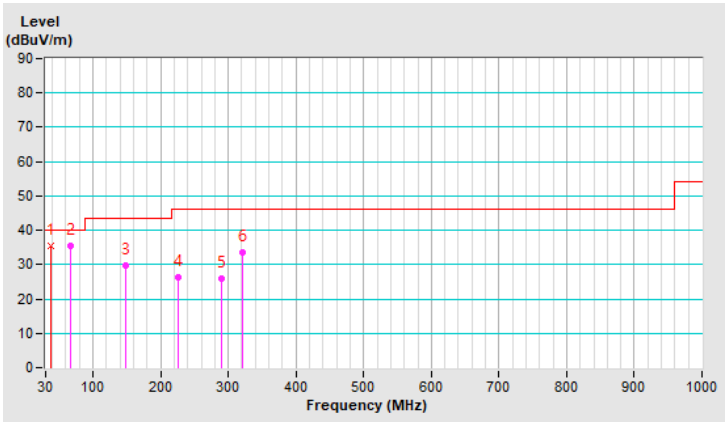


CHANNEL	TX Channel 6	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	38.61	35.3 QP	40.0	-4.7	1.46 V	223	43.6	-8.3
2	67.35	35.5 QP	40.0	-4.5	1.00 V	124	45.0	-9.5
3	147.97	29.6 QP	43.5	-13.9	1.00 V	223	36.7	-7.1
4	225.96	26.2 QP	46.0	-19.8	1.00 V	143	36.0	-9.8
5	289.23	25.8 QP	46.0	-20.2	1.50 V	212	32.5	-6.7
6	321.17	33.4 QP	46.0	-12.6	2.00 V	154	38.9	-5.5

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 of frequency range 30MHz~1000MHz.
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.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver R&S	ESCS 30	847124/029	Oct. 23, 2019	Oct. 22, 2020
Line-Impedance Stabilization Network (for EUT) R&S	ESH3-Z5	848773/004	Oct. 23, 2019	Oct. 22, 2020
Line-Impedance Stabilization Network (for Peripheral) R&S	ESH3-Z5	835239/001	Mar. 19, 2020	Mar. 18, 2021
50 ohms Terminator	50	3	Oct. 23, 2019	Oct. 22, 2020
RF Cable	5D-FB	COCCAB-001	Sep. 27, 2019	Sep. 26, 2020
Fixed attenuator EMCI	STI02-2200-10	005	Aug. 30, 2019	Aug. 29, 2020
Software BVADT	BVADT_Cond_ V7.3.7.4	NA	NA	NA

Note:
1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Conduction 1.
3. Tested Date: June 09, 2020

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.

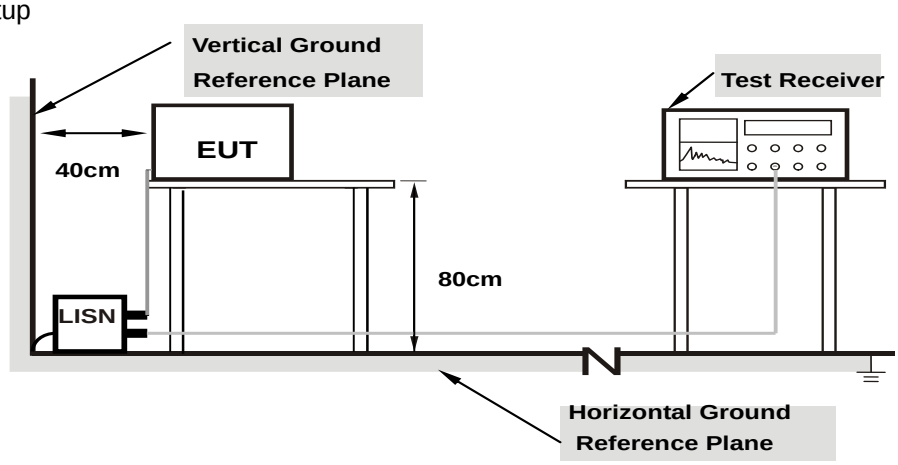
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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.

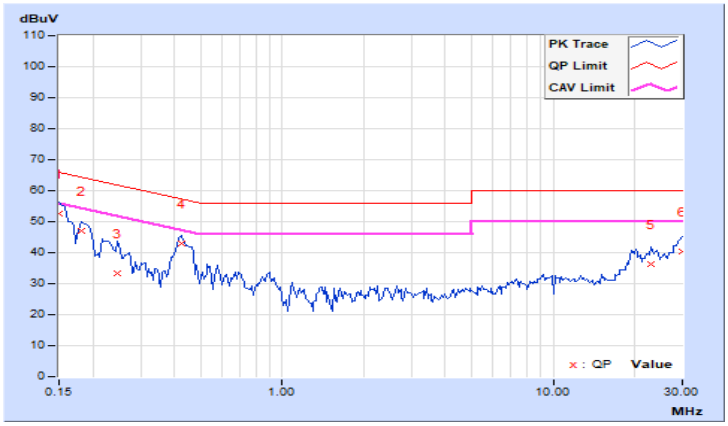
4.2.7 Test Results

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

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.01	42.71	32.23	52.72	42.24	66.00	56.00	-13.28	-13.76
2	0.18125	10.02	37.08	18.11	47.10	28.13	64.43	54.43	-17.33	-26.30
3	0.24766	10.02	23.46	5.97	33.48	15.99	61.84	51.84	-28.36	-35.85
4	0.42344	10.03	33.08	28.90	43.11	38.93	57.38	47.38	-14.27	-8.45
5	22.84375	11.25	25.02	20.13	36.27	31.38	60.00	50.00	-23.73	-18.62
6	29.85547	11.50	28.82	23.68	40.32	35.18	60.00	50.00	-19.68	-14.82

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

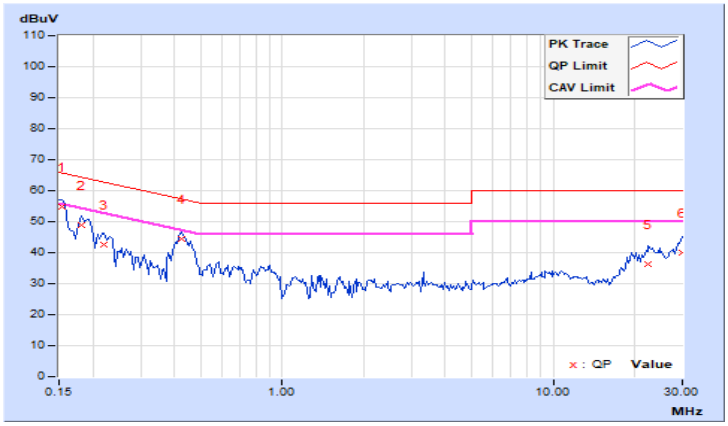


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	10.00	44.78	35.12	54.78	45.12	65.79	55.79	-11.01	-10.67
2	0.18125	10.01	38.72	20.01	48.73	30.02	64.43	54.43	-15.70	-24.41
3	0.22031	10.01	32.72	14.95	42.73	24.96	62.81	52.81	-20.08	-27.85
4	**0.42734**	**10.01**	**34.48**	**30.20**	**44.49**	**40.21**	**57.30**	**47.30**	**-12.81**	**-7.09**
5	22.46484	10.94	25.24	20.15	36.18	31.09	60.00	50.00	-23.82	-18.91
6	29.99609	11.12	28.84	23.84	39.96	34.96	60.00	50.00	-20.04	-15.04

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

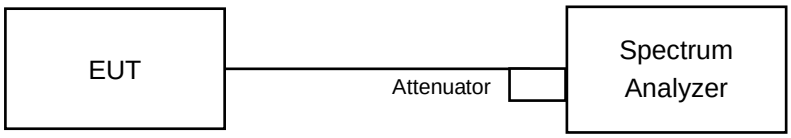


4.3 6dB Bandwidth Measurement

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 from Test 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

CDD Mode:

802.11b

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	7.11	7.11	0.5	Pass
6	2437	7.1	7.1	0.5	Pass
11	2462	7.09	7.11	0.5	Pass

802.11g

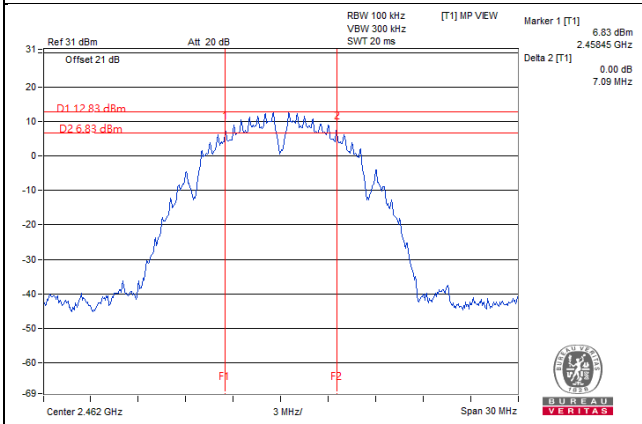
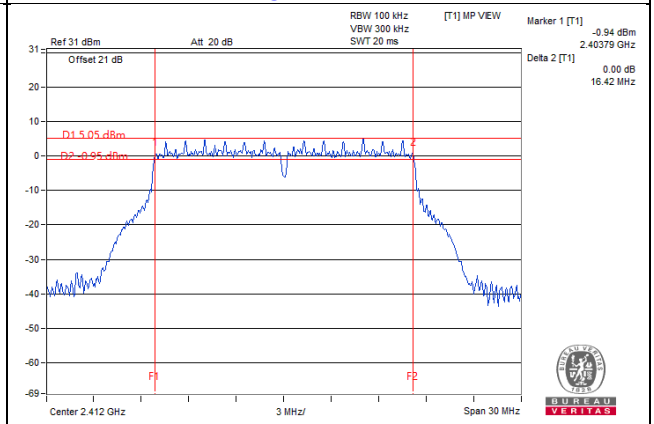
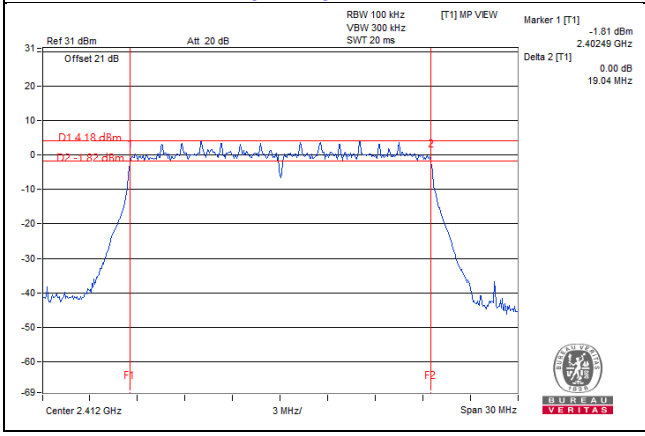
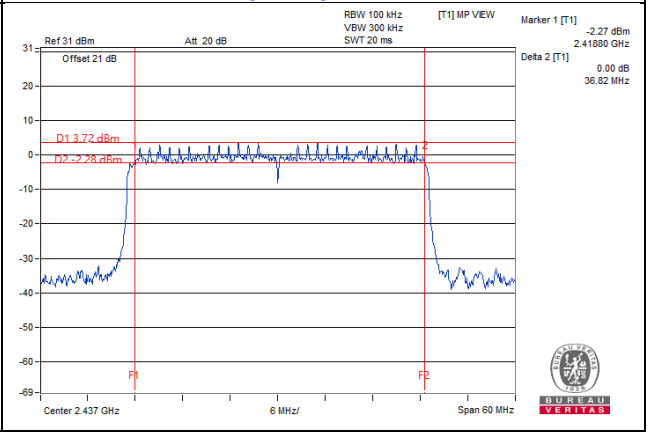
Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	16.43	16.42	0.5	Pass
6	2437	16.44	16.43	0.5	Pass
11	2462	16.43	16.45	0.5	Pass

802.11ax (HE20)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	19.07	19.04	0.5	Pass
6	2437	19.05	19.08	0.5	Pass
11	2462	19.08	19.07	0.5	Pass

802.11ax (HE40)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
3	2422	37.49	37.51	0.5	Pass
6	2437	36.82	37.17	0.5	Pass
9	2452	37.52	37.47	0.5	Pass

Spectrum Plot of Worst Value	
802.11b_Chain 0 / CH11	**802.11g_Chain 1 / CH1**
	
802.11ax (HE20)_Chain 1 / CH1	**802.11ax (HE40)_Chain 0 / CH6**
	

4.4 Conducted Output Power Measurement

4.4.1 Limits of Conducted Output Power Measurement

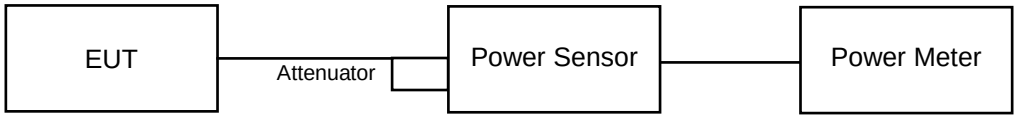
For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30dBm)

Per KDB 662911 D01 Multiple Transmitter Output Method of conducted output power measurement on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT};
Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.

For power measurements on all other devices: Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

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

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

CDD Mode:

802.11b

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	19.71	19.63	185.374	22.68	28	Pass
6	2437	22.45	22.27	344.448	25.37	28	Pass
11	2462	19.67	19.56	183.048	22.63	28	Pass

Note: The Max gain is 8dBi > 6dBi, therefore the limit needs to reduce, so the power limit shall be reduced to 30-(8-6) = 28dBm.

802.11g

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	16.19	15.81	79.698	19.01	28	Pass
6	2437	20.07	20.11	204.19	23.10	28	Pass
11	2462	16.59	16.41	89.356	19.51	28	Pass

Note: The Max gain is 8dBi > 6dBi, therefore the limit needs to reduce, so the power limit shall be reduced to 30-(8-6) = 28dBm.

VHT20

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	15.53	15.43	70.641	18.49	28	Pass
6	2437	19.92	19.87	195.226	22.91	28	Pass
11	2462	15.97	15.90	78.441	18.95	28	Pass

Note: The Max gain is 8dBi > 6dBi, therefore the limit needs to reduce, so the power limit shall be reduced to 30-(8-6) = 28dBm.

VHT40

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
3	2422	14.35	13.89	51.718	17.14	28	Pass
6	2437	17.22	17.02	103.073	20.13	28	Pass
9	2452	15.61	15.06	68.454	18.35	28	Pass

Note: The Max gain is 8dBi > 6dBi, therefore the limit needs to reduce, so the power limit shall be reduced to 30-(8-6) = 28dBm.

802.11ax (HE20)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	15.74	15.66	74.31	18.71	28	Pass
6	2437	20.17	20.15	207.506	23.17	28	Pass
11	2462	16.23	16.11	82.808	19.18	28	Pass

Note: The Max gain is 8dBi > 6dBi, therefore the limit needs to reduce, so the power limit shall be reduced to 30-(8-6) = 28dBm.

802.11ax (HE40)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
3	2422	14.59	14.17	54.896	17.40	28	Pass
6	2437	17.45	17.24	108.557	20.36	28	Pass
9	2452	15.83	15.26	71.856	18.56	28	Pass

Note: The Max gain is 8dBi > 6dBi, therefore the limit needs to reduce, so the power limit shall be reduced to 30-(8-6) = 28dBm.

Beamforming Mode:

VHT20

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	15.53	15.43	70.641	18.49	24.99	Pass
6	2437	19.92	19.87	195.226	22.91	24.99	Pass
11	2462	15.97	15.90	78.441	18.95	24.99	Pass

Note: The directional gain 8 dBi + 10log(2) = 11.01 dBi > 6dBi, so the power limit shall be reduced to 30-(11.01-6) = 24.99 dBm.

VHT40

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
3	2422	14.35	13.89	51.718	17.14	24.99	Pass
6	2437	17.22	17.02	103.073	20.13	24.99	Pass
9	2452	15.61	15.06	68.454	18.35	24.99	Pass

Note: The directional gain 8 dBi + 10log(2) = 11.01 dBi > 6dBi, so the power limit shall be reduced to 30-(11.01-6) = 24.99 dBm.

802.11ax (HE20)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	15.74	15.66	74.31	18.71	24.99	Pass
6	2437	20.17	20.15	207.506	23.17	24.99	Pass
11	2462	16.23	16.11	82.808	19.18	24.99	Pass

Note: The directional gain 8 dBi + 10log(2) = 11.01 dBi > 6dBi, so the power limit shall be reduced to 30-(11.01-6) = 24.99 dBm.

802.11ax (HE40)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
3	2422	14.59	14.17	54.896	17.40	24.99	Pass
6	2437	17.45	17.24	108.557	20.36	24.99	Pass
9	2452	15.83	15.26	71.856	18.56	24.99	Pass

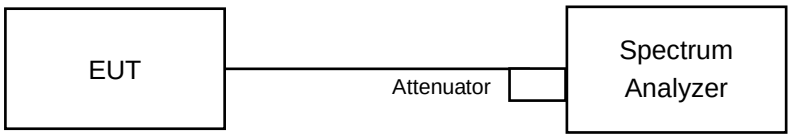
Note: The directional gain 8 dBi + 10log(2) = 11.01 dBi > 6dBi, so the power limit shall be reduced to 30-(11.01-6) = 24.99 dBm.

4.5 Power Spectral Density Measurement

4.5.1 Limits of Power Spectral Density Measurement

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

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

For 802.11b, 802.11g

a. Set instrument center frequency to DTS channel center frequency.
b. Set span to at least 1.5 times the OBW.
c. Set RBW to: 3 kHz ≤ RBW ≤ 100 kHz. .
d. Set VBW ≥3 x RBW.
e. Detector = power averaging (RMS) or sample detector (when RMS not available).
f. Ensure that the number of measurement points in the sweep ≥ 2 x span/RBW.
g. Sweep time = auto couple.
h. Employ trace averaging (RMS) mode over a minimum of 100 traces.
i. Use the peak marker function to determine the maximum amplitude level.

For 802.11ax (HE20), 802.11ax (HE40)

a. Measure the duty cycle (x).
b. Set instrument center frequency to DTS channel center frequency.
c. Set span to at least 1.5 times the OBW.
d. Set RBW to: 3 kHz ≤ RBW ≤ 100 kHz..
e. Set VBW ≥3 x RBW.
f. Detector = power averaging (RMS) or sample detector (when RMS not available).
g. Ensure that the number of measurement points in the sweep ≥ 2 x span/RBW.
h. Sweep time = auto couple.
i. Do not use sweep triggering. Allow sweep to “free run”.
j. Employ trace averaging (RMS) mode over a minimum of 100 traces.
k. Use the peak marker function to determine the maximum amplitude level.
l. Add 10 log (1/x), where x is the duty cycle measured in step (a, to the measured PSD to compute the average PSD during the actual transmission time.

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

CDD Mode:

802.11b

Chan.	Chan. Freq. (MHz)	PSD (dBm/3kHz)		Total PSD (mW/3kHz)	Total PSD (dBm/3kHz)	PSD Limit (dBm/3kHz)	Pass / Fail
		Chain 0	Chain 1				
1	2412	-11.12	-11.51	0.14791	-8.30	2.99	PASS
6	2437	-9.03	-8.10	0.2799	-5.53	2.99	PASS
11	2462	-10.99	-11.05	0.15812	-8.01	2.99	PASS

Note: The directional gain 8 dBi + 10log(2) = 11.01 dBi > 6dBi, so the power density limit shall be reduced to 8-(11.01-6) = 2.99 dBm.

802.11g

Chan.	Chan. Freq. (MHz)	PSD (dBm/3kHz)		Total PSD (mW/3kHz)	Total PSD (dBm/3kHz)	PSD Limit (dBm/3kHz)	Pass / Fail
		Chain 0	Chain 1				
1	2412	-16.33	-15.94	0.04875	-13.12	2.99	PASS
6	2437	-12.10	-10.99	0.14125	-8.50	2.99	PASS
11	2462	-14.80	-16.18	0.05715	-12.43	2.99	PASS

Note: The directional gain 8 dBi + 10log(2) = 11.01 dBi > 6dBi, so the power density limit shall be reduced to 8-(11.01-6) = 2.99 dBm.

802.11ax (HE20)

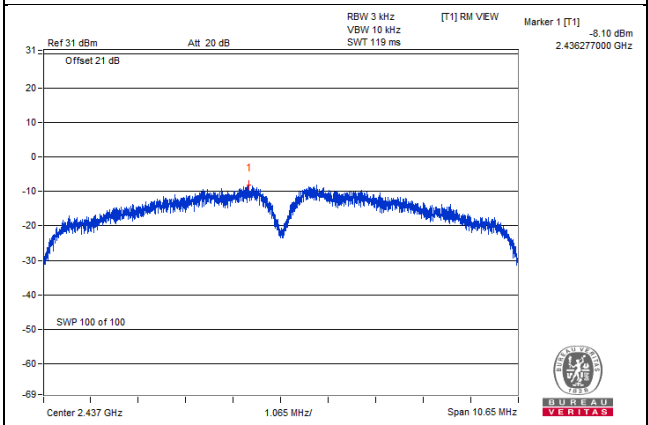
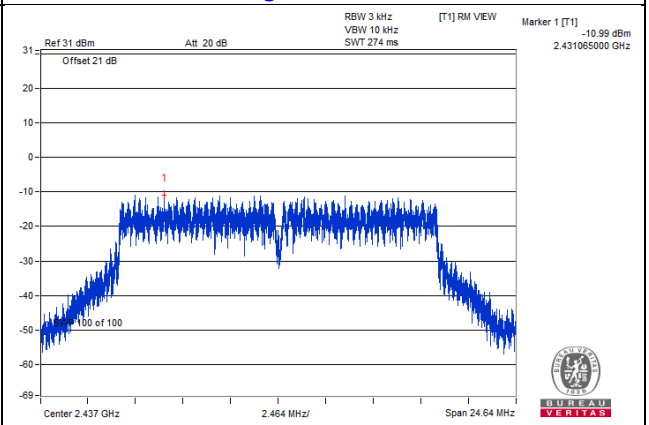
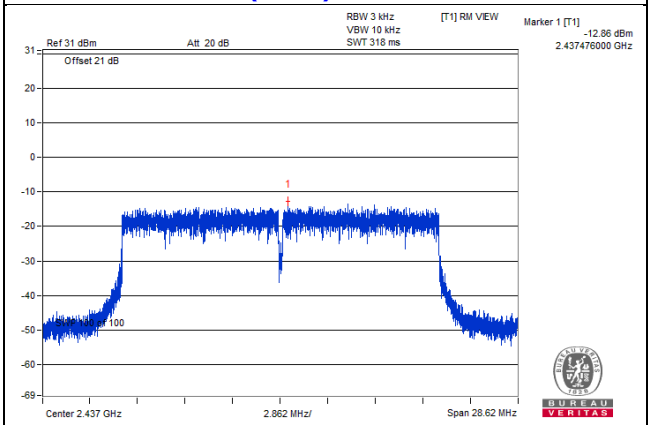
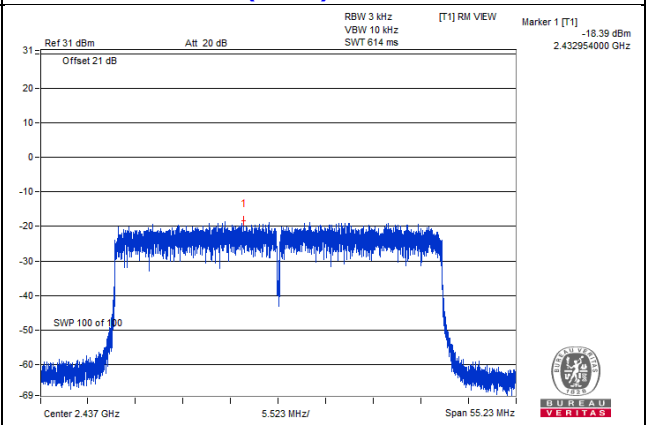
Chan.	Chan. Freq. (MHz)	PSD (dBm/3kHz)		Duty Factor (dB)	Total PSD (mW/3kHz)	Total PSD (dBm/3kHz)	PSD Limit (dBm/3kHz)	Pass / Fail
		Chain 0	Chain 1					
1	2412	-17.83	-17.89	0.10	0.0335	-14.75	2.99	PASS
6	2437	-13.60	-12.86	0.10	0.09772	-10.10	2.99	PASS
11	2462	-17.30	-16.99	0.10	0.03954	-14.03	2.99	PASS

Note: 1. The directional gain 8 dBi + 10log(2) = 11.01 dBi > 6dBi, so the power density limit shall be reduced to 8-(11.01-6) = 2.99 dBm.
2. Refer to section 3.3 for duty cycle spectrum plot.

802.11ax (HE40)

Chan.	Chan. Freq. (MHz)	PSD (dBm/3kHz)		Duty Factor (dB)	Total PSD (mW/3kHz)	Total PSD (dBm/3kHz)	PSD Limit (dBm/3kHz)	Pass / Fail
		Chain 0	Chain 1					
3	2422	-21.52	-21.44	0.23	0.014997	-18.24	2.99	PASS
6	2437	-18.39	-19.03	0.23	0.02844	-15.46	2.99	PASS
9	2452	-20.13	-20.54	0.23	0.019543	-17.09	2.99	PASS

Note: 1. The directional gain 8 dBi + 10log(2) = 11.01 dBi > 6dBi, so the power density limit shall be reduced to 8-(11.01-6) = 2.99 dBm.
2. Refer to section 3.3 for duty cycle spectrum plot.

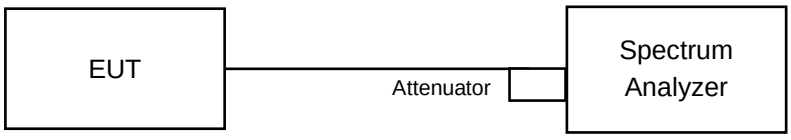
Spectrum Plot of Worst Value	
802.11b_Chain 1 / CH6	**802.11g_Chain 1 / CH6**
	
802.11ax (HE20)_Chain 1 / CH6	**802.11ax (HE40)_Chain 0 / CH6**
	

4.6 Conducted Out of Band Emission Measurement

4.6.1 Limits of Conducted Out of Band Emission Measurement

Below 30dB 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

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

MEASUREMENT PROCEDURE OOBE

1. Set RBW = 100 kHz.
2. Set VBW ≥ 300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

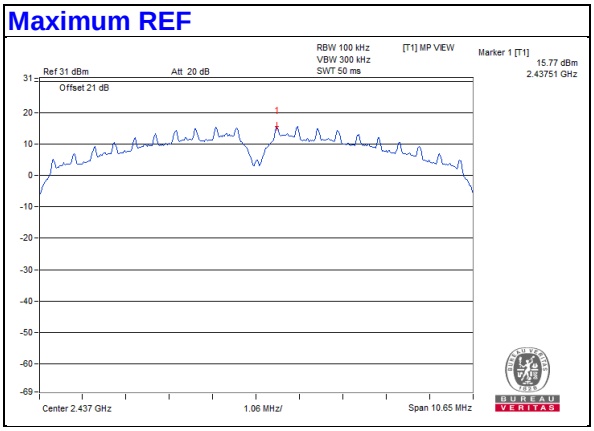
Same as Item 4.3.6

4.6.7 Test Results (Mode 1)

The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 30dB offset below D1. It shows compliance with the requirement.

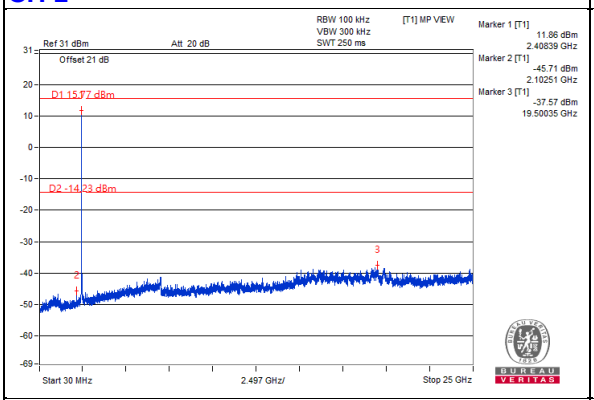
802.11b

Maximum REF

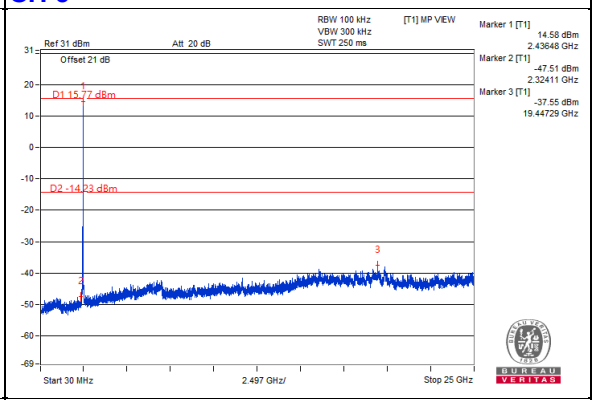


Chain 0

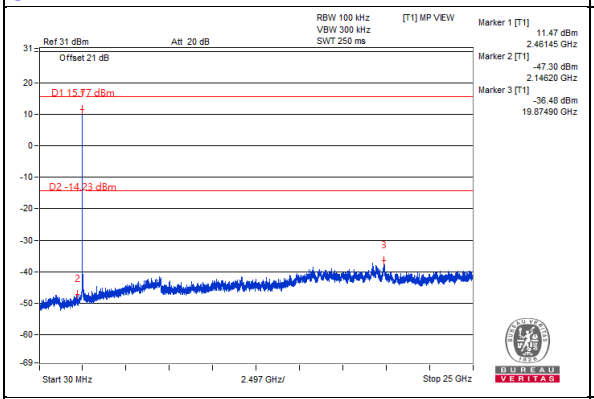
CH 1



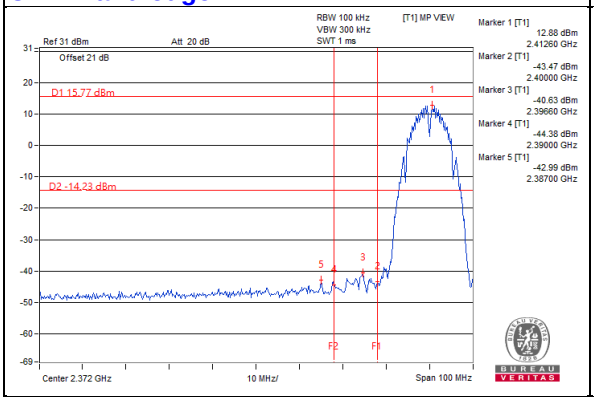
CH 6



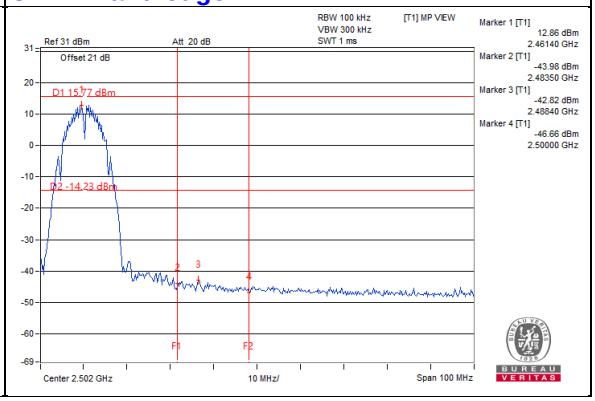
CH 11



CH 1 Band edge

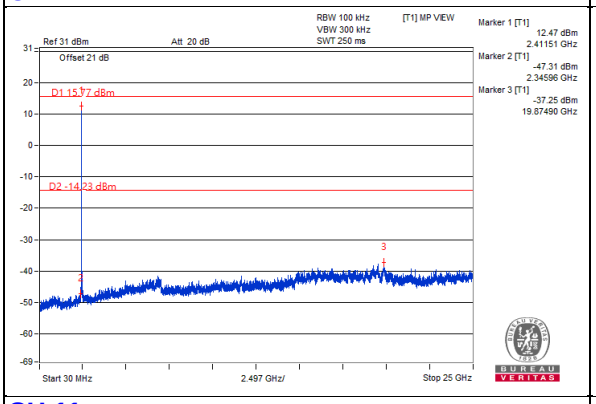


CH 11 Band edge

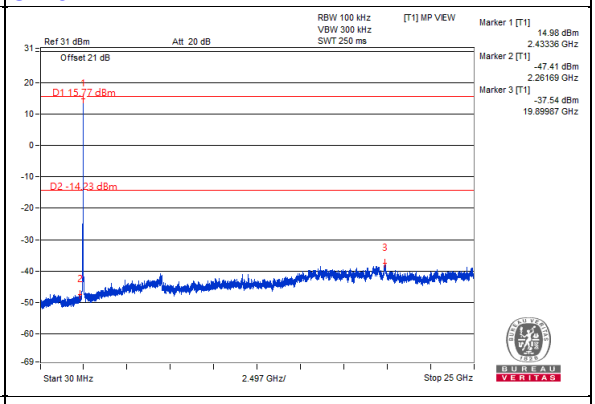


Chain 1

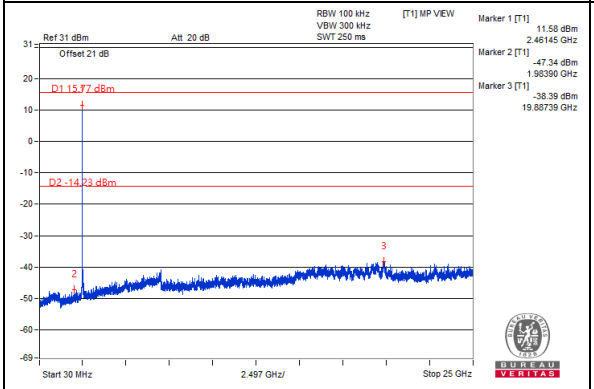
CH 1



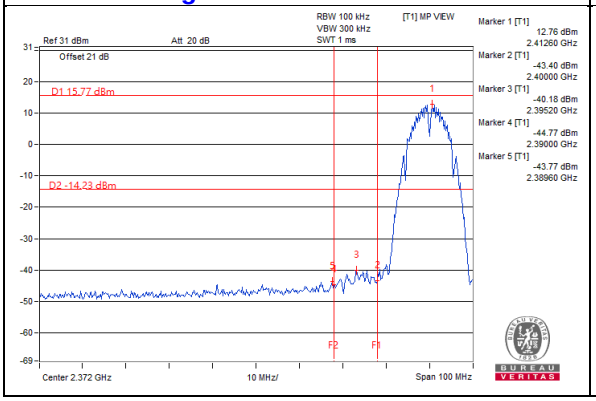
CH 6



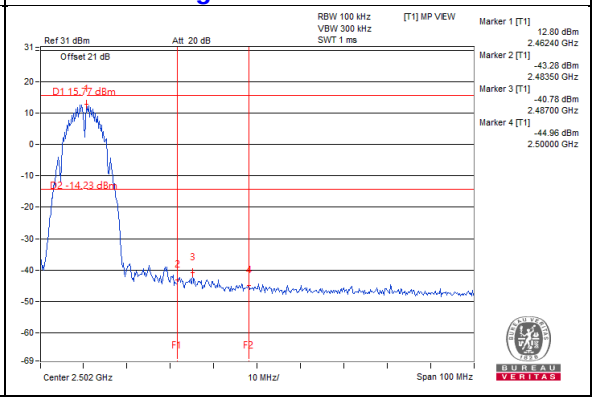
CH 11



CH 1 Band edge

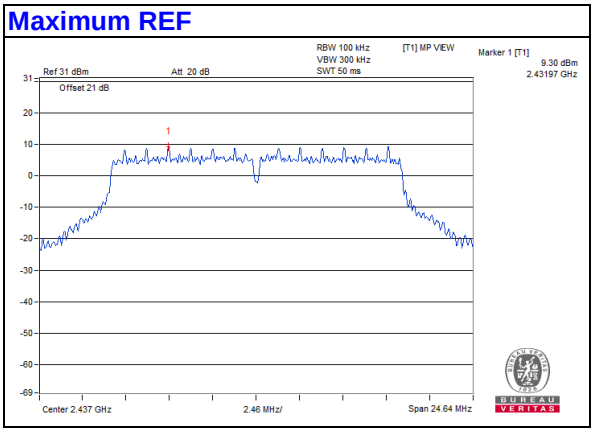


CH 11 Band edge



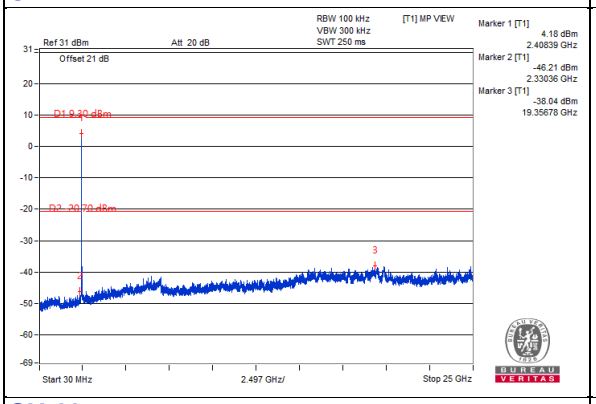
802.11g

Maximum REF

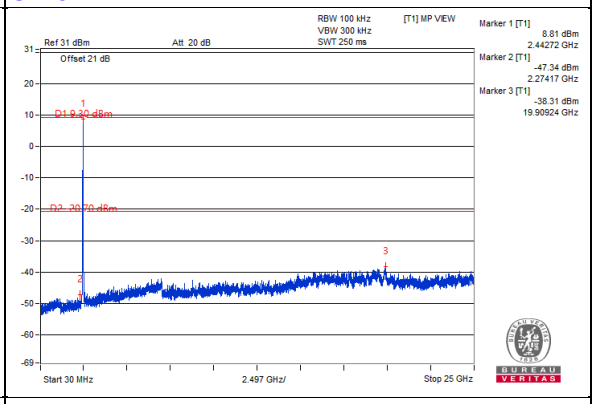


Chain 0

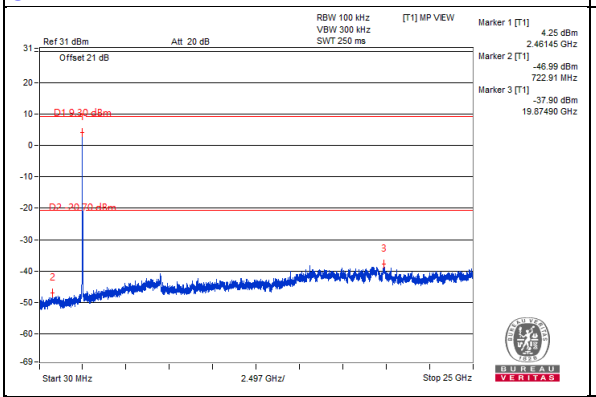
CH 1



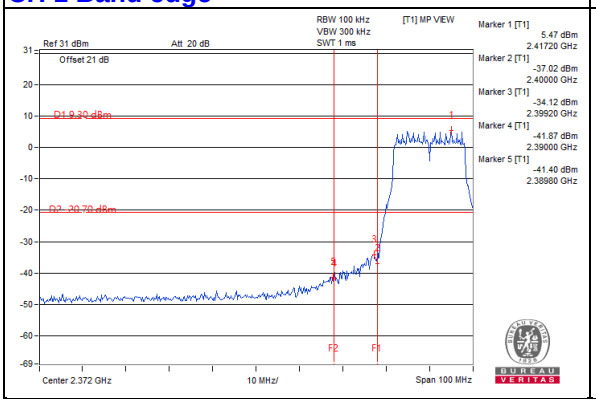
CH 6



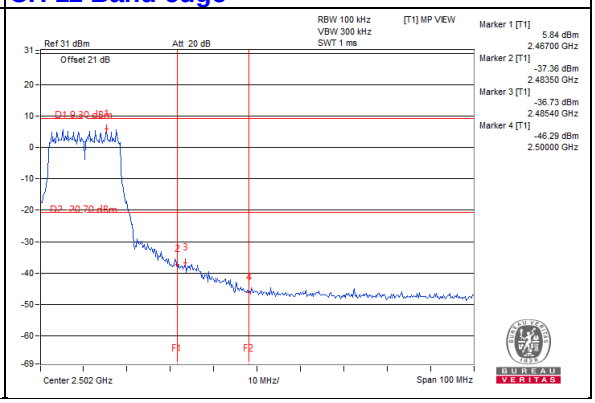
CH 11



CH 1 Band edge

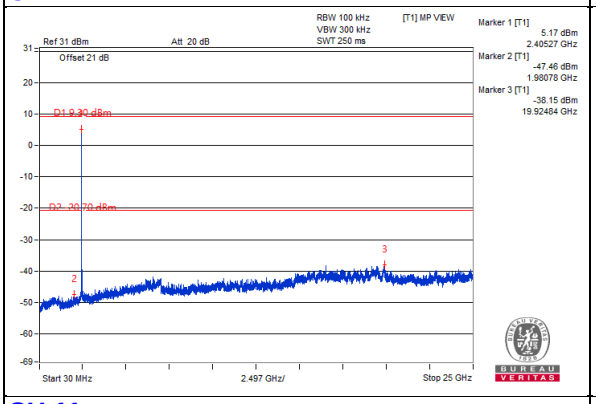


CH 11 Band edge

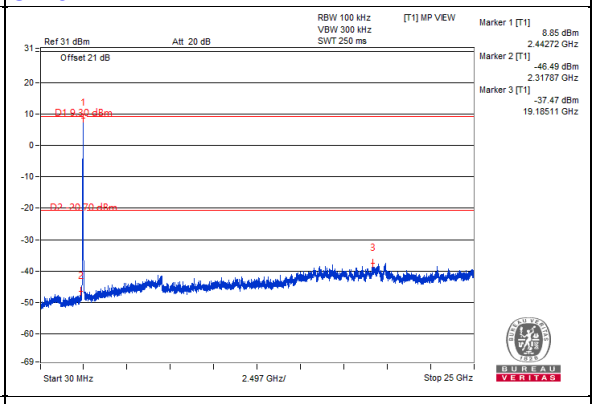


Chain 1

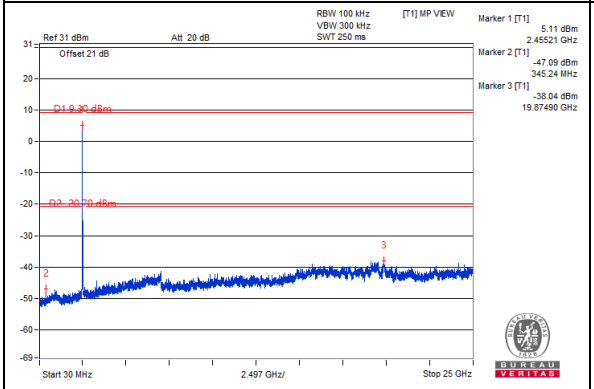
CH 1



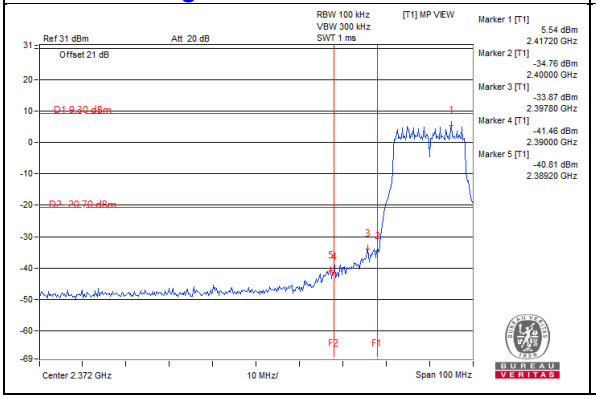
CH 6



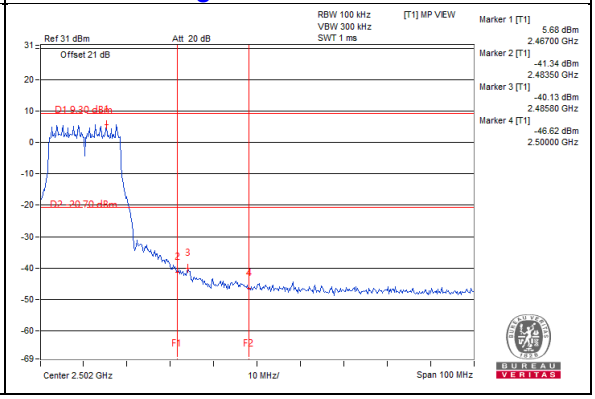
CH 11



CH 1 Band edge

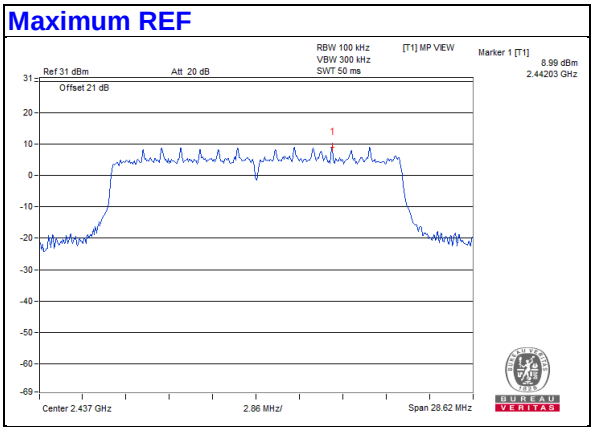


CH 11 Band edge



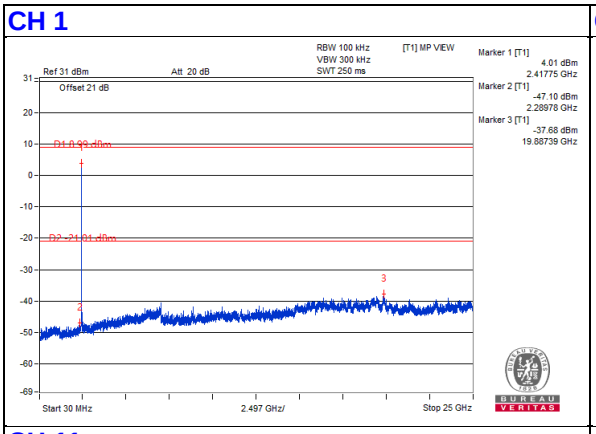
802.11ax (HE20)

Maximum REF

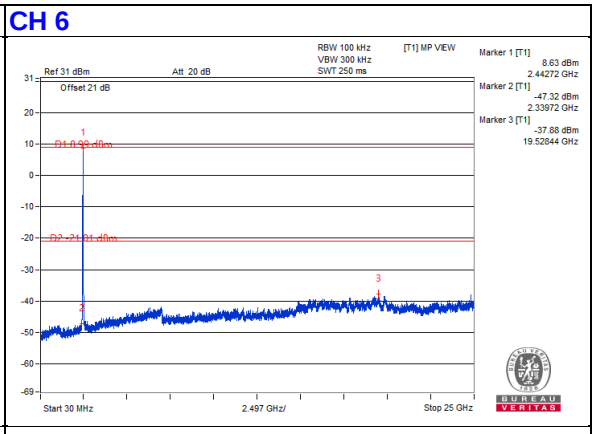


Chain 0

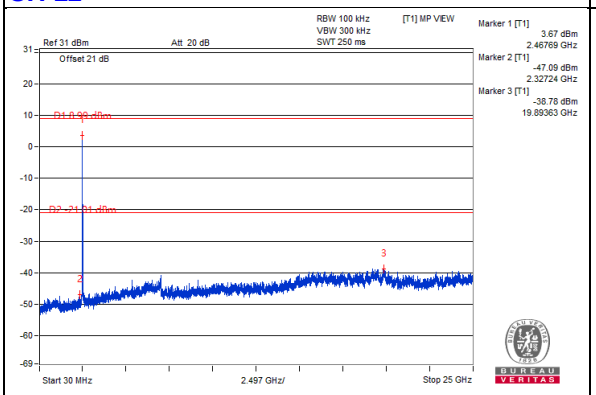
CH 1



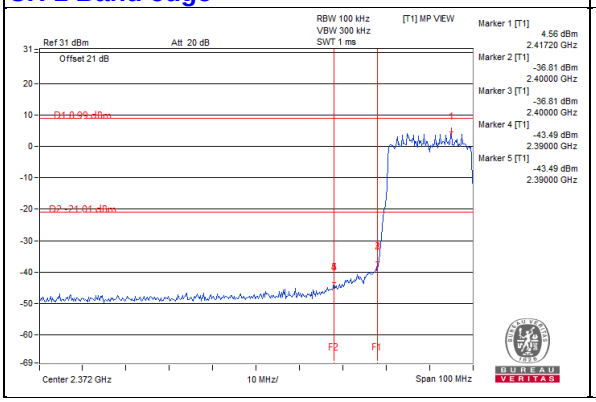
CH 6



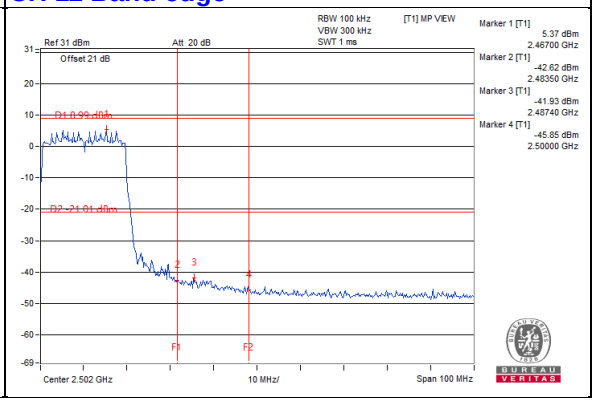
CH 11



CH 1 Band edge

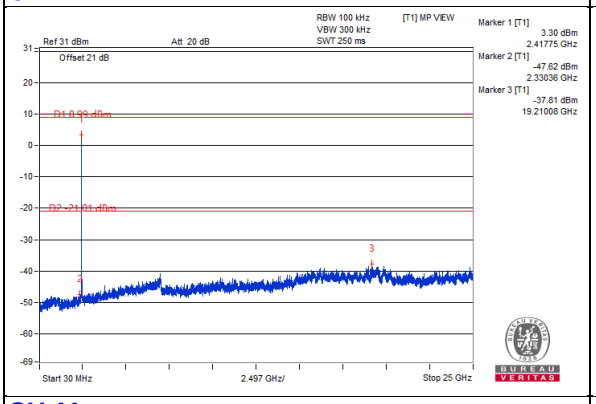


CH 11 Band edge

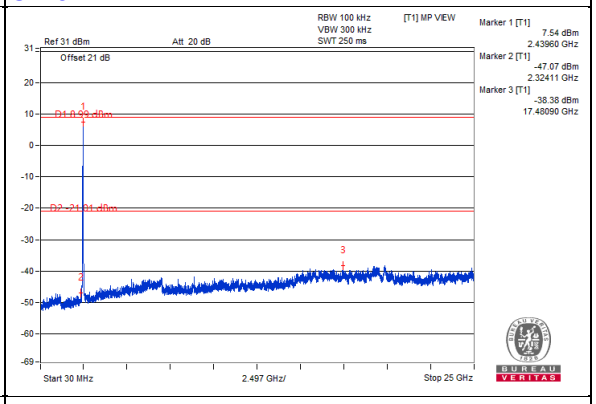


Chain 1

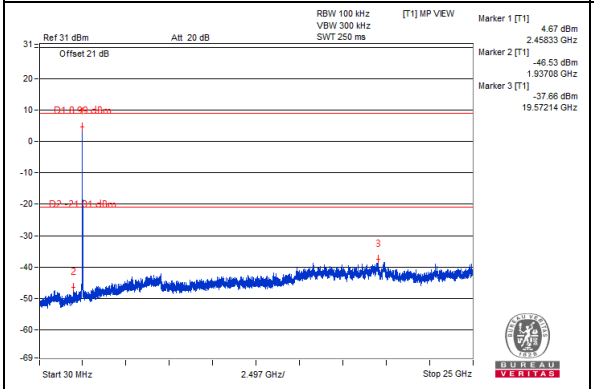
CH 1



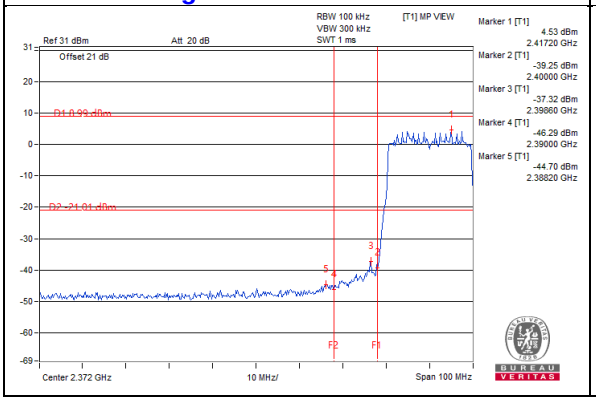
CH 6



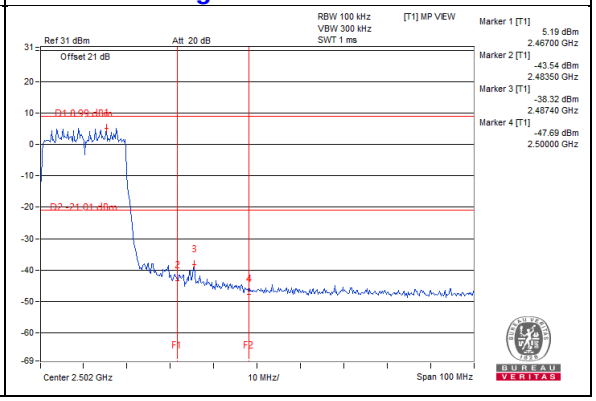
CH 11



CH 1 Band edge

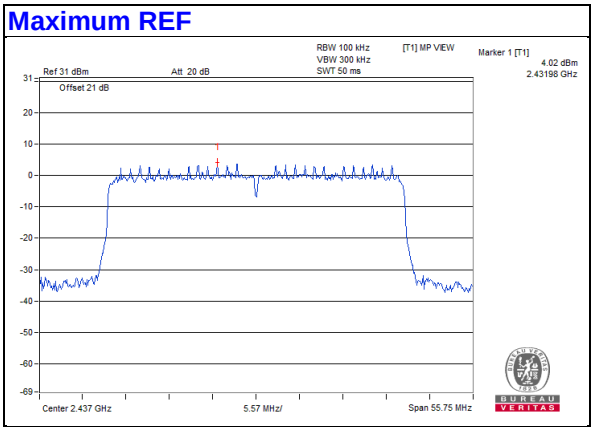


CH 11 Band edge



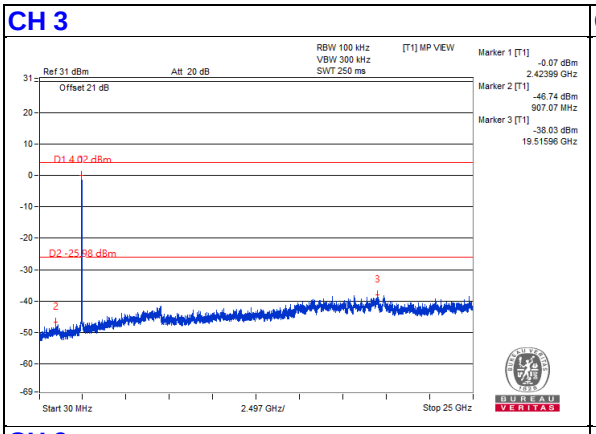
802.11ax (HE40)

Maximum REF

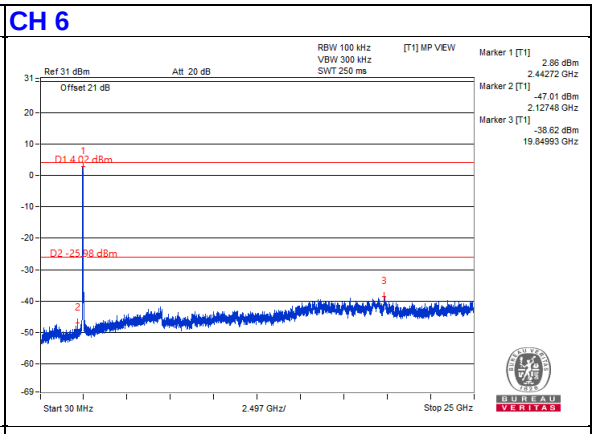


Chain 0

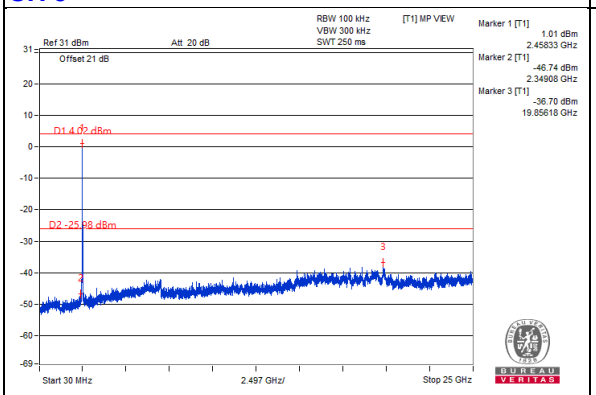
CH 3



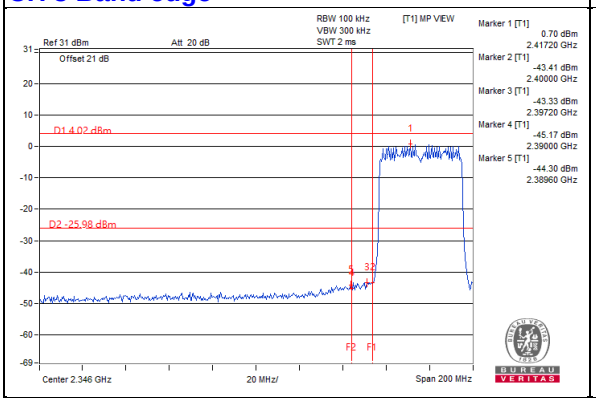
CH 6



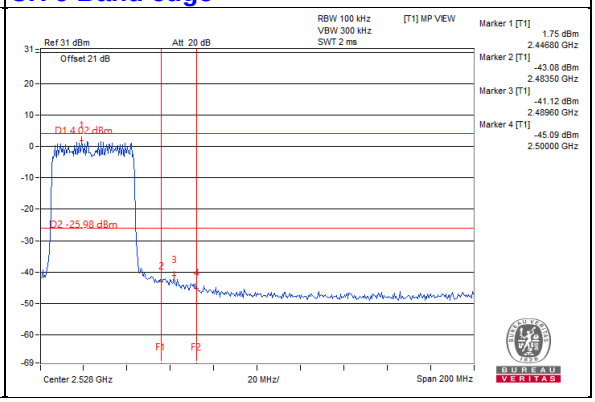
CH 9



CH 3 Band edge

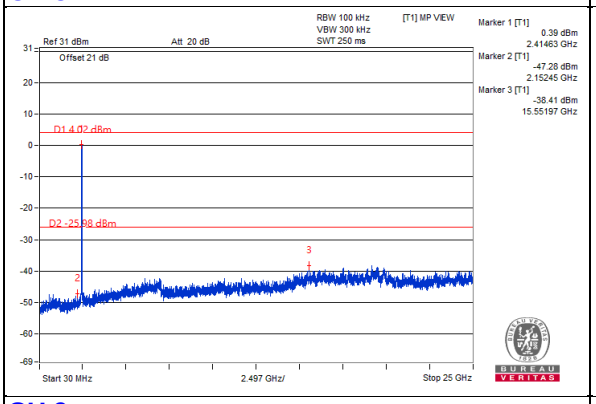


CH 9 Band edge

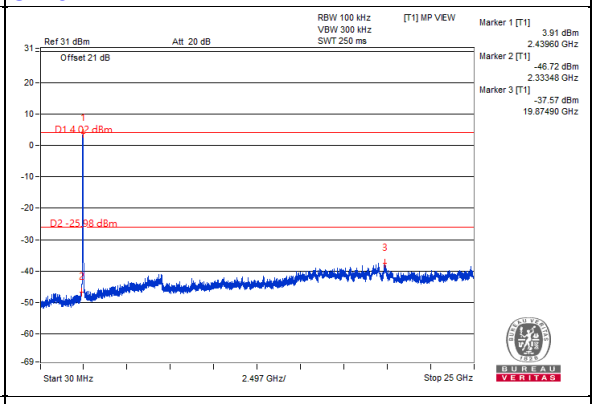


Chain 1

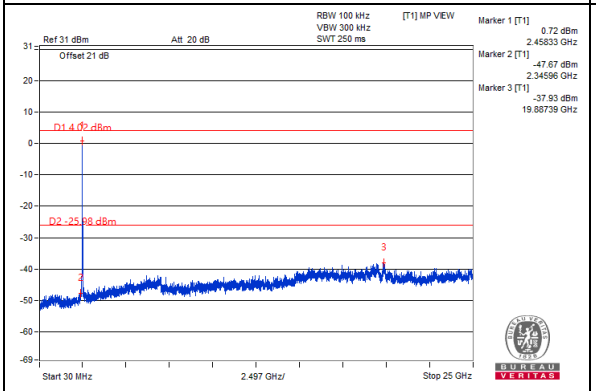
CH 3



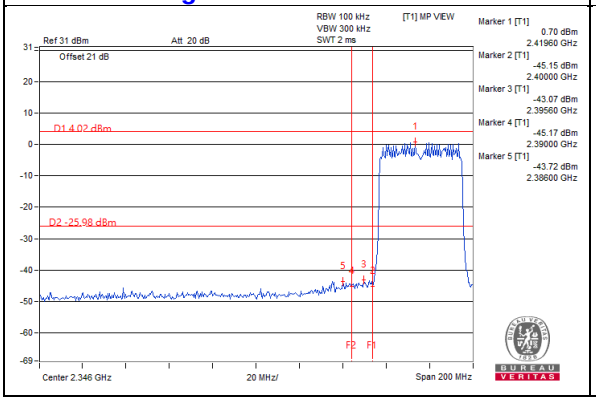
CH 6



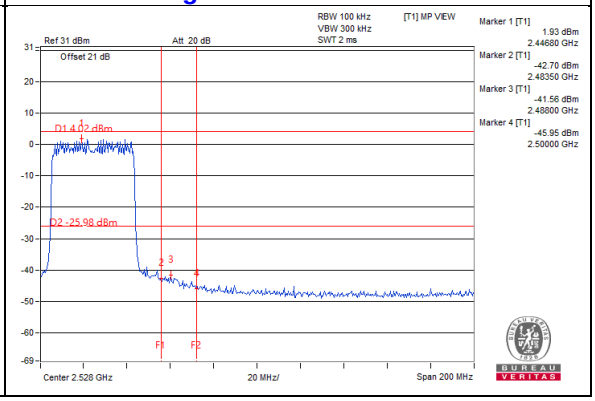
CH 9



CH 3 Band edge



CH 9 Band edge

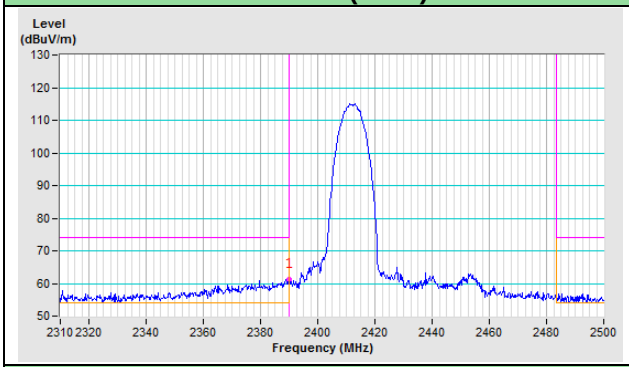
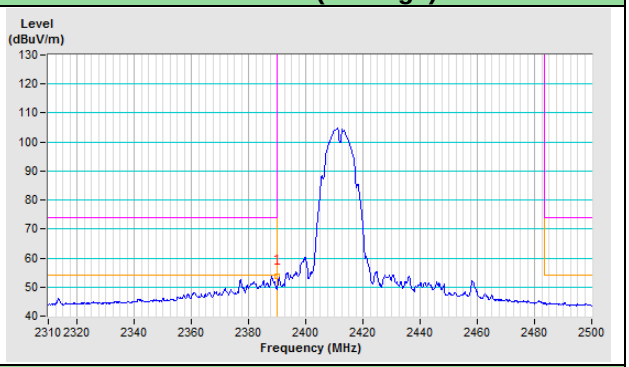
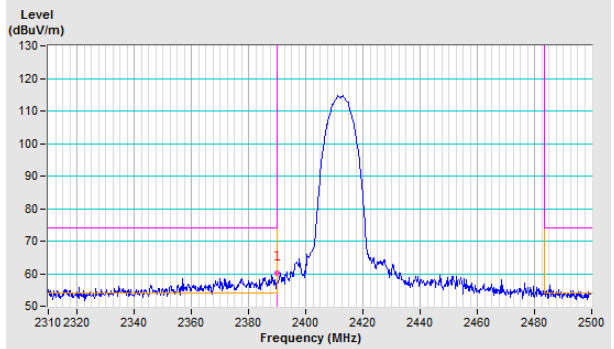
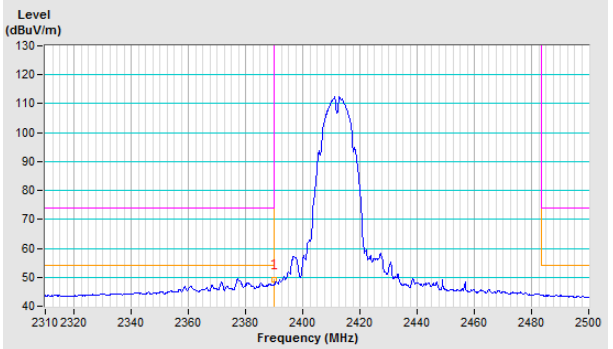
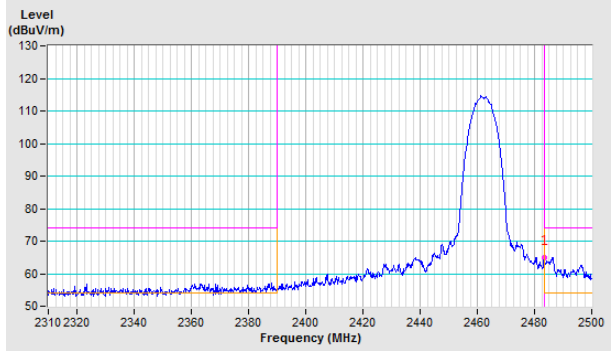
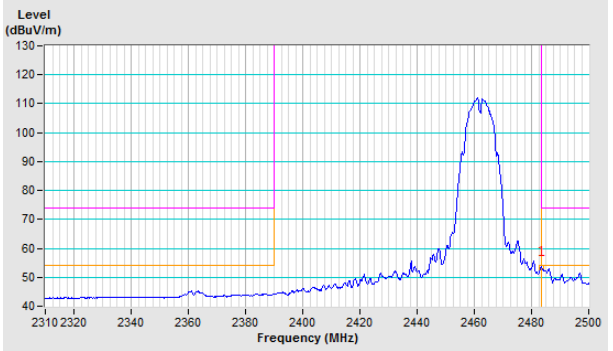
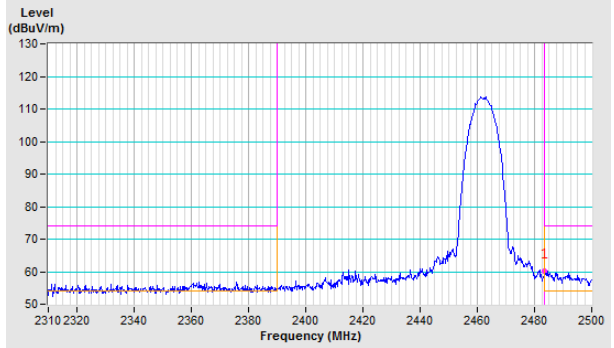
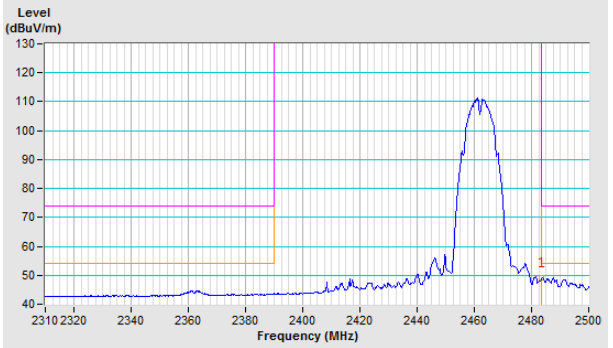


5 Pictures of Test Arrangements

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

Annex A - Band-Edge Measurement

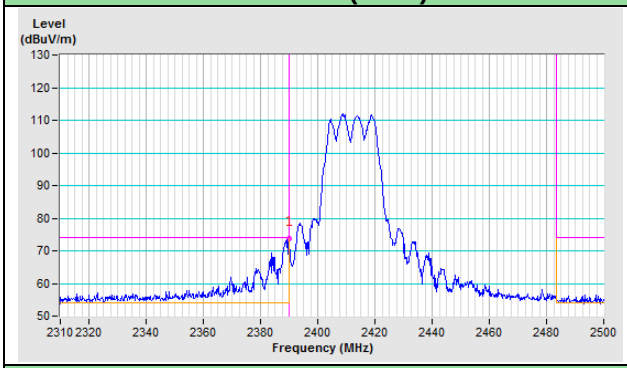
802.11b

Channel 1	
Horizontal (Peak)	Horizontal (Average)
	
Vertical (Peak)	Vertical (Average)
	
Channel 11	
Horizontal (Peak)	Horizontal (Average)
	
Vertical (Peak)	Vertical (Average)
	

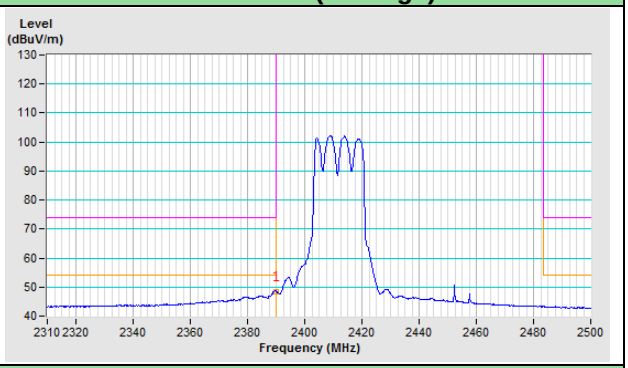
802.11g

Channel 1

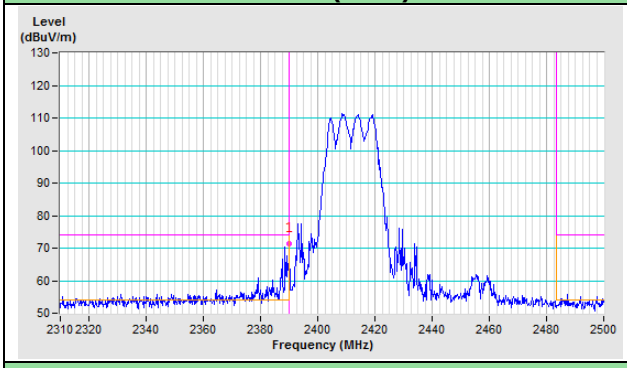
Horizontal (Peak)



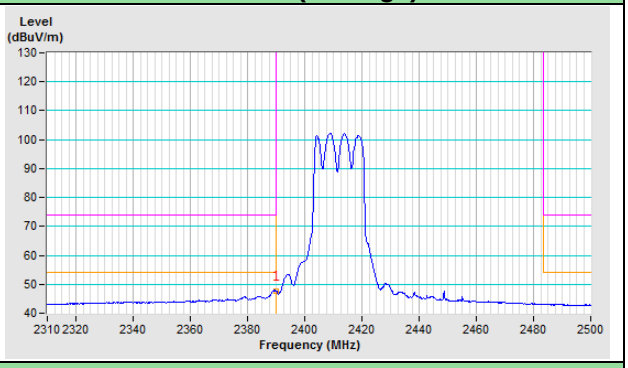
Horizontal (Average)



Vertical (Peak)

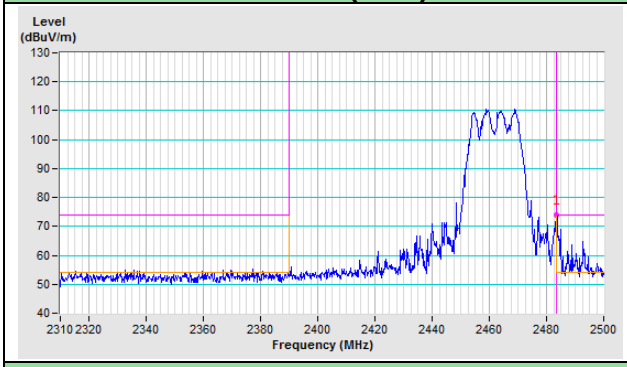


Vertical (Average)

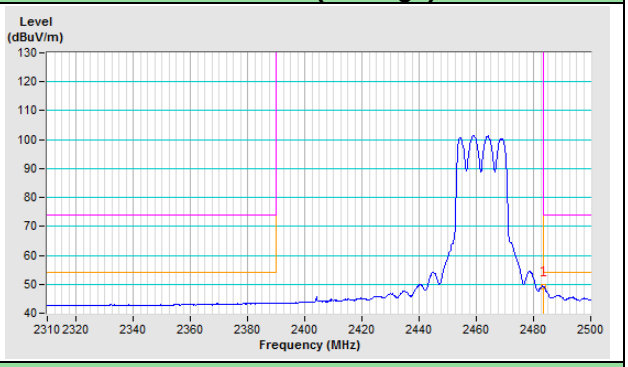


Channel 11

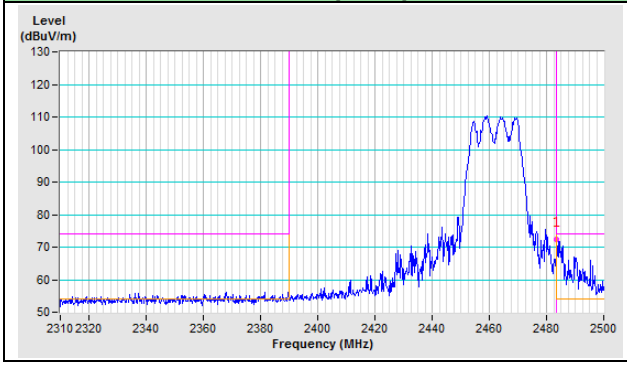
Horizontal (Peak)



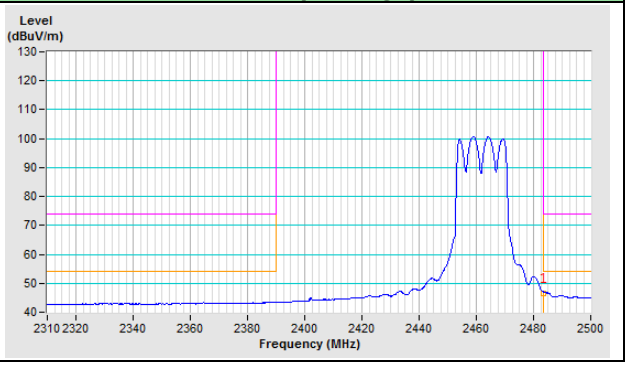
Horizontal (Average)



Vertical (Peak)



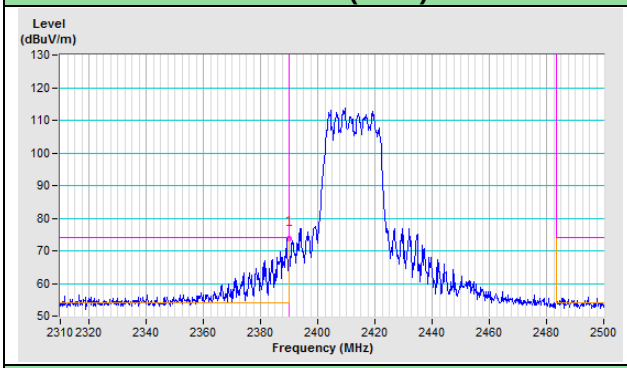
Vertical (Average)



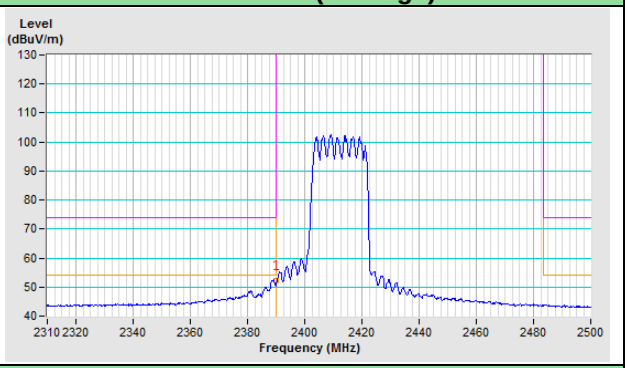
802.11ax (HE20)

Channel 1

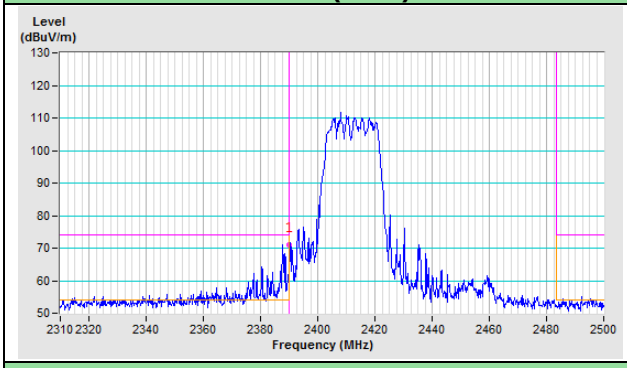
Horizontal (Peak)



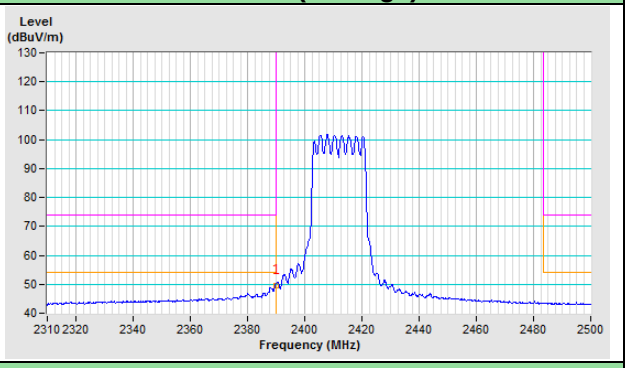
Horizontal (Average)



Vertical (Peak)

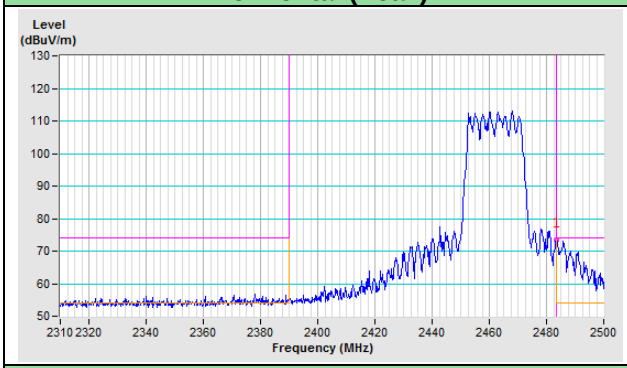


Vertical (Average)

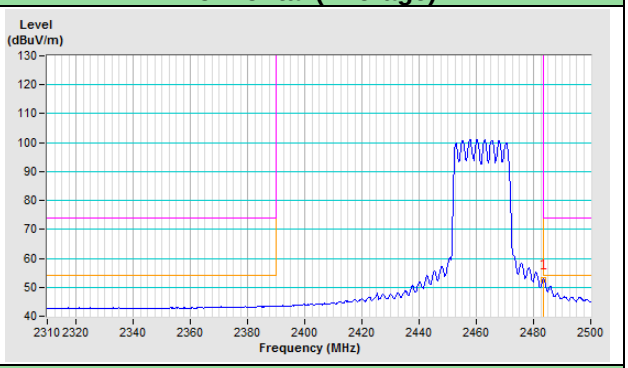


Channel 11

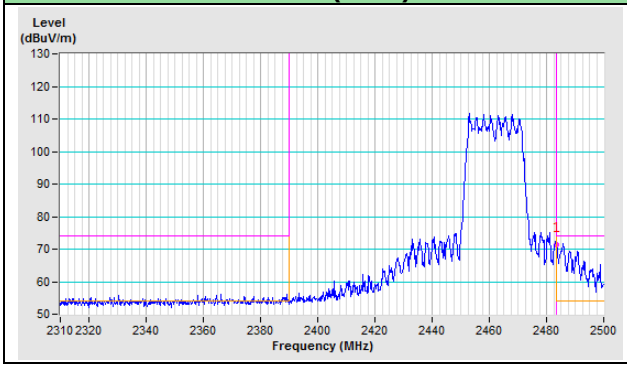
Horizontal (Peak)



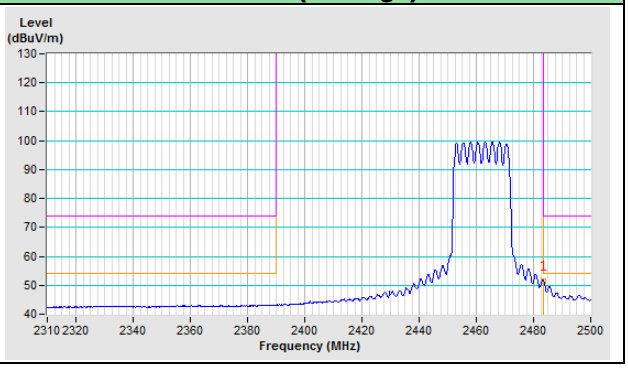
Horizontal (Average)



Vertical (Peak)



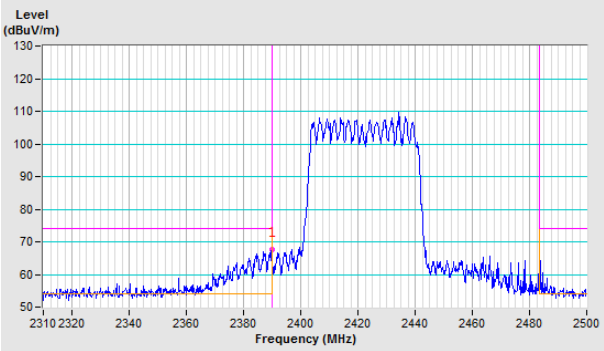
Vertical (Average)



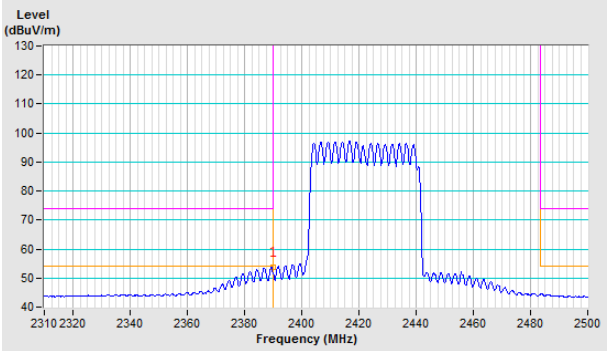
802.11ax (HE20)

Channel 3

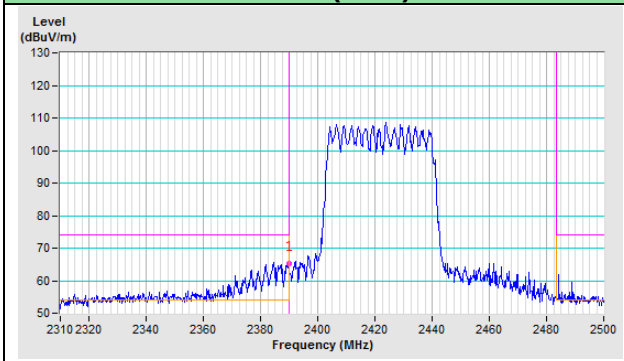
Horizontal (Peak)



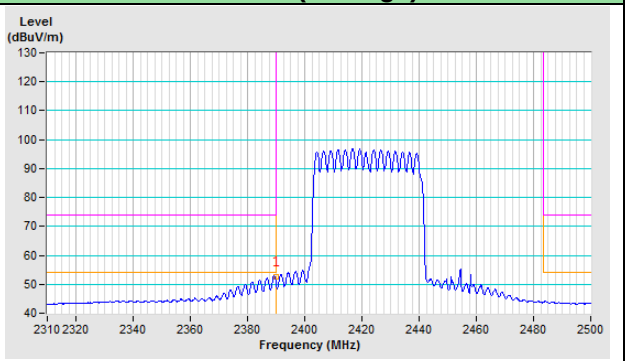
Horizontal (Average)



Vertical (Peak)

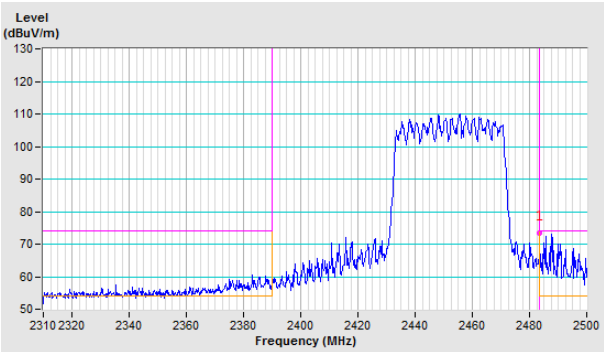


Vertical (Average)

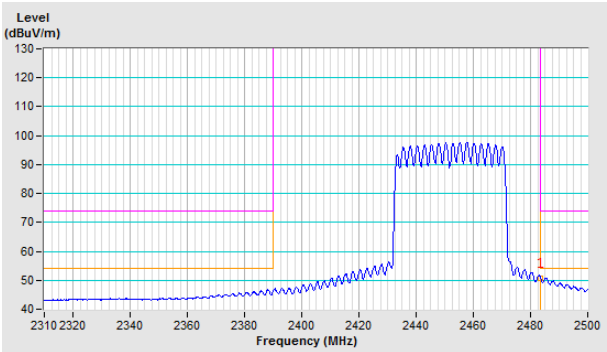


Channel 9

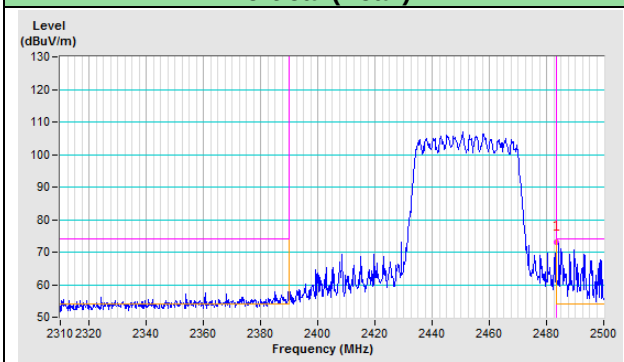
Horizontal (Peak)



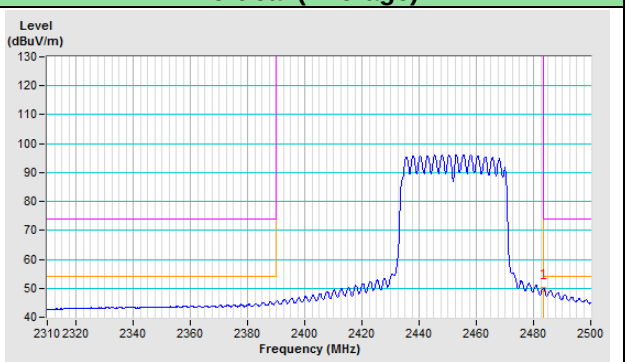
Horizontal (Average)



Vertical (Peak)



Vertical (Average)



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 according to ISO/IEC 17025.

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

Lin Kou EMC/RF Lab
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
Tel: 886-3-6668565
Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab
Tel: 886-3-3183232
Fax: 886-3-3270892

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.

--- END ---