FCC Test Report

Report No.:	RF200504E01
FCC ID:	2AGZ3S01011
Test Model:	S01011
Series Model:	EX5713-M0
Received Date:	May 04, 2020
Test Date:	May 20 to July 15, 2020
Issued Date:	Sep. 30, 2020
Applicant:	Starry, Inc.
Address:	38 Chauncy Street, Suite 200, Boston, MA 02111, 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

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Release Control Record

Issue No.	Description	Date Issued
RF200504E01	Original release.	Sep. 30, 2020

1 Certificate of Conformity

Product:	Starry Atlas WiFi 6 Router, Wireless AX 2.5G Ethernet Gateway
Brand:	Starry, ZYXEL
Test Model:	S01011
Series Model:	EX5713-M0
Sample Status:	ENGINEERING SAMPLE
Applicant:	Starry, Inc.
Test Date:	May 20 to July 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 : Vivian Huang , **Date:** Sep. 30, 2020

Vivian Hunag / Specialist

Approved by : , **Date:** Sep. 30, 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 -11.24dB at 18.24219MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -0.3dB 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 i-pex(MHF) not a standard connector.
-	Occupied Bandwidth Measurement	-	Reference only

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	5.1 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	5.1 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

Product	Starry Atlas WiFi 6 Router, Wireless AX 2.5G Ethernet Gateway
Brand	Starry, ZYXEL
Test Model	S01011
Series Model	EX5713-M0
CPU Model No.	88F7040
RF Chip Model No.	2.4GHz: QT6210X 5GHz: QT7810X
FW	Ver 50.0.56.23
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	19Vdc from power adapter
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode and VHT20/40 in 2.4GHz 1024QAM for OFDMA in 11ax HE mode
Modulation Technology	DSSS,OFDM, OFDMA
Transfer Rate	802.11b: up to 11 Mbps 802.11a/g: up to 54 Mbps 802.11n: up to 600 Mbps 802.11ac: up to 3466.7 Mbps 802.11ax: up to 4803.9 Mbps
Operating Frequency	**2.4GHz:** 2.412GHz ~ 2.462GHz **5GHz:** 5.18 ~ 5.25GHz, 5.25 ~ 5.32GHz, 5.5 ~ 5.72GHz, 5.745 ~ 5.825GHz
Number of Channel	**2.4GHz:** 802.11b, 802.11g, 802.11n (HT20), VHT20, 802.11ax (HE20): 11 802.11n (HT40), VHT40, 802.11ax (HE40): 7 **5GHz:** 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20): 25 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40): 12 802.11ac (VHT80), 802.11ax (HE80): 6 802.11ac (VHT160): 2
Output Power	**2.412 ~ 2.462 GHz:** **CDD Mode:** 993.274 mW **Beamforming Mode:** 899.849 mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	-Adapter x1 (Brand: APD, Model: WA-65B19R)

Note:

1. The EUT has two model names, which are identical to each other in all aspects except for the following information:

Brand Name	Model Name	Brand	Difference
Starry Atlas WiFi 6 Router	S01011	Starry	For marketing
Wireless AX 2.5G Ethernet Gateway	EX5713-M0	ZYXEL	

From the above models, model: S01011 was selected as representative model for the test and its data are recorded in this report.

2. The EUT has two radios as following table:

Radio 1	Radio 2
WLAN 2.4GHz	WLAN 5GHz

3. Simultaneously transmission condition.

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

4. The EUT must be supplied with a power adapter as following table:

Brand	Model No.	Spec.
APD	WA-65B19R	AC Input: 100-240V 50/60Hz, 1.5A DC Output: 19V / 3.43A DC Cable: 1.5m, Unshielded

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

Antenna No.	Antenna Type	Antenna Connector	Cable Length (mm)
Ant1_Dual	PCB	i-pex(MHF)	275
Ant2_Dual	PCB	i-pex(MHF)	160
Ant3_Dual	PCB	i-pex(MHF)	165
Ant4_Dual	PCB	i-pex(MHF)	155
Ant5_5G	PCB	i-pex(MHF)	120
Ant6_5G	PCB	i-pex(MHF)	120
Ant7_5G	PCB	i-pex(MHF)	150
Ant8_5G	PCB	i-pex(MHF)	205
Note: More detailed information, please refer to antenna specification.			

6. The antenna gain information as below table:

Frequency (MHz)	Max Antenna Gain (dBi) for Ant 1~4	Directional Gain (dBi)(4x4 bin by bin)
2412	4.0	6.19
2422	4.0	7.37
2437	3.9	6.12
2452	4.0	6.20
2462	4.0	6.22

7. The EUT incorporates a MIMO function:

2.4GHz Band		
MODULATION MODE	**TX & RX CONFIGURATION**	
802.11b	4TX	4RX
802.11g	4TX	4RX
802.11n (HT20)	4TX	4RX
802.11n (HT40)	4TX	4RX
VHT20	4TX	4RX
VHT40	4TX	4RX
802.11ax (HE20)	4TX	4RX
802.11ax (HE40)	4TX	4RX
5GHz Band		
MODULATION MODE	**TX & RX CONFIGURATION**	
802.11a	8TX	8RX
802.11n (HT20)	8TX	8RX
802.11n (HT40)	8TX	8RX
802.11ac (VHT20)	8TX	8RX
802.11ac (VHT40)	8TX	8RX
802.11ac (VHT80)	8TX	8RX
802.11ac (VHT160)	8TX	8RX
802.11ax (HE20)	8TX	8RX
802.11ax (HE40)	8TX	8RX
802.11ax (HE80)	8TX	8RX

Note:

1. All of modulation mode support beamforming function except 802.11a/b/g modulation mode.
2. The EUT support Beamforming and CDD 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 mode or more lower than it and investigated worst case to representative mode in test report. (Final test mode refer to section 3.2.1)

8. The power setting are list as below:

CDD Mode											
802.11b		802.11g		VHT20		VHT40		802.11ax (HE20)		802.11ax (HE40)	
Freq. (MHz)	Power Setting	Freq. (MHz)	Power Setting	Freq. (MHz)	Power Setting	Freq. (MHz)	Power Setting	Freq. (MHz)	Power Setting	Freq. (MHz)	Power Setting
2412	223	2412	230	2412	225	2422	205	2412	225	2422	205
2437	230	2437	230	2437	230	2437	230	2437	230	2437	230
2462	225	2462	230	2462	225	2452	200	2462	225	2452	200

Beamforming Mode							
VHT20		VHT40		802.11ax (HE20)		802.11ax (HE40)	
Freq. (MHz)	Power Setting	Freq. (MHz)	Power Setting	Freq. (MHz)	Power Setting	Freq. (MHz)	Power Setting
2412	225	2422	205	2412	225	2422	205
2437	230	2437	230	2437	230	2437	230
2462	225	2452	200	2462	225	2452	200

9. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.
10. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

3.2 Description of Test Modes

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

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

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

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

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

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
802.11g	1 to 11	11	OFDM	BPSK	6Mb/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
802.11g	1 to 11	11	OFDM	BPSK	6Mb/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:

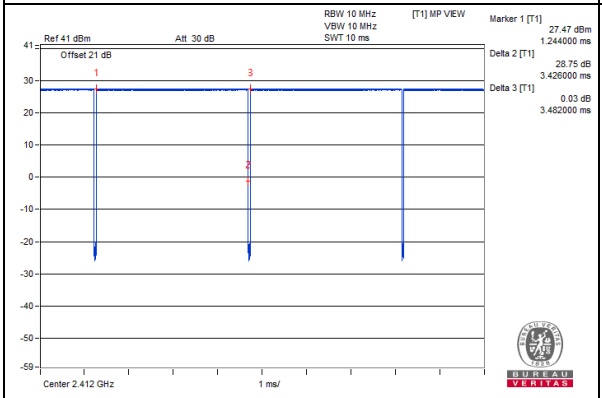
APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	24deg. C, 68%RH	120Vac, 60Hz	Ryan Du
RE<1G	23deg. C, 68%RH	120Vac, 60Hz	Tom Yang
PLC	22deg. C, 68%RH	120Vac, 60Hz	Nick Lo
APCM	25deg. C, 60%RH	120Vac, 60Hz	Jyunchun Lin

3.3 Duty Cycle of Test Signal

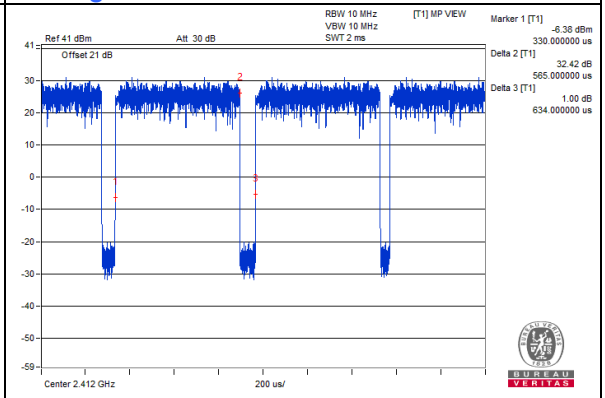
If duty cycle of test signal is ≥ 98 %, duty factor is not required.
If duty cycle of test signal is < 98%, duty factor shall be considered.

802.11b: Duty cycle = 3.426 ms /3.482 ms=0.984
802.11g: Duty cycle = 0.565 ms /0.634 ms=0.891, Duty factor = 10 * log (1/Duty cycle) = 0.50 dB
802.11ax (HE20): Duty cycle = 4.008 ms /4.064 ms=0.986
802.11ax (HE40): Duty cycle = 2.035 ms /2.108 ms=0.995, Duty factor = 10 * log (1/Duty cycle) = 0.15 dB

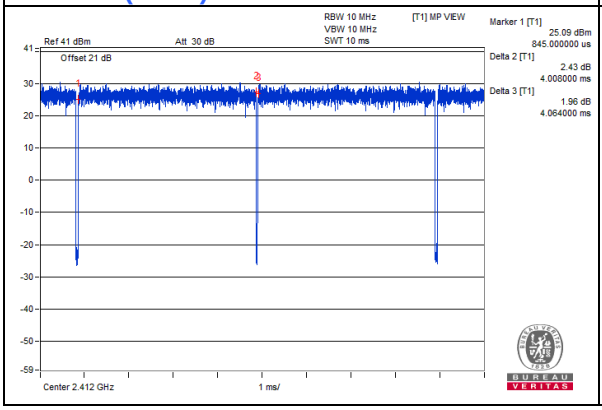
802.11b



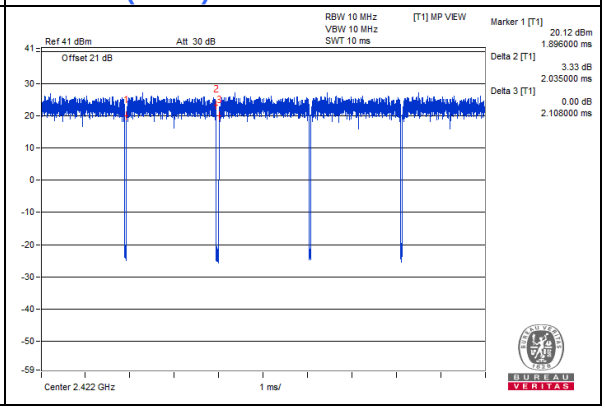
802.11g



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.

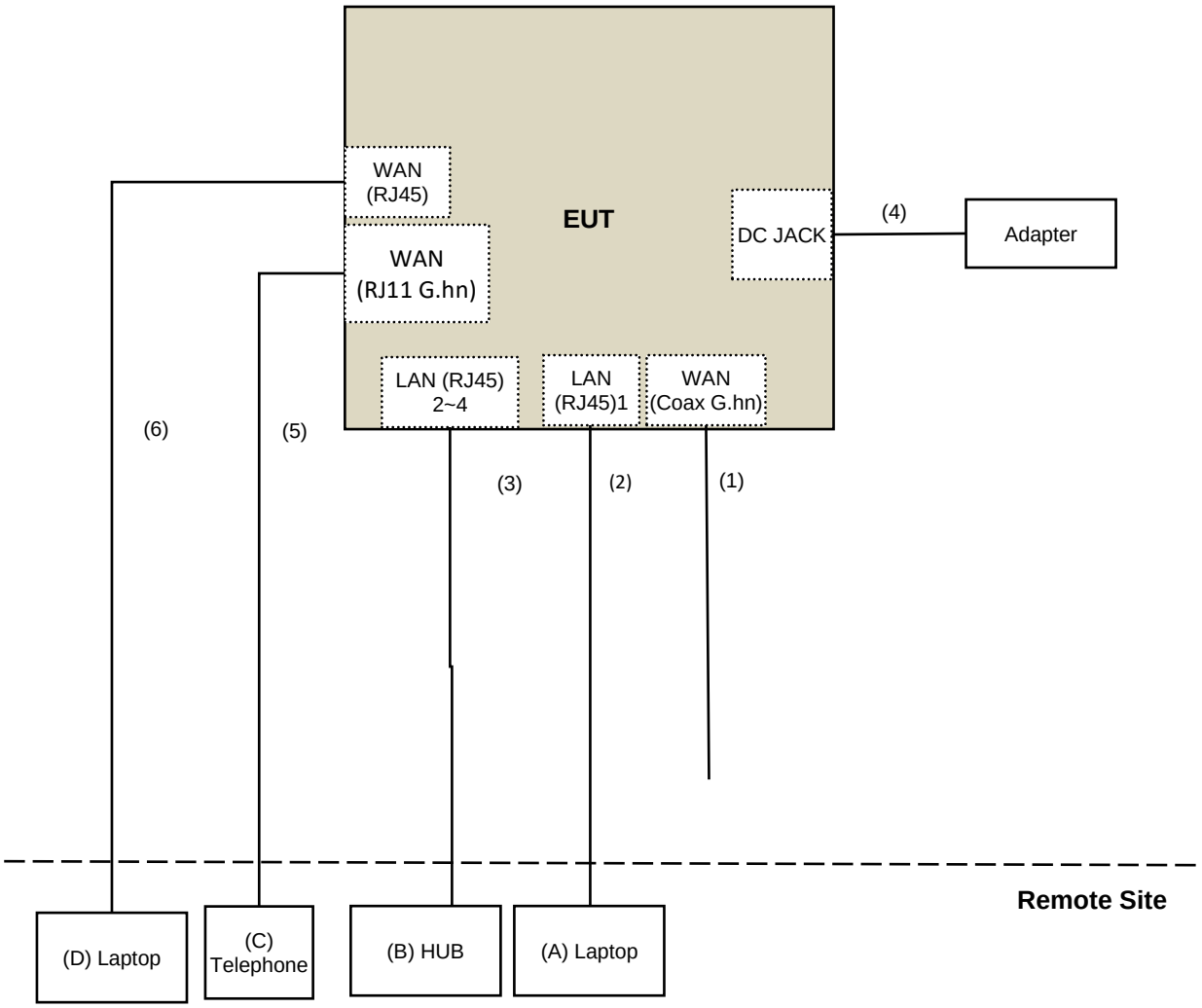
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Laptop	DELL	E5430	HYV4VY1	FCC DoC	Provided by Lab
B.	HUB	ZyXEL	GS1100-16	S150H44000046	FCC DoC	Provided by Lab
C.	Telephone	Romeo	TE-812	97280903	NA	Provided by Lab
D.	Laptop	DELL	E6420	B92T3R1	FCC DoC	Provided by Lab

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.	Coaxial Cable	1	10	No	0	Provided by Lab
2.	RJ-45 Cable	1	10	No	0	Provided by Lab
3.	RJ-45 Cable	3	10	No	0	Provided by Lab
4.	DC Cable	1	1.5	No	0	Supplied by client
5.	RJ-11 Cable	1	10	No	0	Provided by Lab
6.	RJ-45 Cable	1	10	No	0	Provided by Lab

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards and References

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards 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 R&S	ESR7	102026	Apr. 22, 2020	Apr. 21, 2021
Spectrum Analyzer Keysight	N9030B	MY57141948	May 22, 2020	May 21, 2021
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 EMCI	EMC330N	980538	Apr. 28, 2020	Apr. 27, 2021
Trilog Broadband Antenna SCHWARZBECK	VULB9168	9168-0842	Nov. 08, 2019	Nov. 07, 2020
RF Cable	8D	966-5-1	Apr. 29, 2020	Apr. 28, 2021
RF Cable	8D	966-5-2	Apr. 29, 2020	Apr. 28, 2021
RF Cable	8D	966-5-3	Apr. 29, 2020	Apr. 28, 2021
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-ATT5-02	Jan. 14, 2020	Jan. 13, 2021
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-1819	Nov. 24, 2019	Nov. 23, 2020
Pre-Amplifier EMCI	EMC12630SE	980509	Apr. 29, 2020	Apr. 28, 2021
RF Cable EMCI	EMC104-SM-SM-1500	180503	Apr. 29, 2020	Apr. 28, 2021
RF Cable EMCI	EMC104-SM-SM-2000	180501	Apr. 29, 2020	Apr. 28, 2021
RF Cable EMCI	EMC104-SM-SM-6000	180506	Apr. 29, 2020	Apr. 28, 2021
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
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	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. 5.
3. Loop antenna was used for all emissions below 30 MHz.
4. Tested Date: June 02, 2020

For Bandedge test

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver R&S	ESR7	102026	Apr. 22, 2020	Apr. 21, 2021
Spectrum Analyzer Keysight	N9030B	MY57141948	May 25, 2019	May 24, 2020
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-1819	Nov. 24, 2019	Nov. 23, 2020
Pre-Amplifier EMCI	EMC12630SE	980509	Apr. 29, 2020	Apr. 28, 2021
RF Cable EMCI	EMC104-SM-SM-1500	180503	Apr. 29, 2020	Apr. 28, 2021
RF Cable EMCI	EMC104-SM-SM-2000	180501	Apr. 29, 2020	Apr. 28, 2021
RF Cable EMCI	EMC104-SM-SM-6000	180506	Apr. 29, 2020	Apr. 28, 2021
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
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	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. 5.
3. Tested Date: May 20, 2020

For other test

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: July 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:

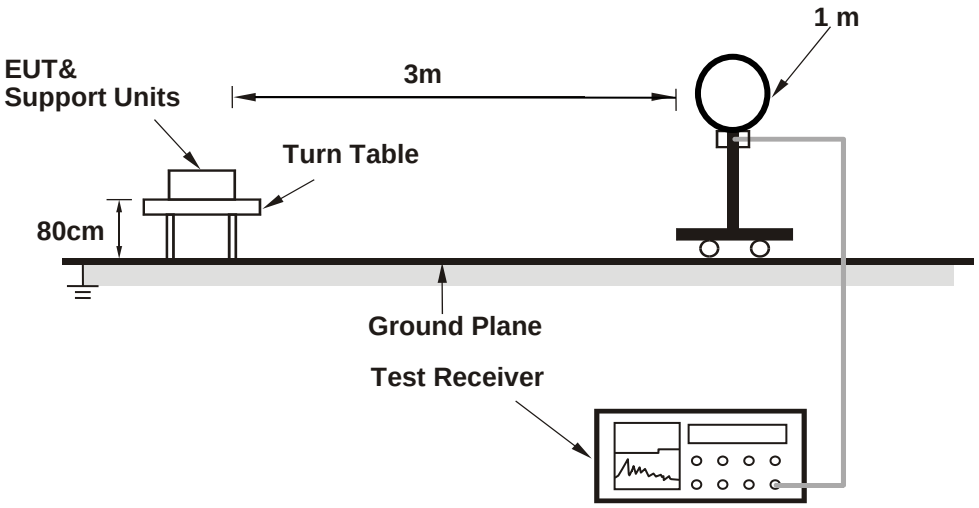
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
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

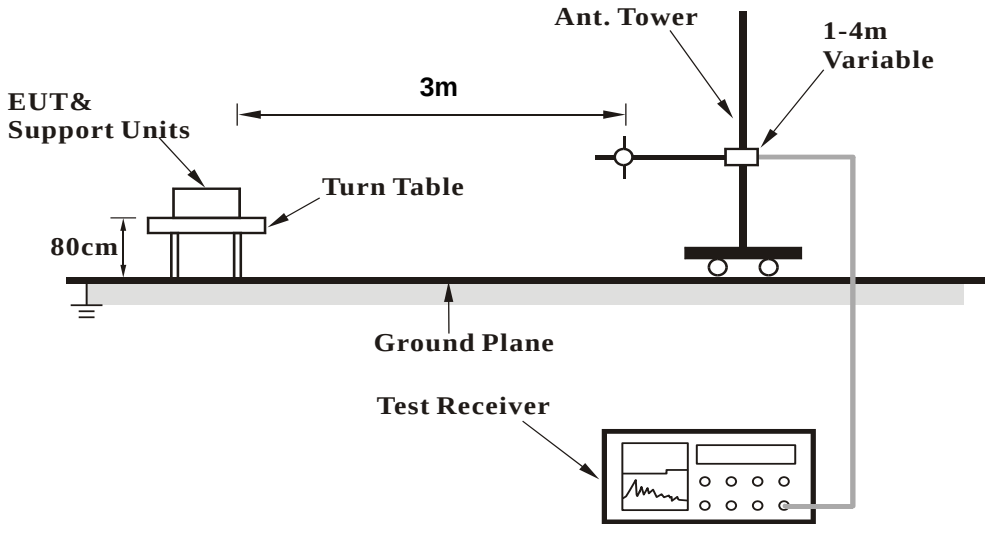
No deviation.

4.1.5 Test Setup

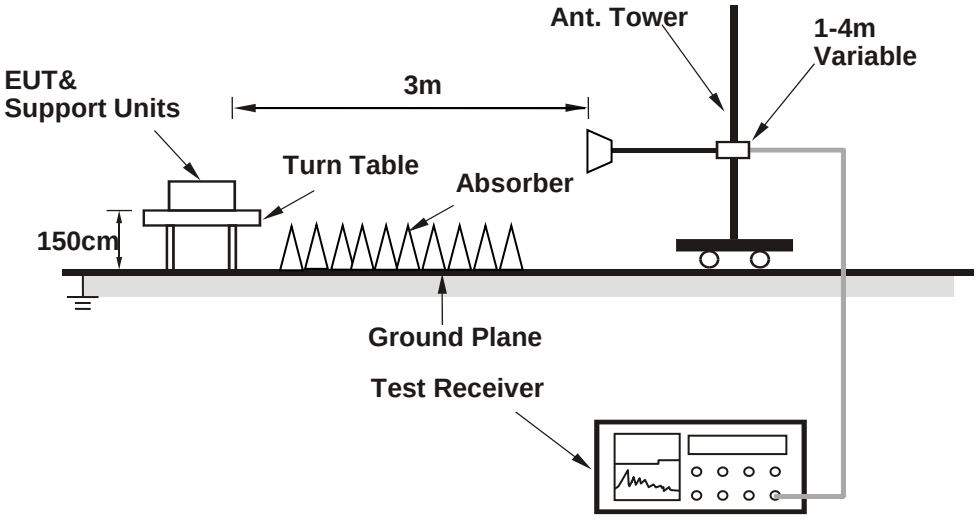
For Radiated emission below 30MHz



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 (Telnet paste 20200506-starry qtn command.txt) has been activated to set the EUT under transmission condition continuously at specific channel frenquency.

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	59.0 PK	74.0	-15.0	1.92 H	191	62.1	-3.1
2	2390.00	46.3 AV	54.0	-7.7	1.92 H	191	49.4	-3.1
3	*2412.00	119.0 PK			1.92 H	191	122.0	-3.0
4	*2412.00	110.0 AV			1.92 H	191	113.0	-3.0
5	4824.00	51.2 PK	74.0	-22.8	2.78 H	94	50.2	1.0
6	4824.00	41.5 AV	54.0	-12.5	2.78 H	94	40.5	1.0
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	2390.00	59.3 PK	74.0	-14.7	2.10 V	69	62.4	-3.1
2	2390.00	46.2 AV	54.0	-7.8	2.10 V	69	49.3	-3.1
3	*2412.00	119.6 PK			2.10 V	69	122.6	-3.0
4	*2412.00	110.8 AV			2.10 V	69	113.8	-3.0
5	4824.00	51.5 PK	74.0	-22.5	1.35 V	85	50.5	1.0
6	4824.00	41.7 AV	54.0	-12.3	1.35 V	85	40.7	1.0

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.

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	55.6 PK	74.0	-18.4	1.91 H	37	58.7	-3.1
2	2390.00	44.1 AV	54.0	-9.9	1.91 H	37	47.2	-3.1
3	*2437.00	117.3 PK			1.91 H	37	120.3	-3.0
4	*2437.00	108.6 AV			1.91 H	37	111.6	-3.0
5	2483.50	55.9 PK	74.0	-18.1	1.91 H	37	59.0	-3.1
6	2483.50	43.9 AV	54.0	-10.1	1.91 H	37	47.0	-3.1
7	4874.00	52.2 PK	74.0	-21.8	2.84 H	95	51.3	0.9
8	4874.00	41.6 AV	54.0	-12.4	2.84 H	95	40.7	0.9
9	7311.00	49.8 PK	74.0	-24.2	1.24 H	38	42.8	7.0
10	7311.00	36.8 AV	54.0	-17.2	1.24 H	38	29.8	7.0
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	2390.00	57.1 PK	74.0	-16.9	2.23 V	46	60.2	-3.1
2	2390.00	45.3 AV	54.0	-8.7	2.23 V	46	48.4	-3.1
3	*2437.00	121.2 PK			2.23 V	46	124.2	-3.0
4	*2437.00	111.6 AV			2.23 V	46	114.6	-3.0
5	2483.50	55.9 PK	74.0	-18.1	2.23 V	46	59.0	-3.1
6	2483.50	44.8 AV	54.0	-9.2	2.23 V	46	47.9	-3.1
7	4874.00	51.7 PK	74.0	-22.3	1.28 V	74	50.8	0.9
8	4874.00	42.0 AV	54.0	-12.0	1.28 V	74	41.1	0.9
9	7311.00	50.7 PK	74.0	-23.3	1.00 V	129	43.7	7.0
10	7311.00	37.3 AV	54.0	-16.7	1.00 V	129	30.3	7.0

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.

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	120.0 PK			1.50 H	198	123.1	-3.1
2	*2462.00	110.6 AV			1.50 H	198	113.7	-3.1
3	2483.50	59.8 PK	74.0	-14.2	1.50 H	198	62.9	-3.1
4	2483.50	47.6 AV	54.0	-6.4	1.50 H	198	50.7	-3.1
5	4924.00	52.1 PK	74.0	-21.9	2.81 H	96	51.1	1.0
6	4924.00	42.3 AV	54.0	-11.7	2.81 H	96	41.3	1.0
7	7386.00	50.6 PK	74.0	-23.4	1.25 H	43	43.5	7.1
8	7386.00	36.8 AV	54.0	-17.2	1.25 H	43	29.7	7.1
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2462.00	121.6 PK			2.41 V	39	124.7	-3.1
2	*2462.00	111.9 AV			2.41 V	39	115.0	-3.1
3	2483.50	56.4 PK	74.0	-17.6	2.41 V	39	59.5	-3.1
4	2483.50	45.1 AV	54.0	-8.9	2.41 V	39	48.2	-3.1
5	4924.00	52.3 PK	74.0	-21.7	1.27 V	66	51.3	1.0
6	4924.00	42.4 AV	54.0	-11.6	1.27 V	66	41.4	1.0
7	7386.00	50.8 PK	74.0	-23.2	1.00 V	143	43.7	7.1
8	7386.00	37.0 AV	54.0	-17.0	1.00 V	143	29.9	7.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. 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	58.6 PK	74.0	-15.4	1.97 H	207	61.7	-3.1
2	2390.00	45.5 AV	54.0	-8.5	1.97 H	207	48.6	-3.1
3	*2412.00	119.8 PK			1.97 H	207	122.8	-3.0
4	*2412.00	110.5 AV			1.97 H	207	113.5	-3.0
5	4824.00	52.4 PK	74.0	-21.6	2.84 H	95	51.4	1.0
6	4824.00	42.0 AV	54.0	-12.0	2.84 H	95	41.0	1.0
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	2390.00	60.3 PK	74.0	-13.7	2.18 V	273	63.4	-3.1
2	2390.00	46.1 AV	54.0	-7.9	2.18 V	273	49.2	-3.1
3	*2412.00	120.3 PK			2.18 V	273	123.3	-3.0
4	*2412.00	110.9 AV			2.18 V	273	113.9	-3.0
5	4824.00	52.6 PK	74.0	-21.4	1.31 V	64	51.6	1.0
6	4824.00	42.6 AV	54.0	-11.4	1.31 V	64	41.6	1.0

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.

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	55.9 PK	74.0	-18.1	1.84 H	180	59.0	-3.1
2	2390.00	44.2 AV	54.0	-9.8	1.84 H	180	47.3	-3.1
3	*2437.00	119.1 PK			1.84 H	180	122.1	-3.0
4	*2437.00	109.1 AV			1.84 H	180	112.1	-3.0
5	2483.50	55.1 PK	74.0	-18.9	1.84 H	180	58.2	-3.1
6	2483.50	44.1 AV	54.0	-9.9	1.84 H	180	47.2	-3.1
7	4874.00	53.1 PK	74.0	-20.9	2.81 H	82	52.2	0.9
8	4874.00	39.9 AV	54.0	-14.1	2.81 H	82	39.0	0.9
9	7311.00	49.0 PK	74.0	-25.0	1.25 H	38	42.0	7.0
10	7311.00	36.0 AV	54.0	-18.0	1.25 H	38	29.0	7.0
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	2390.00	56.2 PK	74.0	-17.8	2.05 V	41	59.3	-3.1
2	2390.00	43.8 AV	54.0	-10.2	2.05 V	41	46.9	-3.1
3	*2437.00	119.2 PK			2.05 V	41	122.2	-3.0
4	*2437.00	110.4 AV			2.05 V	41	113.4	-3.0
5	2483.50	55.2 PK	74.0	-18.8	2.05 V	41	58.3	-3.1
6	2483.50	44.1 AV	54.0	-9.9	2.05 V	41	47.2	-3.1
7	4874.00	53.3 PK	74.0	-20.7	1.36 V	81	52.4	0.9
8	4874.00	41.1 AV	54.0	-12.9	1.36 V	81	40.2	0.9
9	7311.00	50.2 PK	74.0	-23.8	1.04 V	132	43.2	7.0
10	7311.00	37.7 AV	54.0	-16.3	1.04 V	132	30.7	7.0

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.

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	118.6 PK			1.66 H	206	121.7	-3.1
2	*2462.00	110.7 AV			1.66 H	206	113.8	-3.1
3	2483.50	59.3 PK	74.0	-14.7	1.66 H	206	62.4	-3.1
4	2483.50	46.3 AV	54.0	-7.7	1.66 H	206	49.4	-3.1
5	4924.00	52.6 PK	74.0	-21.4	2.84 H	95	51.6	1.0
6	4924.00	41.4 AV	54.0	-12.6	2.84 H	95	40.4	1.0
7	5111.51	53.6 PK	74.0	-20.4	1.46 H	210	51.9	1.7
8	5111.51	52.8 AV	54.0	-1.2	1.46 H	210	51.1	1.7
9	7386.00	49.4 PK	74.0	-24.6	1.24 H	38	42.3	7.1
10	7386.00	36.5 AV	54.0	-17.5	1.24 H	38	29.4	7.1
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2462.00	120.2 PK			2.22 V	48	123.3	-3.1
2	*2462.00	111.3 AV			2.22 V	48	114.4	-3.1
3	2483.50	64.0 PK	74.0	-10.0	2.22 V	48	67.1	-3.1
4	2483.50	47.3 AV	54.0	-6.7	2.22 V	48	50.4	-3.1
5	4924.00	52.7 PK	74.0	-21.3	1.31 V	89	51.7	1.0
6	4924.00	41.5 AV	54.0	-12.5	1.31 V	89	40.5	1.0
7	5111.51	51.8 PK	74.0	-22.2	1.00 V	61	50.1	1.7
8	5111.51	50.1 AV	54.0	-3.9	1.00 V	61	48.4	1.7
9	7386.00	50.3 PK	74.0	-23.7	1.02 V	128	43.2	7.1
10	7386.00	37.6 AV	54.0	-16.4	1.02 V	128	30.5	7.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. 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	66.5 PK	74.0	-7.5	1.97 H	150	69.6	-3.1
2	2390.00	49.1 AV	54.0	-4.9	1.97 H	150	52.2	-3.1
3	*2412.00	120.0 PK			1.97 H	150	123.0	-3.0
4	*2412.00	106.5 AV			1.97 H	150	109.5	-3.0
5	4824.00	52.4 PK	74.0	-21.6	2.83 H	105	51.4	1.0
6	4824.00	41.3 AV	54.0	-12.7	2.83 H	105	40.3	1.0
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	2390.00	70.4 PK	74.0	-3.6	2.62 V	17	73.5	-3.1
2	2390.00	53.5 AV	54.0	-0.5	2.62 V	17	56.6	-3.1
3	*2412.00	122.5 PK			2.62 V	17	125.5	-3.0
4	*2412.00	109.1 AV			2.62 V	17	112.1	-3.0
5	4824.00	52.5 PK	74.0	-21.5	1.32 V	86	51.5	1.0
6	4824.00	41.6 AV	54.0	-12.4	1.32 V	86	40.6	1.0

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.

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	55.6 PK	74.0	-18.4	2.19 H	166	58.7	-3.1
2	2390.00	42.5 AV	54.0	-11.5	2.19 H	166	45.6	-3.1
3	*2437.00	119.2 PK			2.19 H	166	122.2	-3.0
4	*2437.00	106.3 AV			2.19 H	166	109.3	-3.0
5	2483.50	55.0 PK	74.0	-19.0	2.19 H	166	58.1	-3.1
6	2483.50	42.6 AV	54.0	-11.4	2.19 H	166	45.7	-3.1
7	4874.00	52.5 PK	74.0	-21.5	2.79 H	88	51.6	0.9
8	4874.00	41.4 AV	54.0	-12.6	2.79 H	88	40.5	0.9
9	7311.00	50.3 PK	74.0	-23.7	1.24 H	41	43.3	7.0
10	7311.00	37.8 AV	54.0	-16.2	1.24 H	41	30.8	7.0
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	2390.00	55.0 PK	74.0	-19.0	1.51 V	191	58.1	-3.1
2	2390.00	42.5 AV	54.0	-11.5	1.51 V	191	45.6	-3.1
3	*2437.00	120.3 PK			1.51 V	191	123.3	-3.0
4	*2437.00	107.3 AV			1.51 V	191	110.3	-3.0
5	2483.50	55.9 PK	74.0	-18.1	1.51 V	191	59.0	-3.1
6	2483.50	42.3 AV	54.0	-11.7	1.51 V	191	45.4	-3.1
7	4874.00	52.6 PK	74.0	-21.4	1.29 V	82	51.7	0.9
8	4874.00	41.7 AV	54.0	-12.3	1.29 V	82	40.8	0.9
9	7311.00	50.5 PK	74.0	-23.5	1.01 V	123	43.5	7.0
10	7311.00	37.9 AV	54.0	-16.1	1.01 V	123	30.9	7.0

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.

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	120.7 PK			1.94 H	207	123.8	-3.1
2	*2462.00	108.3 AV			1.94 H	207	111.4	-3.1
3	2483.50	68.7 PK	74.0	-5.3	1.94 H	207	71.8	-3.1
4	2483.50	50.6 AV	54.0	-3.4	1.94 H	207	53.7	-3.1
5	4924.00	52.6 PK	74.0	-21.4	2.80 H	86	51.6	1.0
6	4924.00	41.2 AV	54.0	-12.8	2.80 H	86	40.2	1.0
7	7386.00	50.4 PK	74.0	-23.6	1.27 H	44	43.3	7.1
8	7386.00	37.8 AV	54.0	-16.2	1.27 H	44	30.7	7.1
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2462.00	122.2 PK			2.14 V	8	125.3	-3.1
2	*2462.00	109.0 AV			2.14 V	8	112.1	-3.1
3	2483.50	70.1 PK	74.0	-3.9	2.14 V	8	73.2	-3.1
4	2483.50	53.4 AV	54.0	-0.6	2.14 V	8	56.5	-3.1
5	4924.00	52.8 PK	74.0	-21.2	1.31 V	85	51.8	1.0
6	4924.00	41.6 AV	54.0	-12.4	1.31 V	85	40.6	1.0
7	7386.00	50.7 PK	74.0	-23.3	1.02 V	129	43.6	7.1
8	7386.00	37.9 AV	54.0	-16.1	1.02 V	129	30.8	7.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. 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	60.3 PK	74.0	-13.7	2.28 H	215	63.4	-3.1
2	2390.00	46.7 AV	54.0	-7.3	2.28 H	215	49.8	-3.1
3	*2422.00	115.8 PK			2.28 H	215	118.8	-3.0
4	*2422.00	102.8 AV			2.28 H	215	105.8	-3.0
5	4844.00	52.1 PK	74.0	-21.9	2.82 H	88	51.1	1.0
6	4844.00	41.2 AV	54.0	-12.8	2.82 H	88	40.2	1.0
7	7266.00	50.5 PK	74.0	-23.5	1.27 H	59	43.5	7.0
8	7266.00	37.8 AV	54.0	-16.2	1.27 H	59	30.8	7.0
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	2390.00	68.3 PK	74.0	-5.7	2.56 V	8	71.4	-3.1
2	2390.00	53.6 AV	54.0	-0.4	2.56 V	8	56.7	-3.1
3	*2422.00	118.0 PK			2.56 V	8	121.0	-3.0
4	*2422.00	105.7 AV			2.56 V	8	108.7	-3.0
5	4844.00	52.4 PK	74.0	-21.6	1.28 V	87	51.4	1.0
6	4844.00	41.4 AV	54.0	-12.6	1.28 V	87	40.4	1.0
7	7266.00	50.8 PK	74.0	-23.2	1.03 V	125	43.8	7.0
8	7266.00	38.0 AV	54.0	-16.0	1.03 V	125	31.0	7.0

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.

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	59.0 PK	74.0	-15.0	1.77 H	151	62.1	-3.1
2	2390.00	44.4 AV	54.0	-9.6	1.77 H	151	47.5	-3.1
3	*2437.00	116.9 PK			1.77 H	151	119.9	-3.0
4	*2437.00	105.1 AV			1.77 H	151	108.1	-3.0
5	2483.50	58.5 PK	74.0	-15.5	1.77 H	151	61.6	-3.1
6	2483.50	44.3 AV	54.0	-9.7	1.77 H	151	47.4	-3.1
7	4874.00	52.4 PK	74.0	-21.6	2.82 H	101	51.5	0.9
8	4874.00	41.6 AV	54.0	-12.4	2.82 H	101	40.7	0.9
9	7311.00	50.5 PK	74.0	-23.5	1.27 H	58	43.5	7.0
10	7311.00	37.8 AV	54.0	-16.2	1.27 H	58	30.8	7.0
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	2390.00	69.6 PK	74.0	-4.4	2.50 V	9	72.7	-3.1
2	2390.00	52.0 AV	54.0	-2.0	2.50 V	9	55.1	-3.1
3	*2437.00	118.6 PK			2.50 V	9	121.6	-3.0
4	*2437.00	107.3 AV			2.50 V	9	110.3	-3.0
5	2483.50	68.8 PK	74.0	-5.2	2.50 V	9	71.9	-3.1
6	2483.50	52.1 AV	54.0	-1.9	2.50 V	9	55.2	-3.1
7	4874.00	52.6 PK	74.0	-21.4	1.22 V	84	51.7	0.9
8	4874.00	41.3 AV	54.0	-12.7	1.22 V	84	40.4	0.9
9	7311.00	50.6 PK	74.0	-23.4	1.04 V	129	43.6	7.0
10	7311.00	37.9 AV	54.0	-16.1	1.04 V	129	30.9	7.0

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.

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	117.7 PK			2.24 H	199	120.8	-3.1
2	*2452.00	104.8 AV			2.24 H	199	107.9	-3.1
3	2483.50	67.2 PK	74.0	-6.8	2.24 H	199	70.3	-3.1
4	2483.50	51.6 AV	54.0	-2.4	2.24 H	199	54.7	-3.1
5	4904.00	51.5 PK	74.0	-22.5	2.80 H	87	50.5	1.0
6	4904.00	40.8 AV	54.0	-13.2	2.80 H	87	39.8	1.0
7	7356.00	50.3 PK	74.0	-23.7	1.30 H	46	43.2	7.1
8	7356.00	37.7 AV	54.0	-16.3	1.30 H	46	30.6	7.1
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2452.00	118.0 PK			2.47 V	7	121.1	-3.1
2	*2452.00	105.4 AV			2.47 V	7	108.5	-3.1
3	2483.50	69.4 PK	74.0	-4.6	2.47 V	7	72.5	-3.1
4	**2483.50**	**53.7 AV**	**54.0**	**-0.3**	**2.47 V**	**7**	**56.8**	**-3.1**
5	4904.00	53.0 PK	74.0	-21.0	1.24 V	93	52.0	1.0
6	4904.00	41.8 AV	54.0	-12.2	1.24 V	93	40.8	1.0
7	7356.00	50.3 PK	74.0	-23.7	1.02 V	131	43.2	7.1
8	7356.00	37.7 AV	54.0	-16.3	1.02 V	131	30.6	7.1

Remarks:

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

Below 1GHz Data:

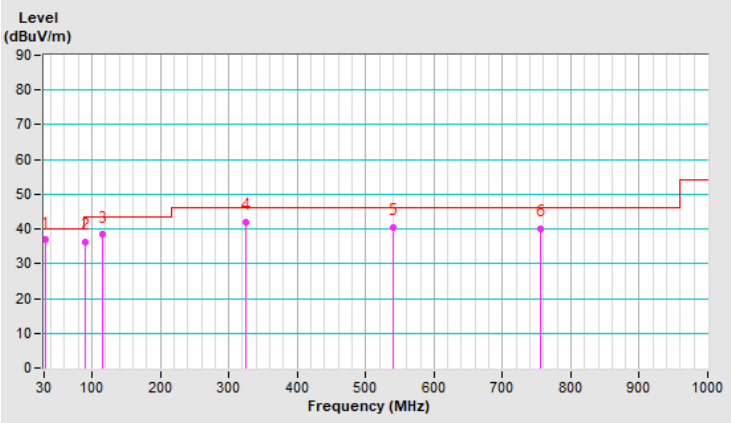
802.11g

CHANNEL	TX Channel 11	**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	32.35	37.0 QP	40.0	-3.0	1.50 H	0	50.7	-13.7
2	90.16	36.4 QP	43.5	-7.1	3.00 H	283	54.8	-18.4
3	114.46	38.5 QP	43.5	-5.0	1.50 H	270	53.8	-15.3
4	324.03	42.1 QP	46.0	-3.9	1.00 H	82	53.3	-11.2
5	539.98	40.6 QP	46.0	-5.4	1.50 H	210	47.2	-6.6
6	755.88	40.2 QP	46.0	-5.8	1.00 H	200	42.8	-2.6

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.

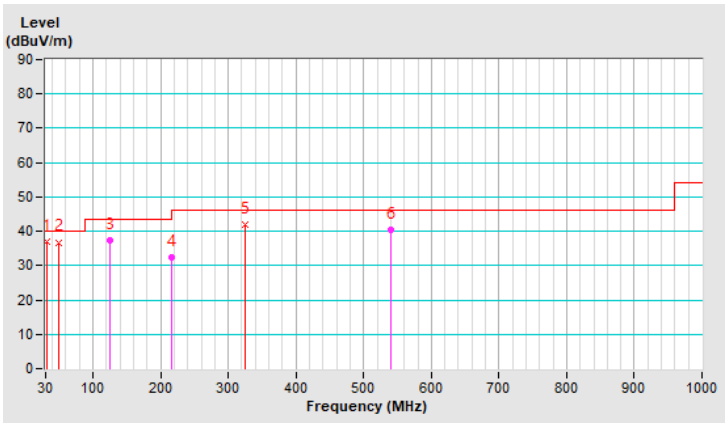


CHANNEL	TX Channel 11	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

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	31.88	37.0 QP	40.0	-3.0	1.00 V	170	50.7	-13.7
2	49.99	36.8 QP	40.0	-3.2	2.00 V	0	49.3	-12.5
3	125.01	37.2 QP	43.5	-6.3	1.00 V	240	51.5	-14.3
4	216.00	32.3 QP	43.5	-11.2	1.00 V	223	48.1	-15.8
5	324.03	42.0 QP	46.0	-4.0	1.50 V	339	53.2	-11.2
6	540.00	40.4 QP	46.0	-5.6	1.00 V	282	47.0	-6.6

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 01, 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.

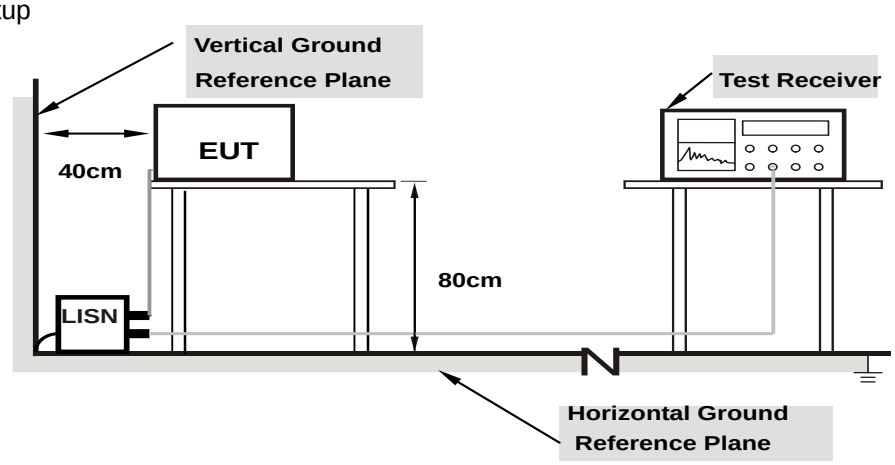
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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.

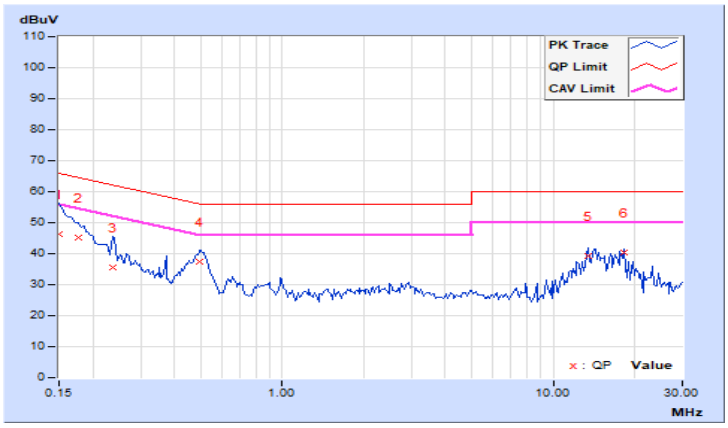
4.2.7 Test Results

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

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	0.15000	10.03	36.43	20.31	46.46	30.34	66.00	56.00	-19.54	-25.66
2	0.17734	10.04	35.26	19.66	45.30	29.70	64.61	54.61	-19.31	-24.91
3	0.23594	10.04	25.57	11.82	35.61	21.86	62.24	52.24	-26.63	-30.38
4	0.49766	10.06	27.40	22.88	37.46	32.94	56.04	46.04	-18.58	-13.10
5	13.42188	11.00	28.14	25.34	39.14	36.34	60.00	50.00	-20.86	-13.66
6	**18.24219**	**11.34**	**29.08**	**27.42**	**40.42**	**38.76**	**60.00**	**50.00**	**-19.58**	**-11.24**

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

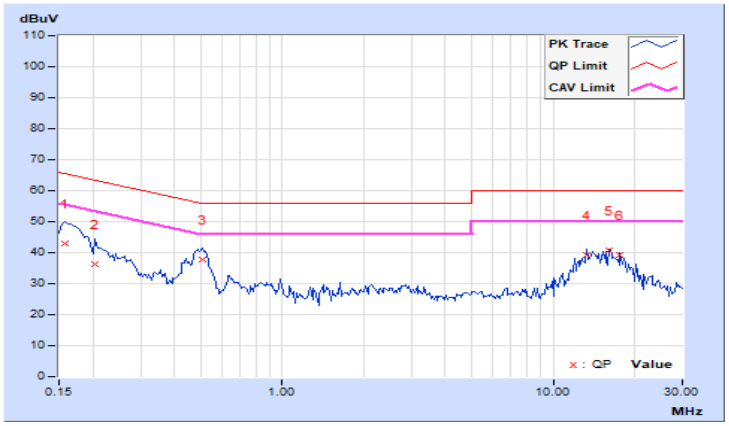


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

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	0.15781	10.02	32.98	13.90	43.00	23.92	65.58	55.58	-22.58	-31.66
2	0.20469	10.03	26.32	9.95	36.35	19.98	63.42	53.42	-27.07	-33.44
3	0.50547	10.05	27.65	22.73	37.70	32.78	56.00	46.00	-18.30	-13.22
4	13.35938	10.85	28.54	25.60	39.39	36.45	60.00	50.00	-20.61	-13.55
5	16.16797	10.99	29.71	27.61	40.70	38.60	60.00	50.00	-19.30	-11.40
6	17.69531	11.07	28.25	26.69	39.32	37.76	60.00	50.00	-20.68	-12.24

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

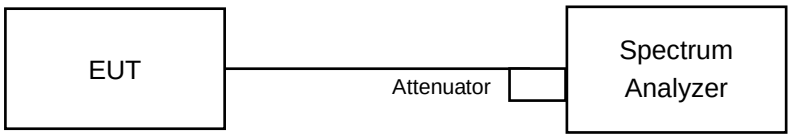


4.3 6dB Bandwidth Measurement

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

802.11b

Channel	Frequency (MHz)	6dB Bandwidth (MHz)				Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3		
1	2412	10.22	10.21	10.22	10.21	0.5	PASS
6	2437	10.24	10.25	10.25	10.22	0.5	PASS
11	2462	10.23	10.23	10.24	10.21	0.5	PASS

802.11g

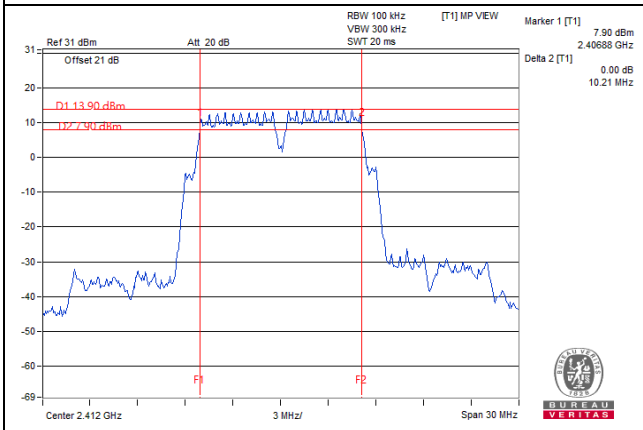
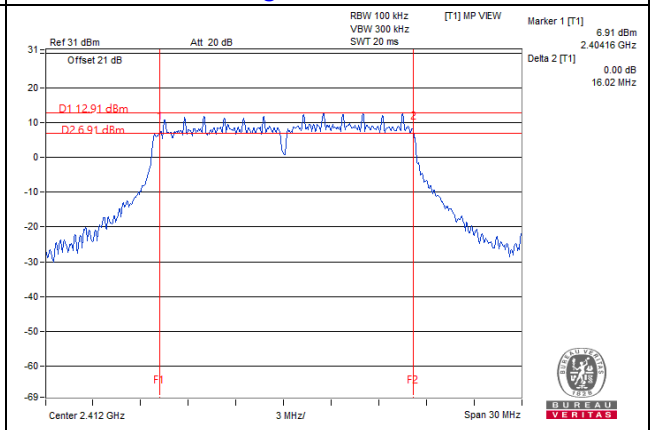
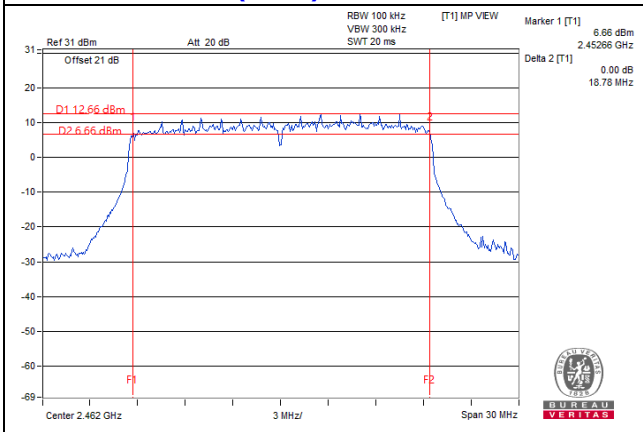
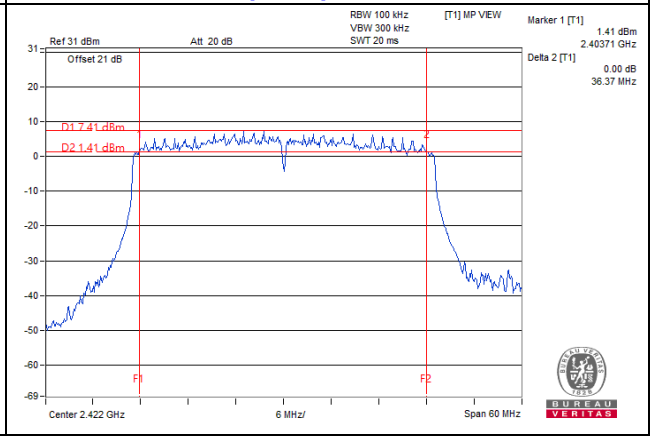
Channel	Frequency (MHz)	6dB Bandwidth (MHz)				Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3		
1	2412	16.02	16.12	16.04	16.43	0.5	PASS
6	2437	16.41	16.44	16.43	16.43	0.5	PASS
11	2462	16.4	16.39	16.41	16.37	0.5	PASS

802.11ax (HE20)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)				Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3		
1	2412	19.01	19	19.01	18.92	0.5	PASS
6	2437	19.03	19.11	19.11	18.95	0.5	PASS
11	2462	18.85	18.83	19.02	18.78	0.5	PASS

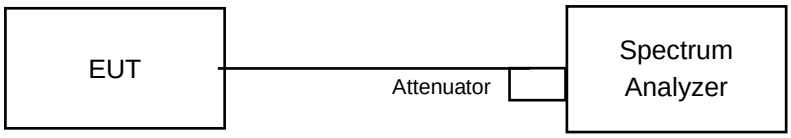
802.11ax (HE40)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)				Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3		
3	2422	37.39	36.37	37.63	37.77	0.5	PASS
6	2437	38.09	38.16	38.2	37.94	0.5	PASS
9	2452	37.97	37.79	38.1	38.15	0.5	PASS

Spectrum Plot of Worst Value	
802.11b / Chain 1 : CH1	**802.11g / Chain 0 : CH1**
	
802.11ax (HE20) / Chain 3 : CH11	**802.11ax (HE40) / Chain 1 : CH3**
	

4.4 Occupied Bandwidth Measurement

4.4.1 Test Setup



4.4.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.3 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to sampling. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean power of a given emission.

4.4.4 Deviation from Test Standard

No deviation.

4.4.5 EUT Operating Conditions

Same as Item 4.3.6.

4.4.6 Test Results

802.11b

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
1	2412	10.44	10.52	10.44	10.6
6	2437	10.52	10.44	10.44	10.56
11	2462	10.44	10.44	10.44	10.44

802.11g

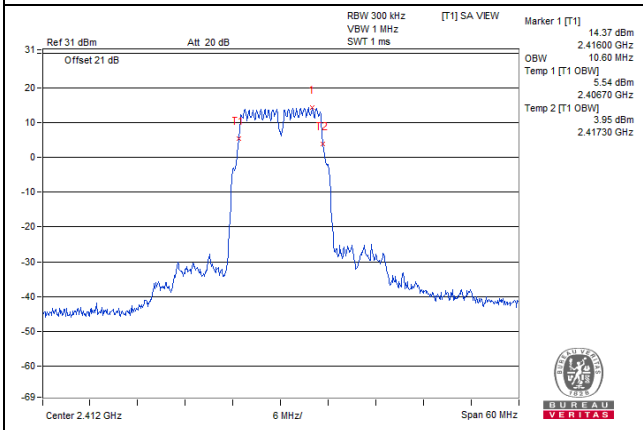
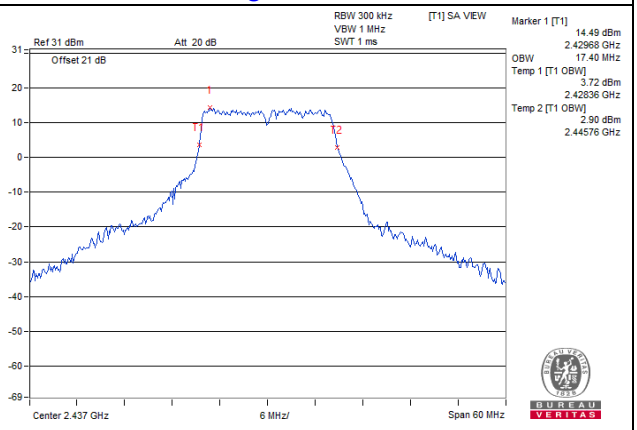
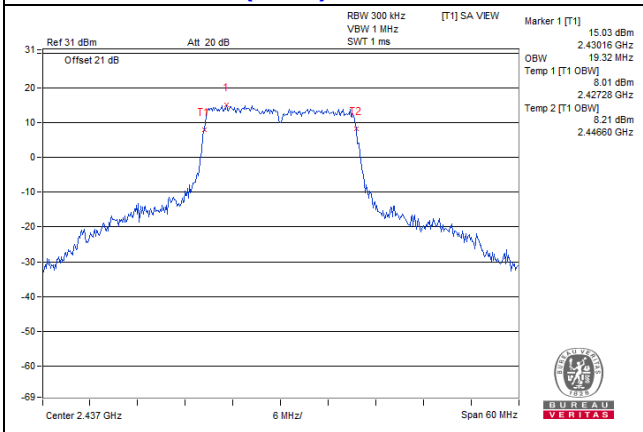
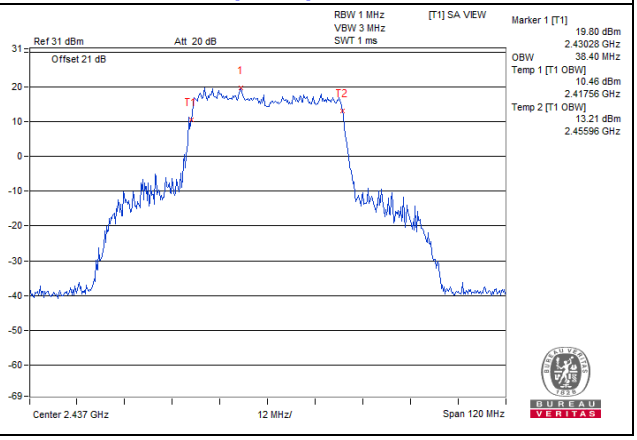
Channel	Frequency (MHz)	Occupied Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
1	2412	17.04	16.68	16.92	17.04
6	2437	17.28	17.4	17.16	17.04
11	2462	16.92	16.8	16.92	16.8

802.11ax (HE20)

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
1	2412	18.96	18.96	19.08	19.08
6	2437	19.32	19.08	19.2	19.32
11	2462	19.08	19.08	19.08	18.96

802.11ax (HE40)

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)			
		Chain 0	Chain 1	Chain 2	Chain 3
3	2422	37.92	37.92	37.92	37.92
6	2437	38.16	38.4	38.4	38.4
9	2452	38.16	38.16	37.68	38.4

Spectrum Plot of Worst Value	
802.11b_Chain 3 / CH1	**802.11g _Chain 1 / CH6**
	
802.11ax (HE20) _Chain 0 / CH6	**802.11ax (HE40) _Chain 1 / CH6**
	

4.5 Conducted Output Power Measurement

4.5.1 Limits of Conducted Output Power Measurement

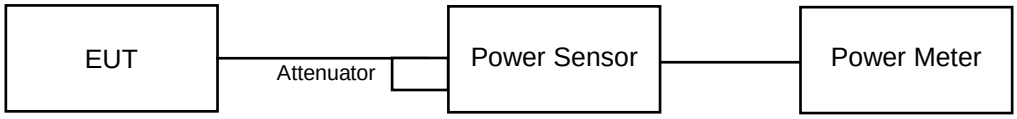
For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30dBm)

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.

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test 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.

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Conditions

Same as Item 4.3.6.

4.5.7 Test Results

CDD Mode

802.11b

Chan.	Frequency (MHz)	Avg. Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
1	2412	24.07	23.83	23.77	24.12	993.274	29.97	30	Pass
6	2437	23.06	23.46	23.28	23.55	863.4	29.36	30	Pass
11	2462	24.06	23.73	23.74	24.14	986.741	29.94	30	Pass

802.11g

Chan.	Frequency (MHz)	Avg. Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
1	2412	23.99	23.65	23.91	24.22	992.628	29.97	30	Pass
6	2437	22.78	23.26	23.26	23.29	826.647	29.17	30	Pass
11	2462	23.88	23.92	23.82	24.11	989.57	29.95	30	Pass

VHT20

Chan.	Frequency (MHz)	Avg. Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
1	2412	23.24	22.77	22.98	23.62	828.851	29.18	30	Pass
6	2437	22.62	22.97	22.93	22.90	772.283	28.88	30	Pass
11	2462	23.08	22.91	23.10	23.14	808.906	29.08	30	Pass

VHT40

Chan.	Frequency (MHz)	Avg. Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
3	2422	21.22	21.07	21.28	21.77	544.963	27.36	30	Pass
6	2437	23.12	23.01	23.26	23.70	851.361	29.30	30	Pass
9	2452	20.78	21.30	20.90	20.71	495.358	26.95	30	Pass

802.11ax (HE20)

Chan.	Frequency (MHz)	Avg. Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
1	2412	23.46	22.97	23.22	23.87	873.647	29.41	30	Pass
6	2437	22.86	23.17	23.16	23.17	815.194	29.11	30	Pass
11	2462	23.34	23.15	23.32	23.38	854.866	29.32	30	Pass

802.11ax (HE40)

Chan.	Frequency (MHz)	Avg. Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
3	2422	21.44	21.27	21.51	22.02	574.084	27.59	30	Pass
6	2437	23.36	23.25	23.48	23.96	899.849	29.54	30	Pass
9	2452	21.02	21.54	21.16	20.98	524.966	27.20	30	Pass

Beamforming Mode

VHT20

Chan.	Frequency (MHz)	Avg. Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
1	2412	23.24	22.77	22.98	23.62	828.851	29.18	29.81	Pass
6	2437	22.62	22.97	22.93	22.90	772.283	28.88	29.88	Pass
11	2462	23.08	22.91	23.10	23.14	808.906	29.08	29.78	Pass

Note: 1. For Ch 1: Directional gain = 6.19 dBi > 6 dBi, so the power limit shall be reduced to 30-(6.19-6) = 29.81dBm.
2. For Ch 6: Directional gain = 6.12 dBi > 6 dBi, so the power limit shall be reduced to 30-(6.12-6) = 29.88dBm.
3. For Ch 11: Directional gain = 6.22 dBi > 6 dBi, so the power limit shall be reduced to 30-(6.22-6) = 29.78dBm.

VHT40

Chan.	Frequency (MHz)	Avg. Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
3	2422	21.22	21.07	21.28	21.77	544.963	27.36	28.63	Pass
6	2437	23.12	23.01	23.26	23.70	851.361	29.30	29.88	Pass
9	2452	20.78	21.30	20.90	20.71	495.358	26.95	29.80	Pass

Note: 1. For Ch 3: Directional gain = 7.37 dBi > 6 dBi, so the power limit shall be reduced to 30-(7.37-6) = 28.6 dBm.
2. For Ch 6: Directional gain = 6.12 dBi > 6 dBi, so the power limit shall be reduced to 30-(6.12-6) = 29.88 dBm.
3. For Ch 9: Directional gain = 6.20 dBi > 6 dBi, so the power limit shall be reduced to 30-(6.20-6) = 29.80 dBm.

802.11ax (HE20)

Chan.	Frequency (MHz)	Avg. Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
1	2412	23.46	22.97	23.22	23.87	873.647	29.41	29.81	Pass
6	2437	22.86	23.17	23.16	23.17	815.194	29.11	29.88	Pass
11	2462	23.34	23.15	23.32	23.38	854.866	29.32	29.78	Pass

Note: 1. For Ch 1: Directional gain = 6.19 dBi > 6 dBi, so the power limit shall be reduced to 30-(6.19-6) = 29.81dBm.
2. For Ch 6: Directional gain = 6.12 dBi > 6 dBi, so the power limit shall be reduced to 30-(6.12-6) = 29.88dBm.
3. For Ch 11: Directional gain = 6.22 dBi > 6 dBi, so the power limit shall be reduced to 30-(6.22-6) = 29.78dBm.

802.11ax (HE40)

Chan.	Frequency (MHz)	Avg. Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
3	2422	21.44	21.27	21.51	22.02	574.084	27.59	28.63	Pass
6	2437	23.36	23.25	23.48	23.96	899.849	29.54	29.88	Pass
9	2452	21.02	21.54	21.16	20.98	524.966	27.20	29.80	Pass

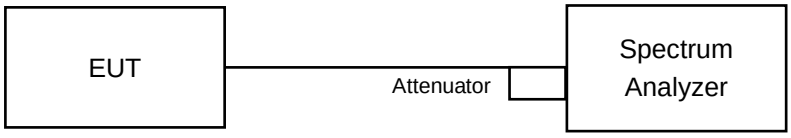
Note: 1. For Ch 3: Directional gain = 7.37 dBi > 6 dBi, so the power limit shall be reduced to 30-(7.37-6) = 28.6 dBm.
2. For Ch 6: Directional gain = 6.12 dBi > 6 dBi, so the power limit shall be reduced to 30-(6.12-6) = 29.88 dBm.
3. For Ch 9: Directional gain = 6.20 dBi > 6 dBi, so the power limit shall be reduced to 30-(6.20-6) = 29.80 dBm.

4.6 Power Spectral Density Measurement

4.6.1 Limits of Power Spectral Density Measurement

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

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

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.

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

Same as Item 4.3.6

4.6.7 Test Results

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	Chain 2	Chain 3				
1	2412	-7.07	-8.46	-6.07	-7.52	0.7638	-1.17	7.81	PASS
6	2437	-6.33	-5.62	-7.83	-6.61	0.8892	-0.51	7.88	PASS
11	2462	-8.73	-6.79	-6.32	-4.88	0.9016	-0.45	7.78	PASS

Note: 1. For Ch 1: Directional gain = 6.19 dBi > 6 dBi, so the power limit shall be reduced to 8-(6.19-6) = 7.81 dBm.
2. For Ch 6: Directional gain = 6.12 dBi > 6 dBi, so the power limit shall be reduced to 8-(6.12-6) = 7.88 dBm.
3. For Ch 11: Directional gain = 6.22 dBi > 6 dBi, so the power limit shall be reduced to 8-(6.22-6) = 7.78 dBm.

802.11g

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	Chain 2	Chain 3					
1	2412	-6.39	-7.14	-5.54	-5.73	0.50	1.0864	0.36	7.81	PASS
6	2437	-7.00	-7.24	-6.58	-7.61	0.50	0.877	-0.57	7.88	PASS
11	2462	-7.13	-6.90	-6.83	-6.35	0.50	0.9397	-0.27	7.78	PASS

Note: 1. For Ch 1: Directional gain = 6.19 dBi > 6 dBi, so the power limit shall be reduced to 8-(6.19-6) = 7.81 dBm.
2. For Ch 6: Directional gain = 6.12 dBi > 6 dBi, so the power limit shall be reduced to 8-(6.12-6) = 7.88 dBm.
3. For Ch 11: Directional gain = 6.22 dBi > 6 dBi, so the power limit shall be reduced to 8-(6.22-6) = 7.78 dBm.

802.11ax (HE20)

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	Chain 2	Chain 3				
1	2412	-11.12	-11.84	-10.80	-10.16	0.32211	-4.92	7.81	PASS
6	2437	-12.17	-11.74	-11.74	-11.02	0.27353	-5.63	7.88	PASS
11	2462	-10.96	-10.56	-11.40	-11.40	0.31261	-5.05	7.78	PASS

Note: 1. For Ch 1: Directional gain = 6.19 dBi > 6 dBi, so the power limit shall be reduced to 8-(6.19-6) = 7.81 dBm.
2. For Ch 6: Directional gain = 6.12 dBi > 6 dBi, so the power limit shall be reduced to 8-(6.12-6) = 7.88 dBm.
3. For Ch 11: Directional gain = 6.22 dBi > 6 dBi, so the power limit shall be reduced to 8-(6.22-6) = 7.78 dBm.

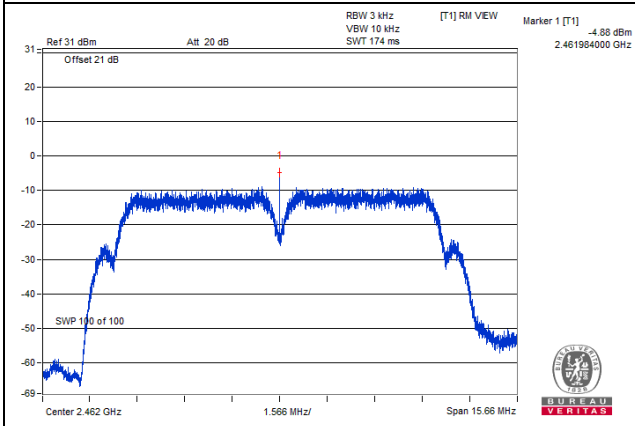
802.11ax (HE40)

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	Chain 2	Chain 3					
3	2422	-15.04	-15.59	-14.73	-14.32	0.15	0.13428	-8.72	6.63	PASS
6	2437	-11.37	-13.57	-14.37	-13.12	0.15	0.20941	-6.79	7.88	PASS
9	2452	-15.86	-14.90	-15.67	-15.94	0.15	0.11482	-9.40	7.80	PASS

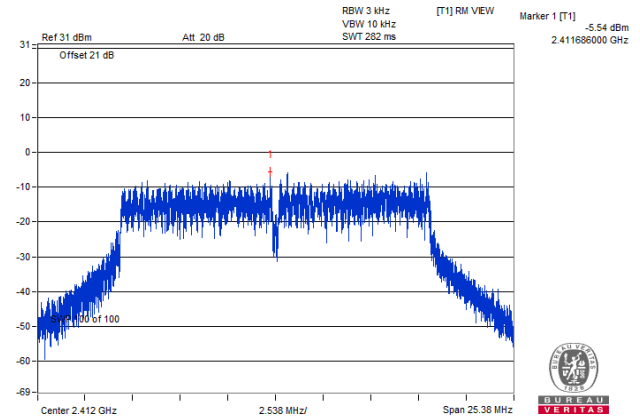
Note: 1. For Ch 3: Directional gain = 7.37 dBi > 6 dBi, so the power limit shall be reduced to 8-(7.37-6) = 6.63 dBm.
2. For Ch 6: Directional gain = 6.12 dBi > 6 dBi, so the power limit shall be reduced to 8-(6.12-6) = 7.88 dBm.
3. For Ch 9: Directional gain = 6.20 dBi > 6 dBi, so the power limit shall be reduced to 8-(6.20-6) = 7.80 dBm.

Spectrum Plot of Worst Value

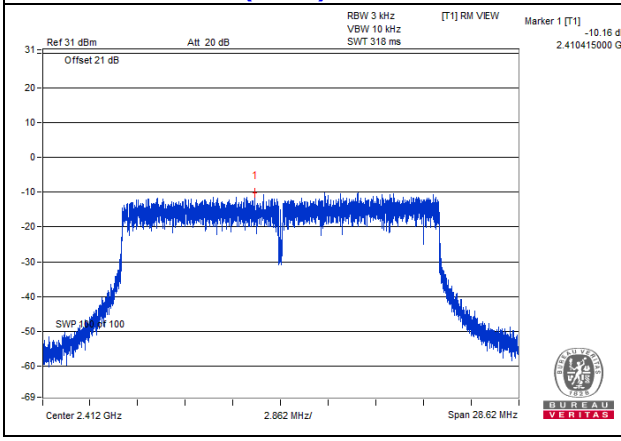
802.11b / Chain 3 : CH11



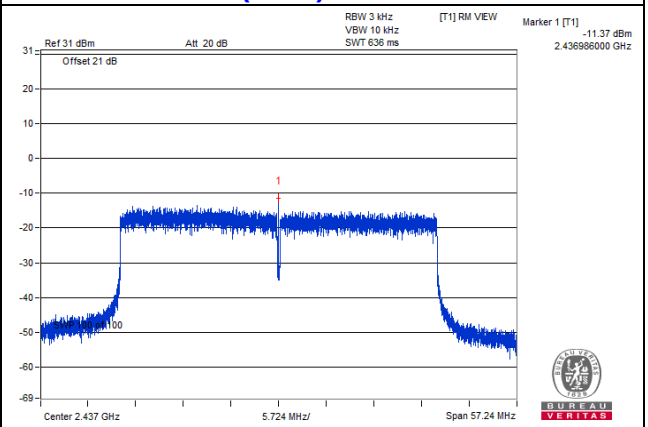
802.11g / Chain 2 : CH1



802.11ax (HE20) / Chain 3 : CH1



802.11ax (HE40) / Chain 0 : CH6

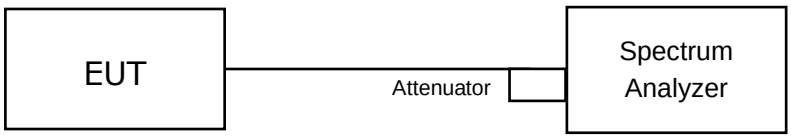


4.7 Conducted Out of Band Emission Measurement

4.7.1 Limits of Conducted Out of Band Emission Measurement

Below -30dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

4.7.2 Test Setup



4.7.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.7.4 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.

4.7.5 Deviation from Test Standard

No deviation.

4.7.6 EUT Operating Condition

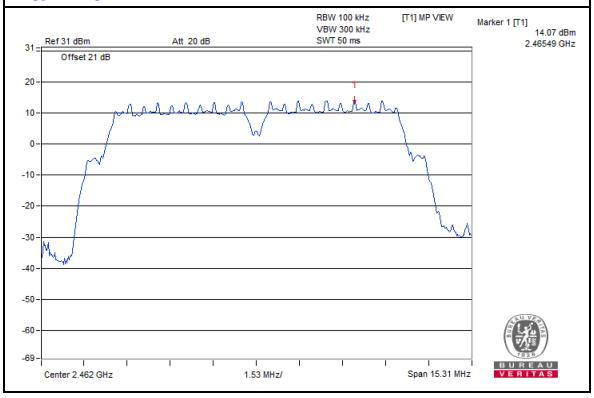
Same as Item 4.3.6

4.7.7 Test Results

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.

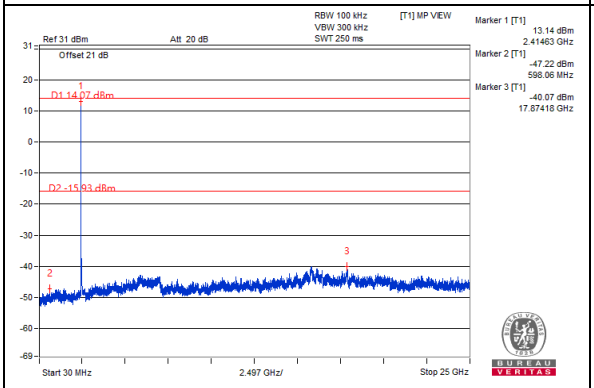
802.11b

Maximum REF

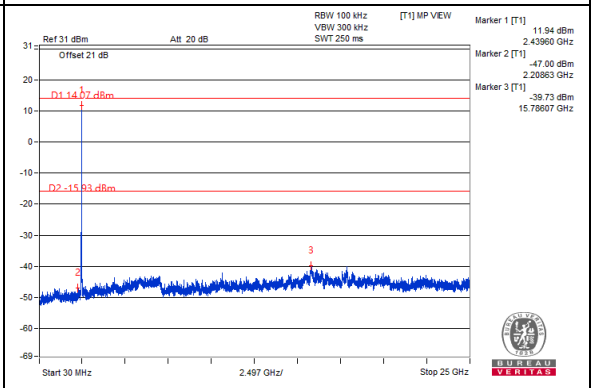


Chain 0

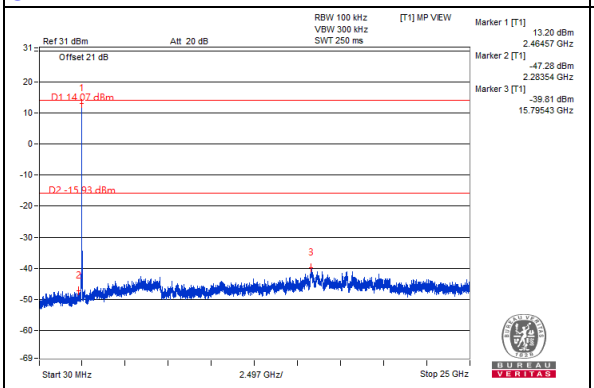
CH 1



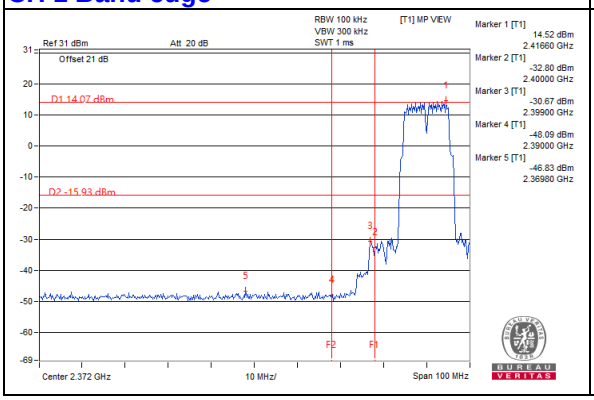
CH 6



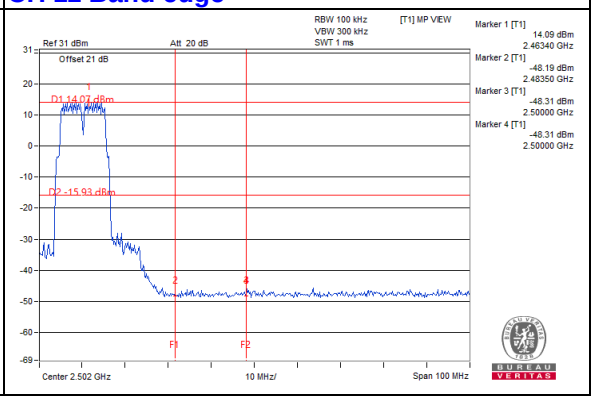
CH 11



CH 1 Band edge

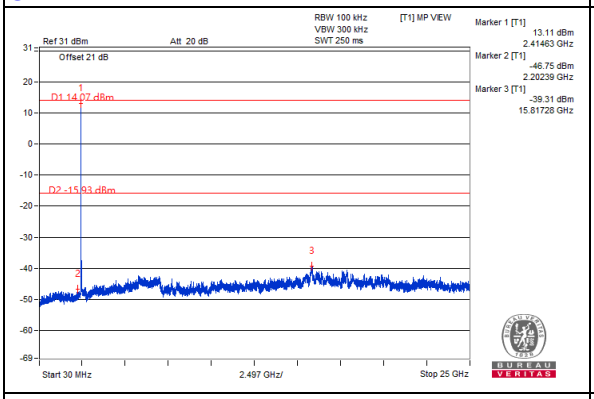


CH 11 Band edge

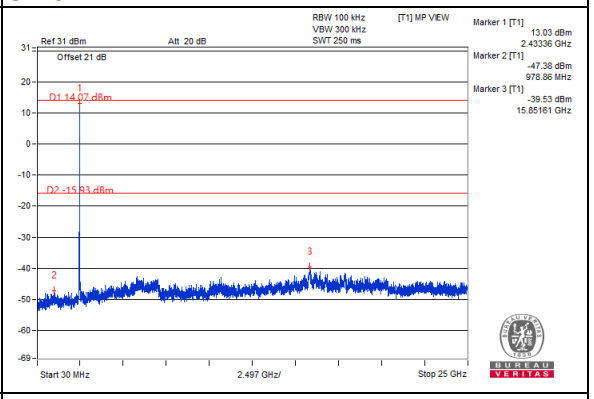


Chain 1

CH 1



CH 6



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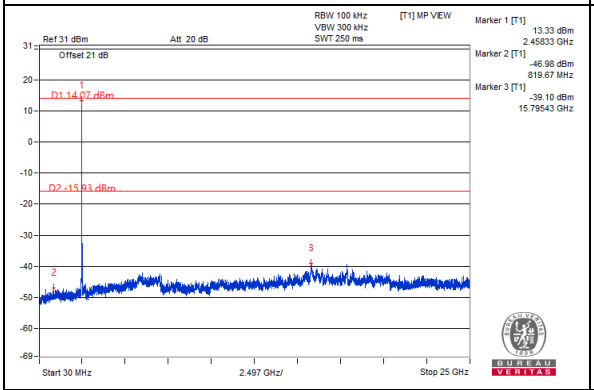

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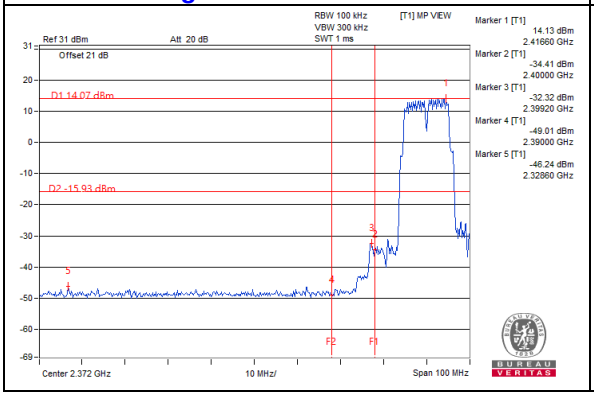
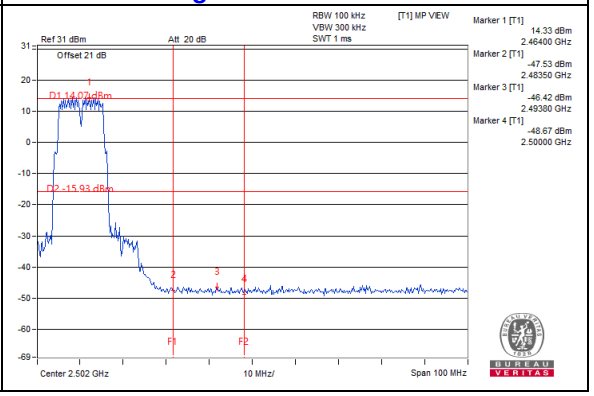
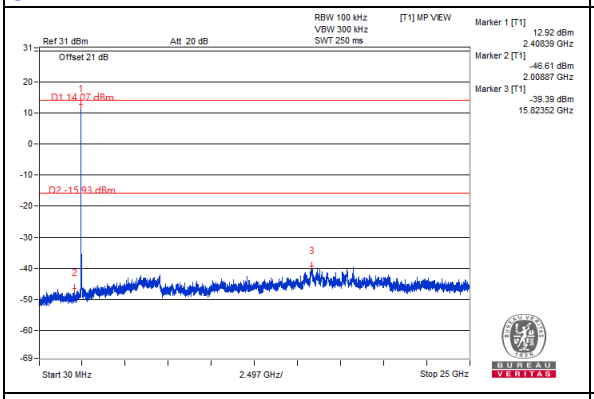


CH 11 Band edge

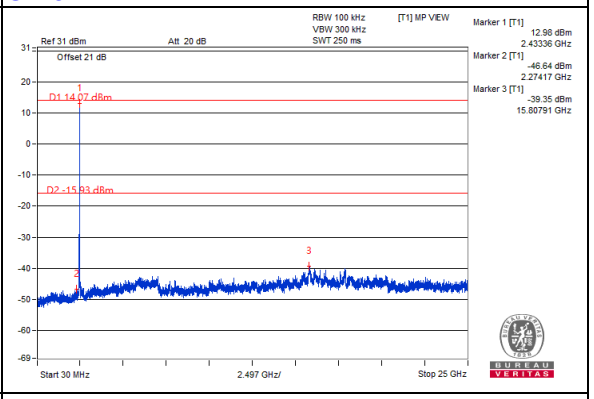


Chain 2

CH 1



CH 6



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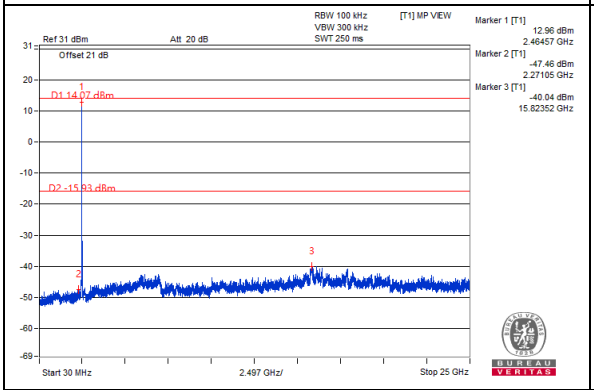
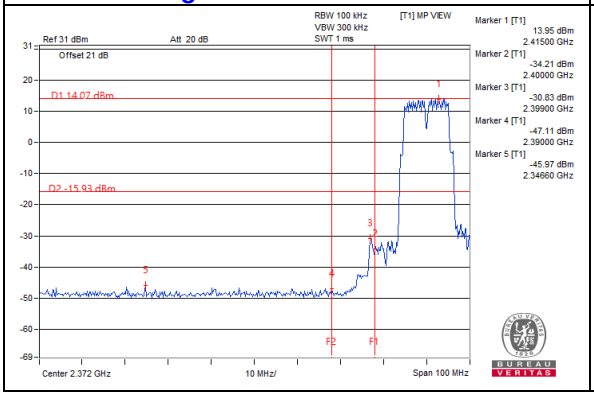
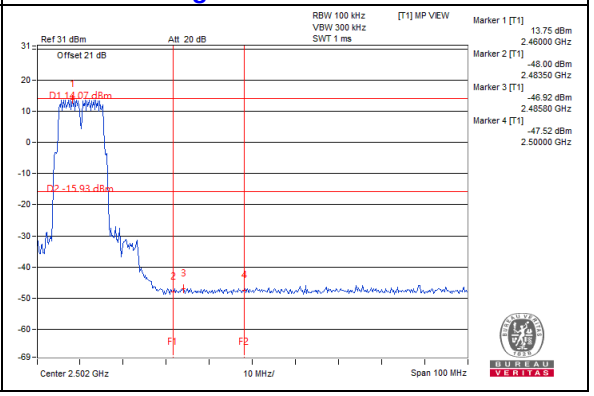


CH 1 Band edge

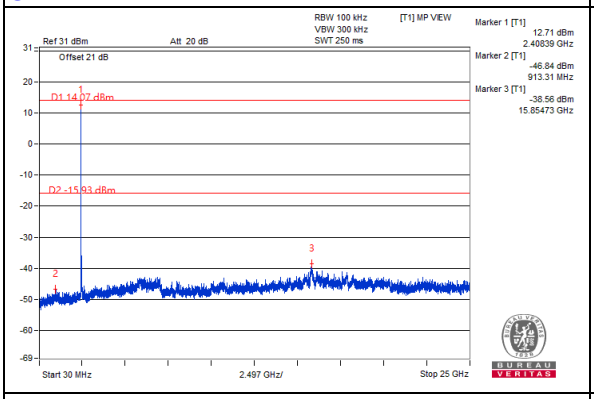


CH 11 Band edge

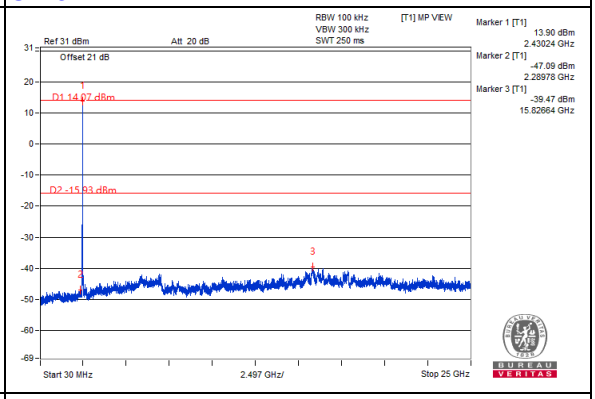


Chain 3

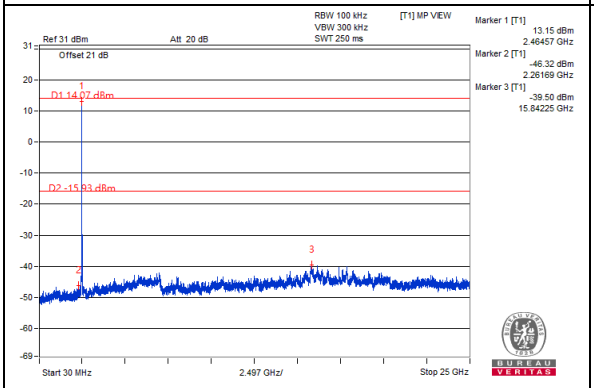
CH 1



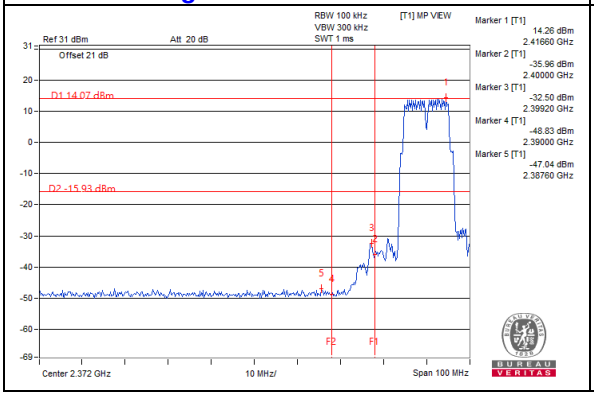
CH 6



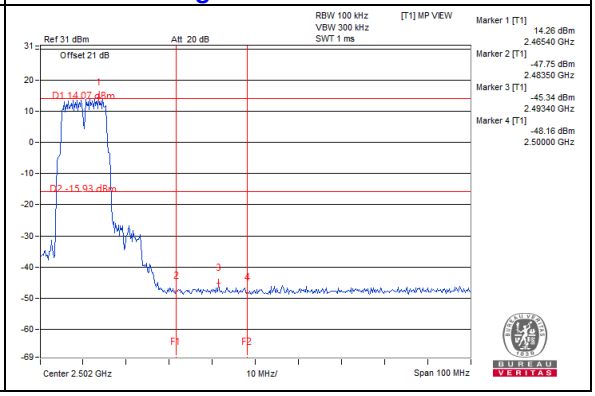
CH 11



CH 1 Band edge

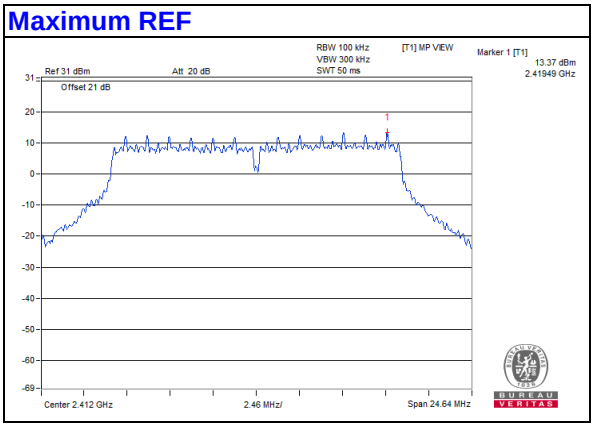


CH 11 Band edge



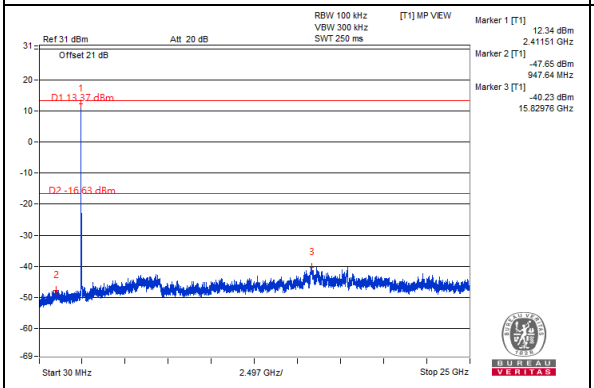
802.11g

Maximum REF

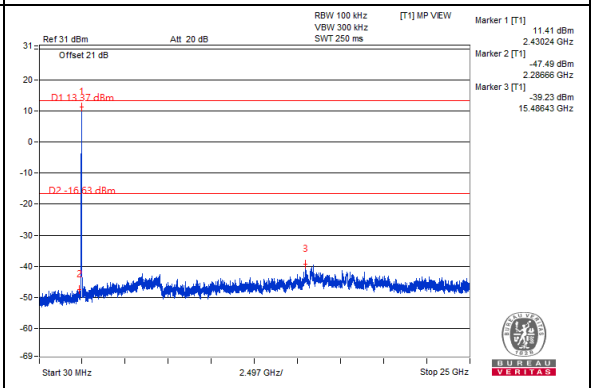


Chain 0

CH 1



CH 6



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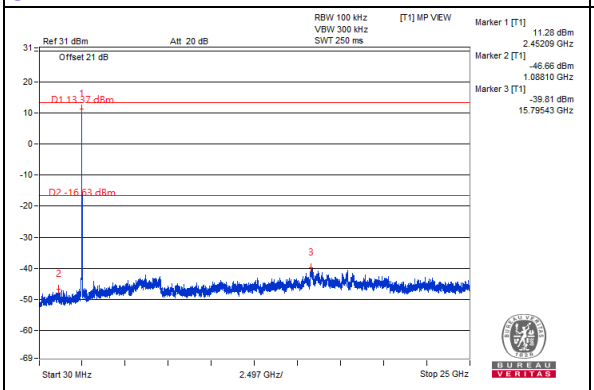
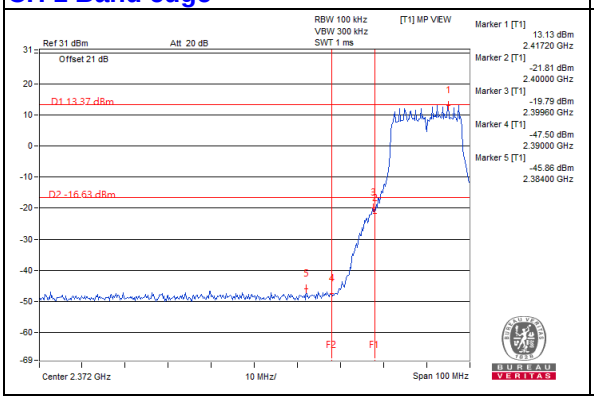
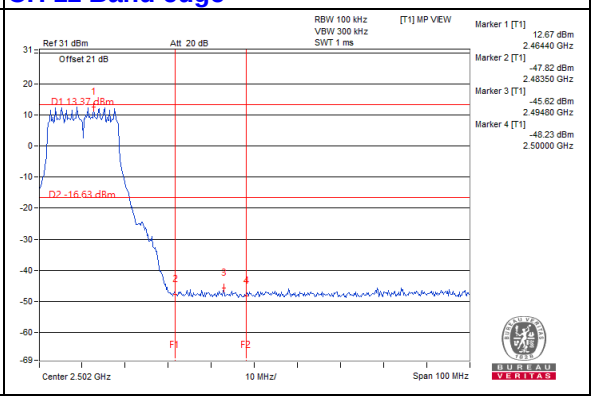


CH 1 Band edge

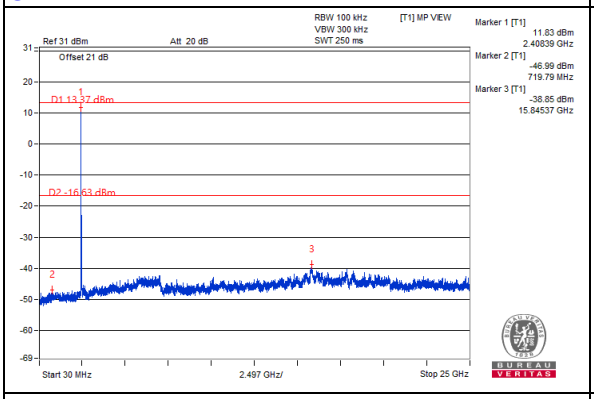


CH 11 Band edge

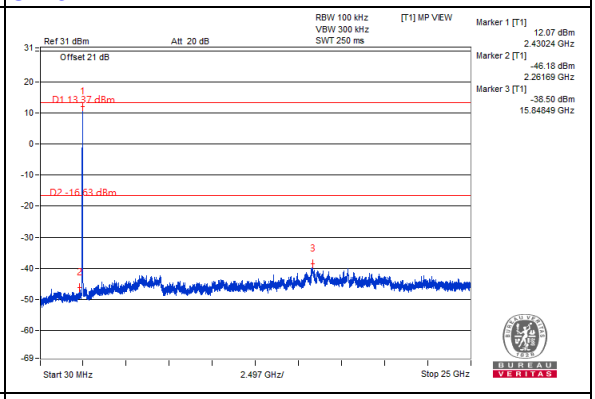


Chain 1

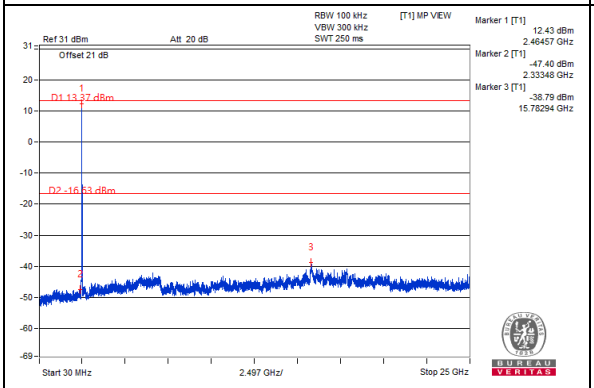
CH 1



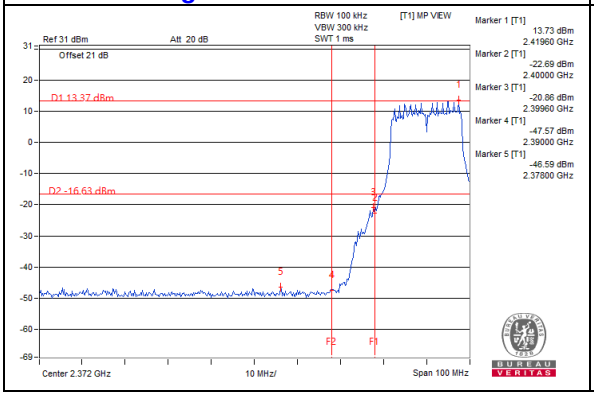
CH 6



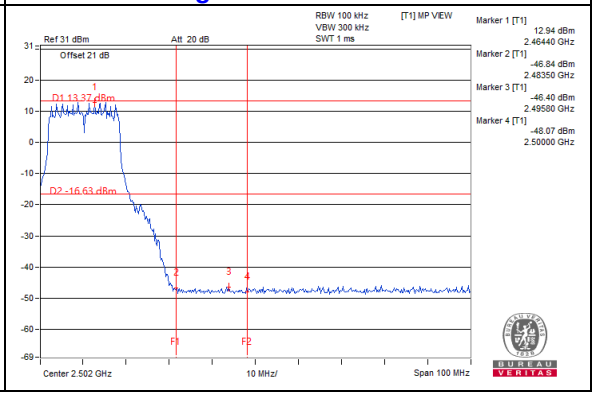
CH 11



CH 1 Band edge

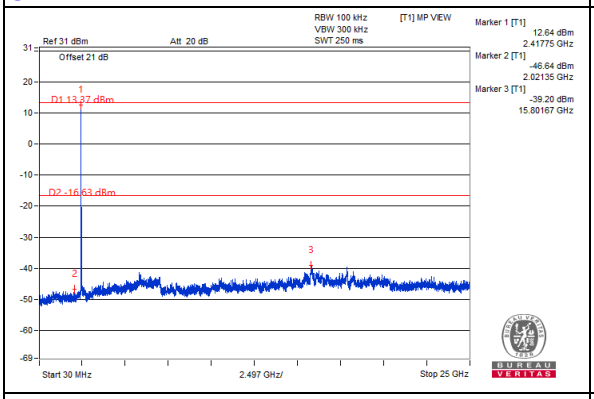


CH 11 Band edge

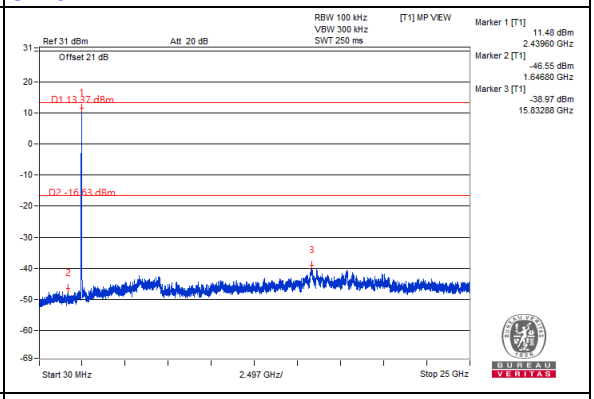


Chain 2

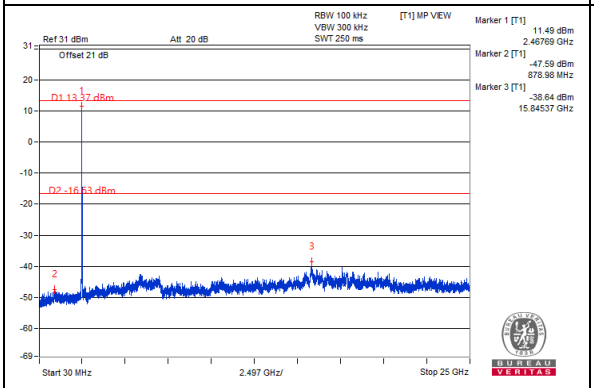
CH 1



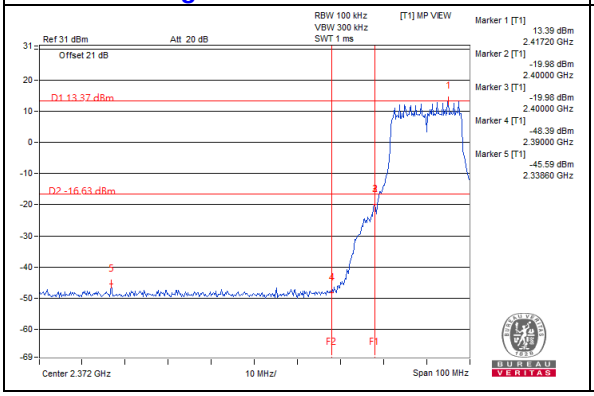
CH 6



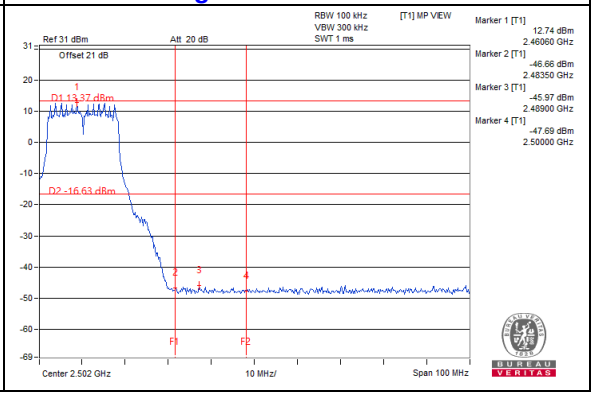
CH 11



CH 1 Band edge

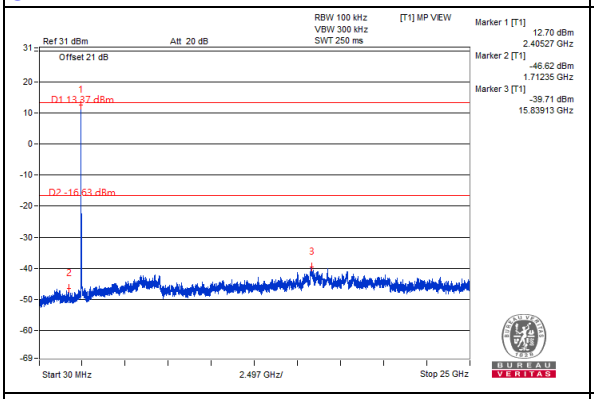


CH 11 Band edge

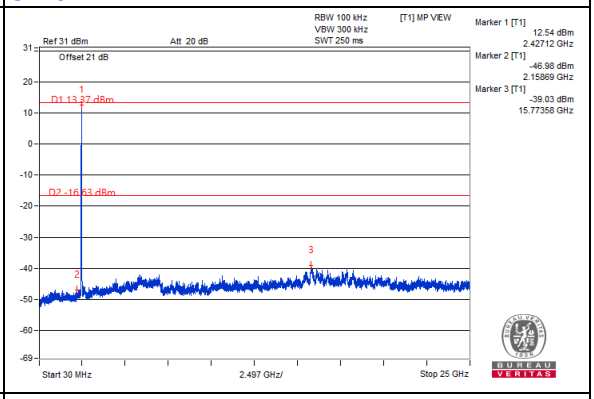


Chain 3

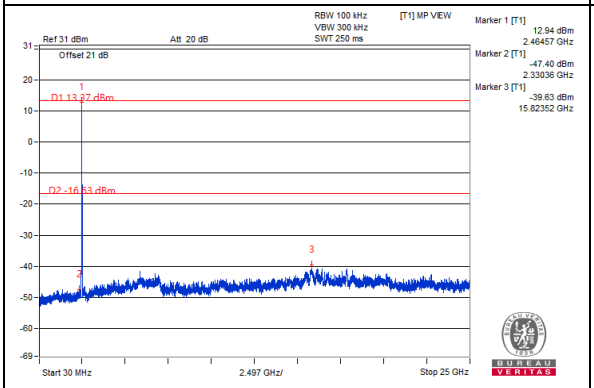
CH 1



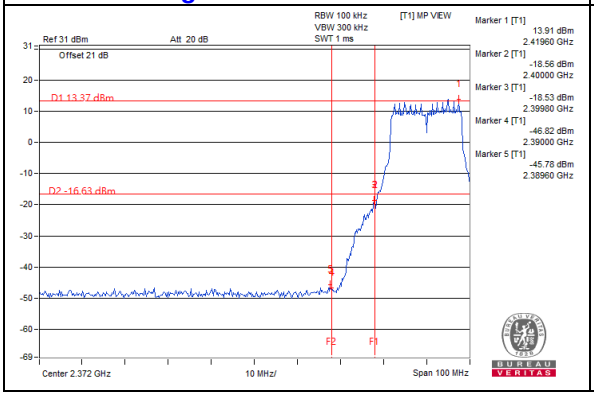
CH 6



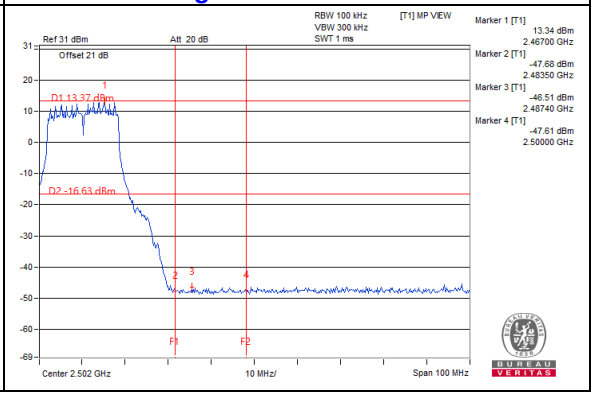
CH 11



CH 1 Band edge

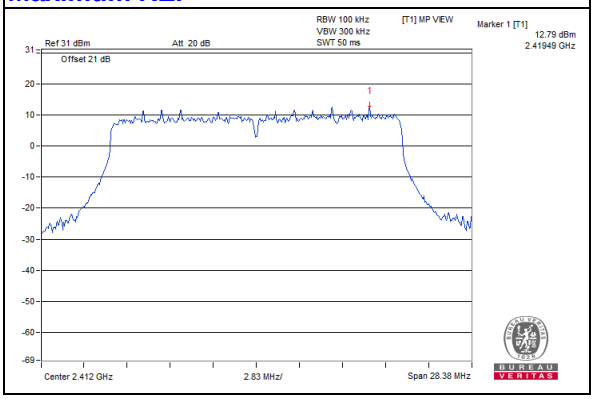


CH 11 Band edge



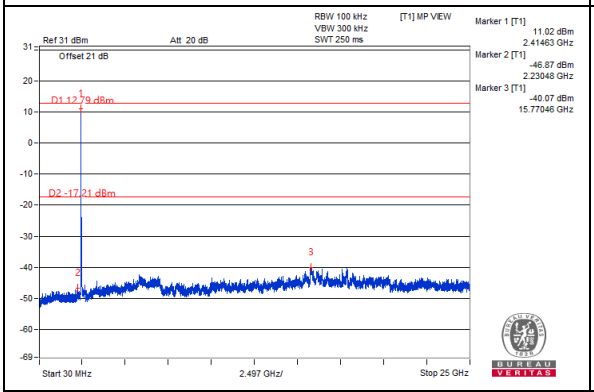
802.11ax (HE20)

Maximum REF

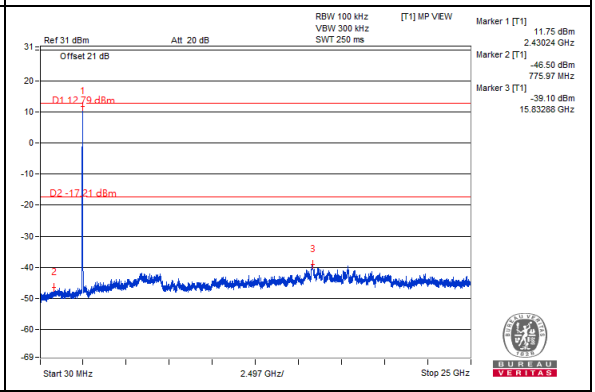


Chain 0

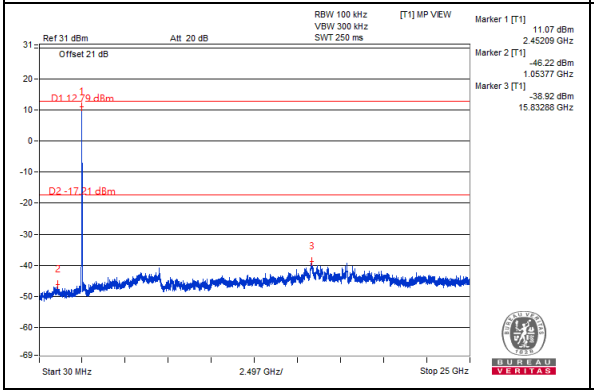
CH 1



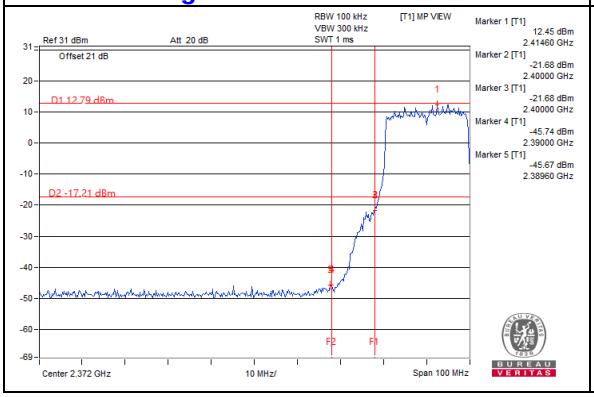
CH 6



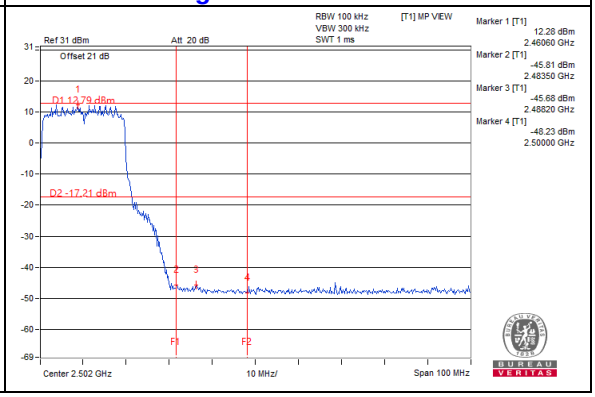
CH 11



CH 1 Band edge

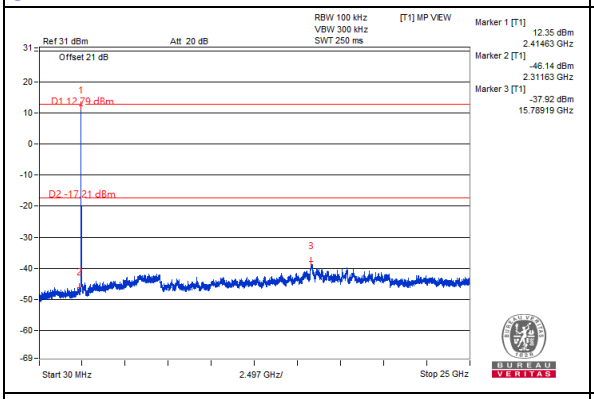


CH 11 Band edge

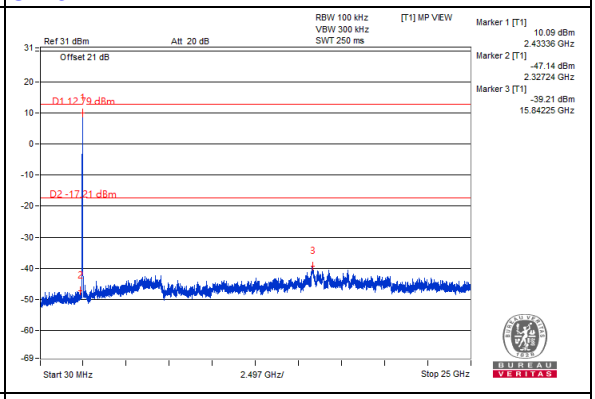


Chain 1

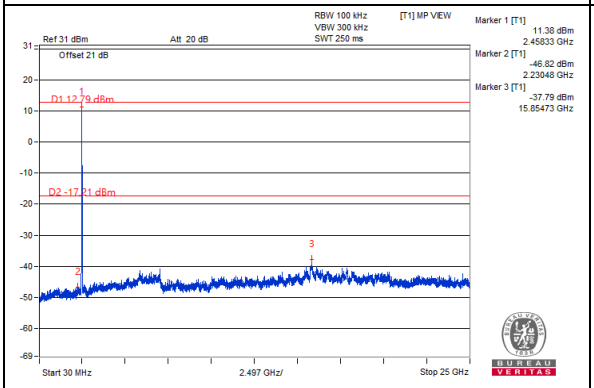
CH 1



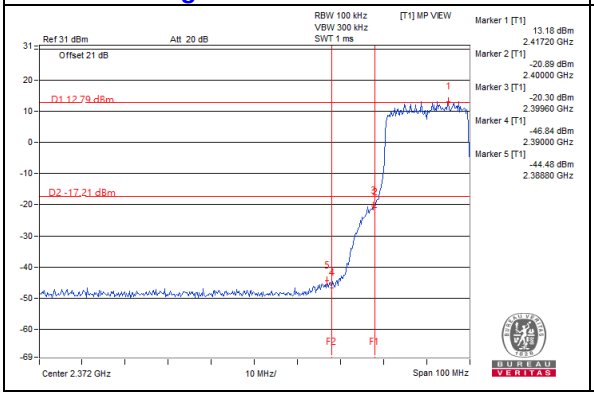
CH 6



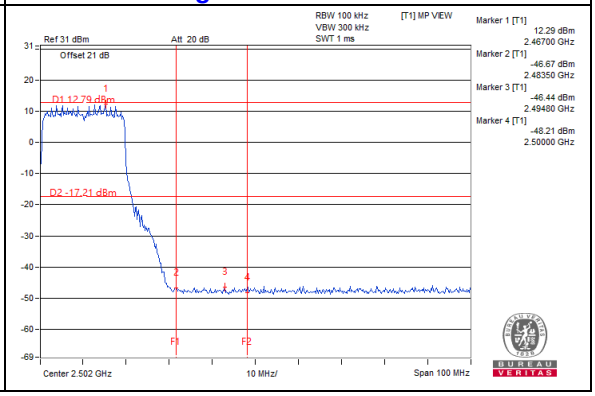
CH 11



CH 1 Band edge

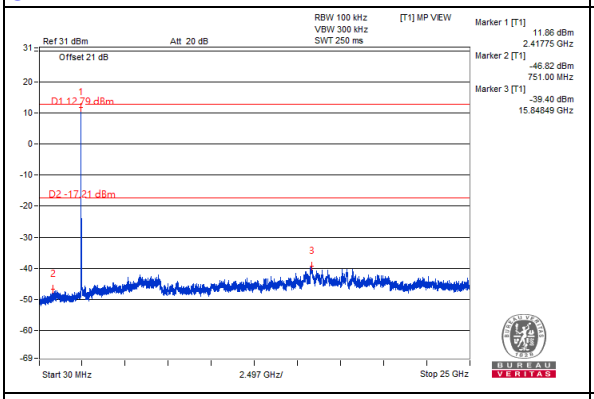


CH 11 Band edge

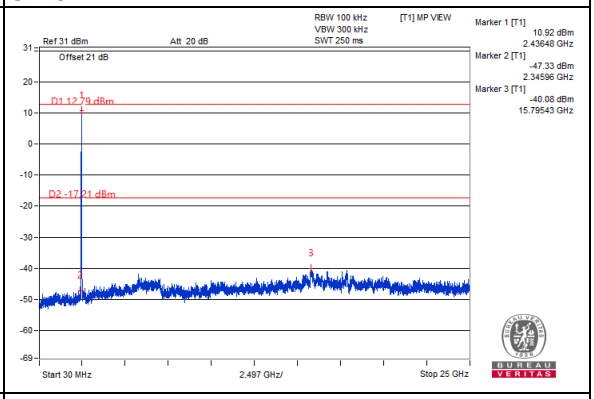


Chain 2

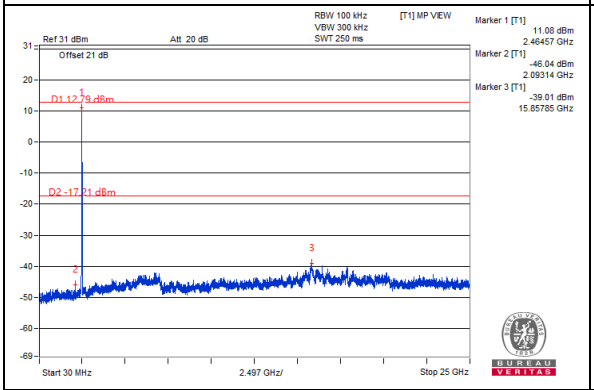
CH 1



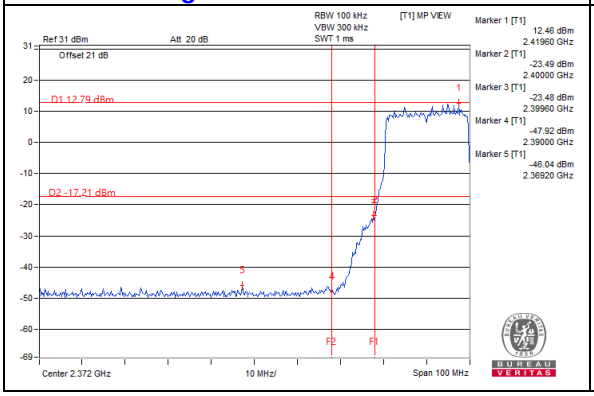
CH 6



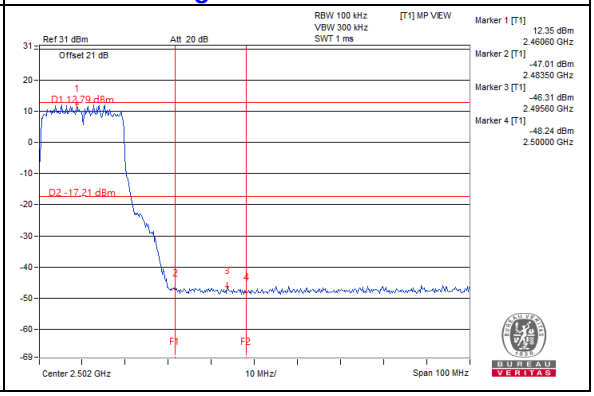
CH 11



CH 1 Band edge

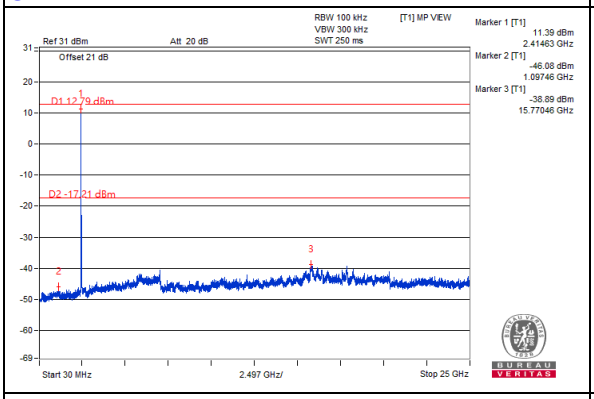


CH 11 Band edge

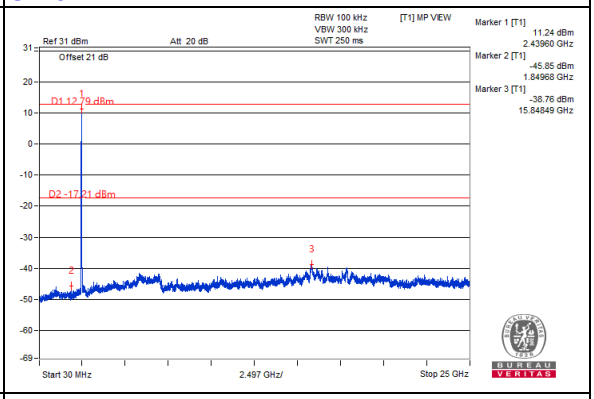


Chain 3

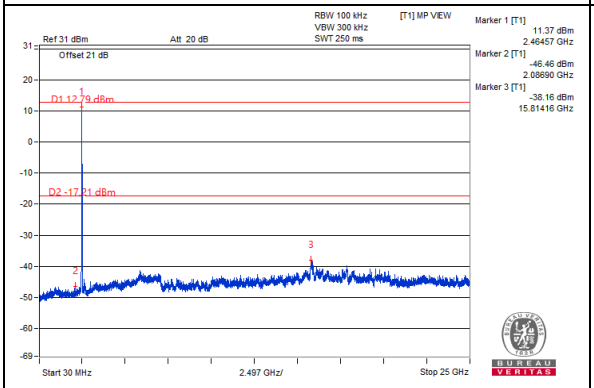
CH 1



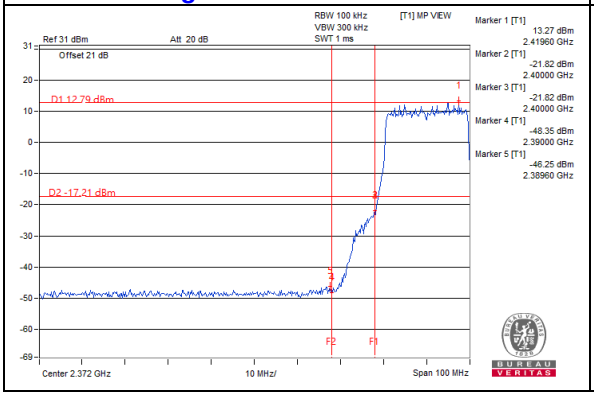
CH 6



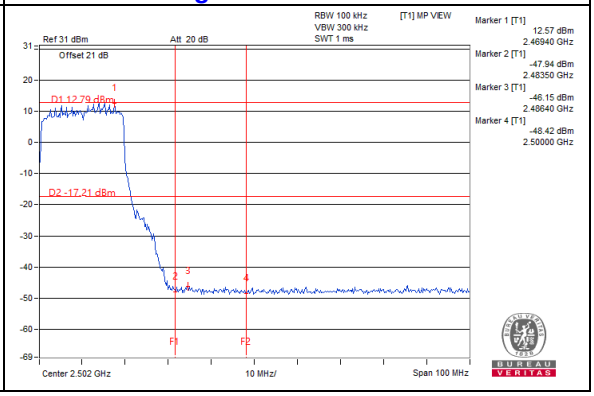
CH 11



CH 1 Band edge

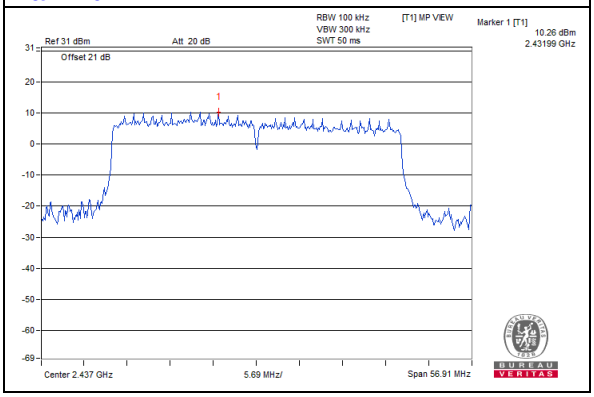


CH 11 Band edge



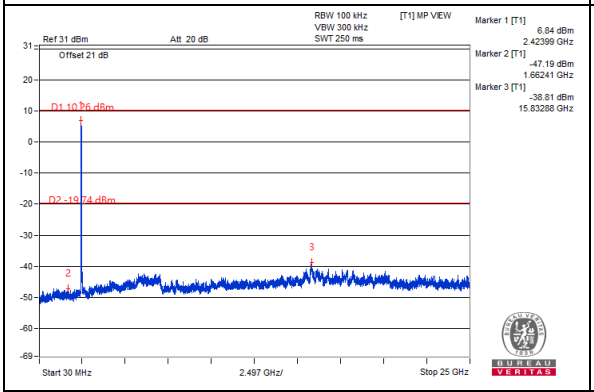
802.11ax (HE40)

Maximum REF

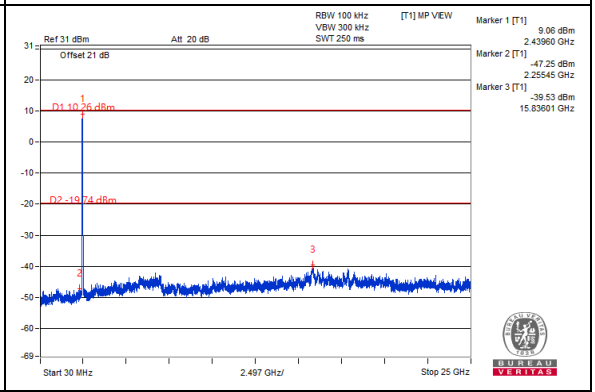


Chain 0

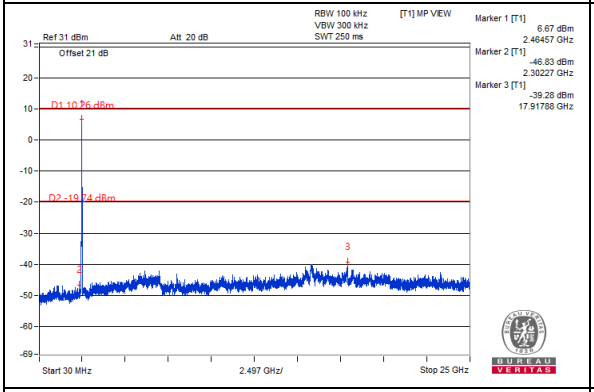
CH 3



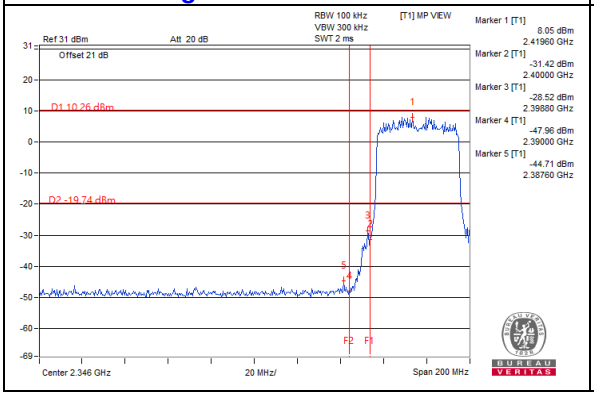
CH 6



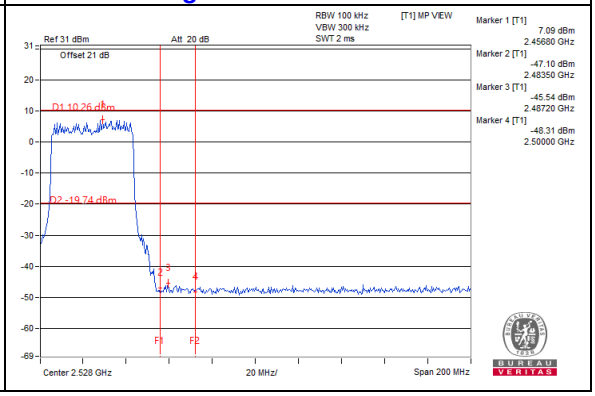
CH 9



CH 3 Band edge

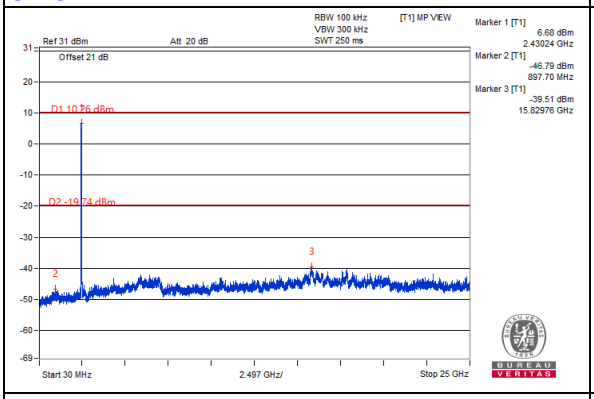


CH 9 Band edge

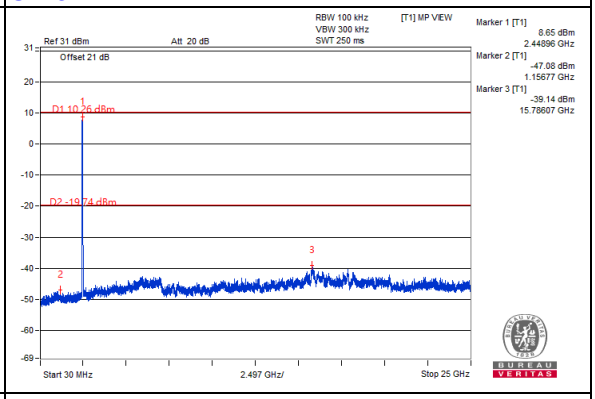


Chain 1

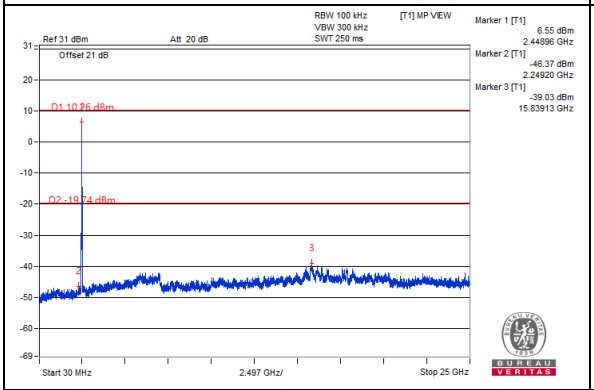
CH 3



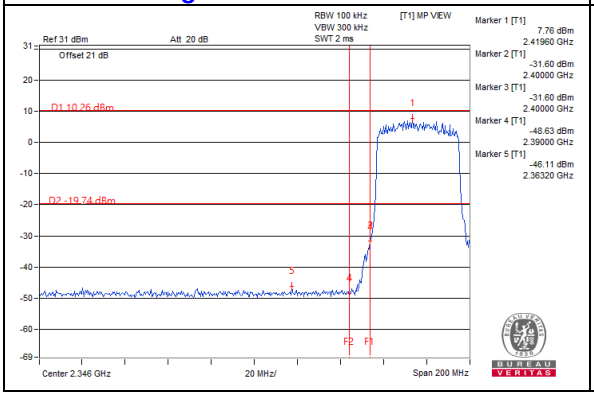
CH 6



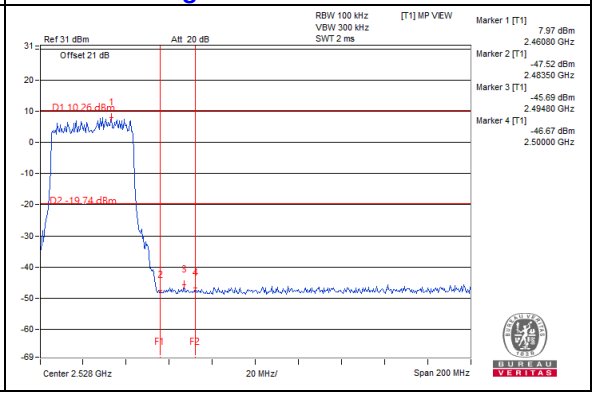
CH 9



CH 3 Band edge

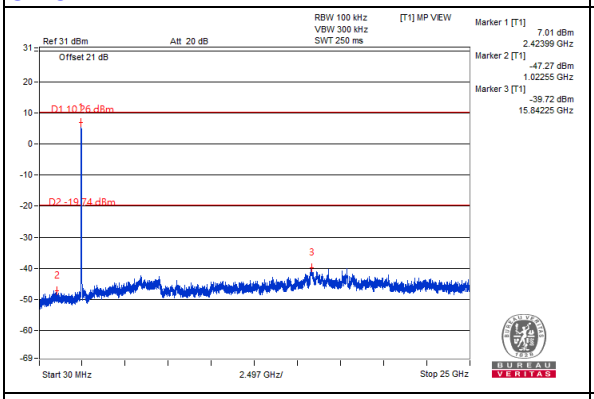


CH 9 Band edge

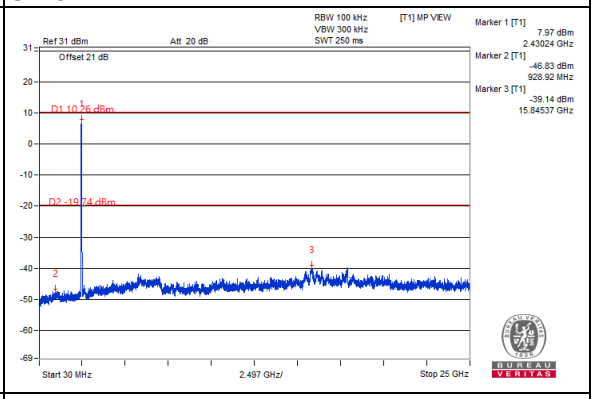


Chain 2

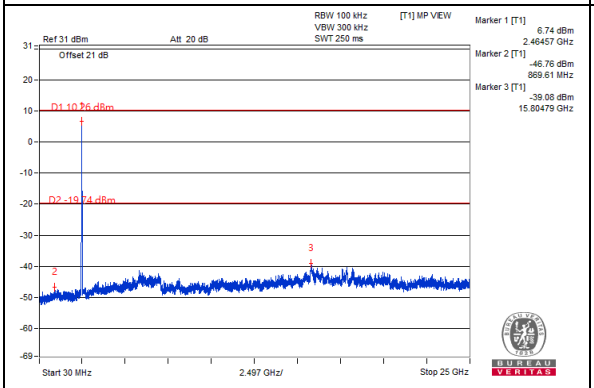
CH 3



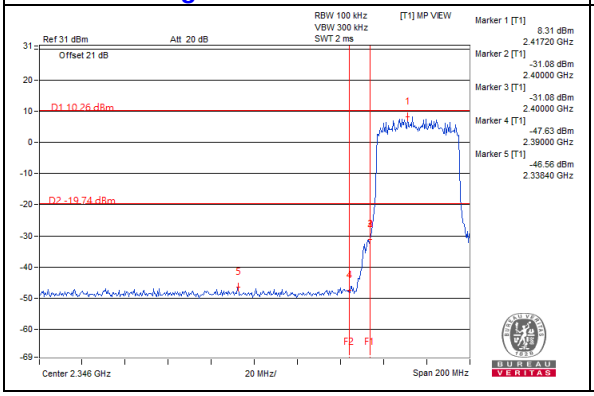
CH 6



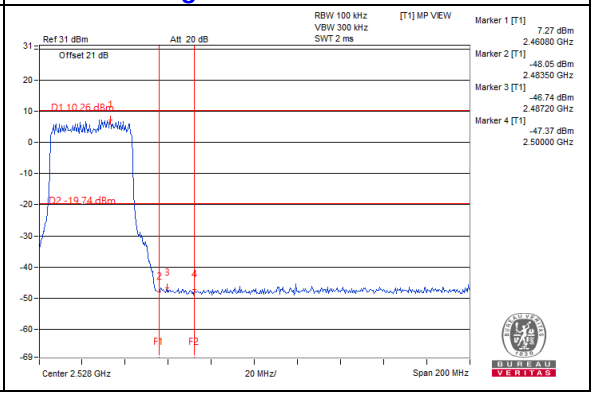
CH 9



CH 3 Band edge

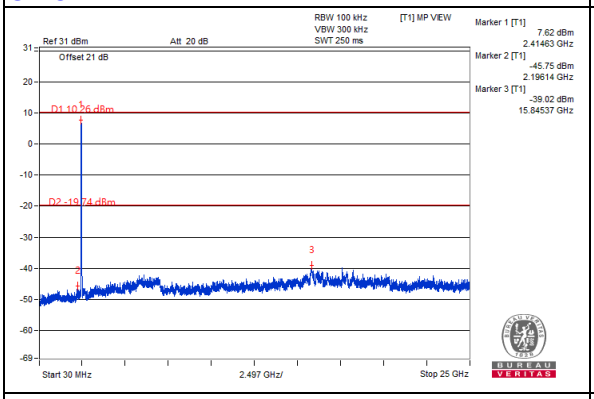


CH 9 Band edge

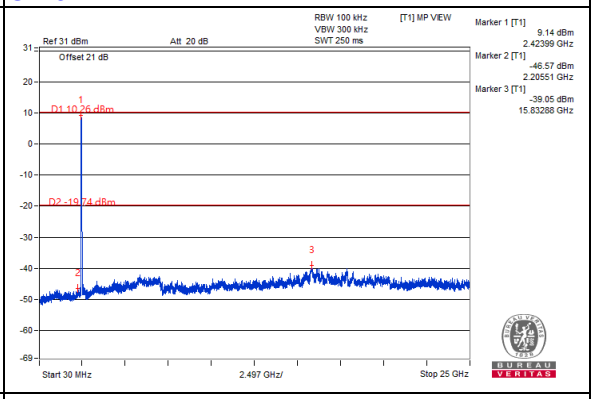


Chain 3

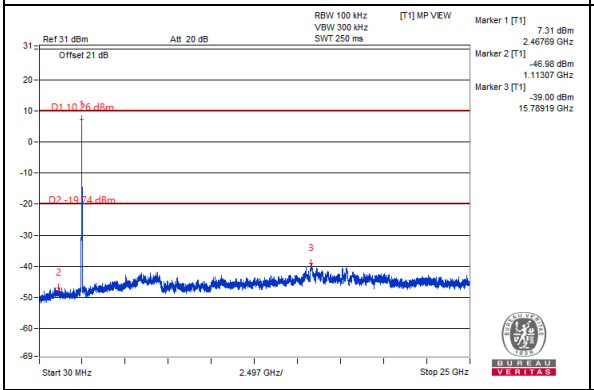
CH 3



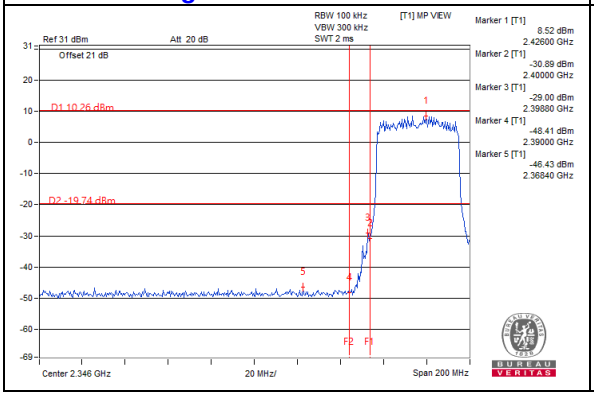
CH 6



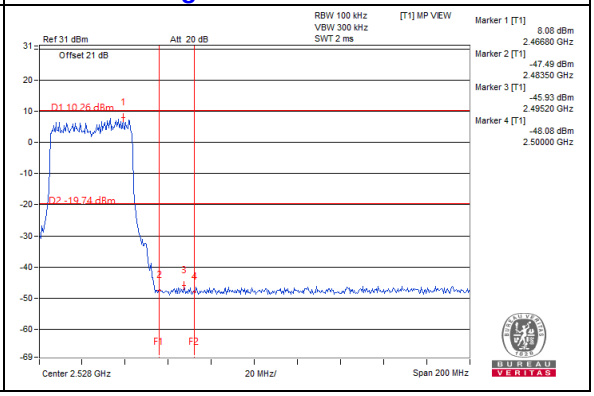
CH 9



CH 3 Band edge



CH 9 Band edge



5 Pictures of Test Arrangements

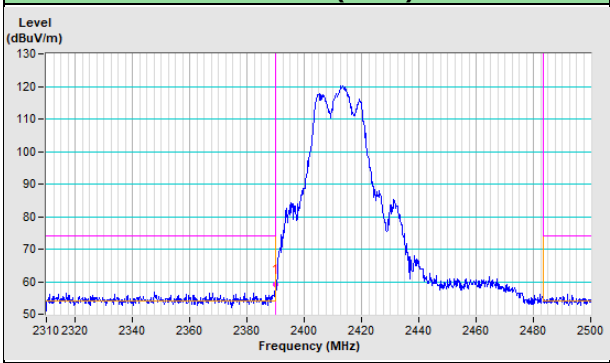
Please refer to the attached file (Test Setup Photo).

Annex A - Band-Edge Measurement

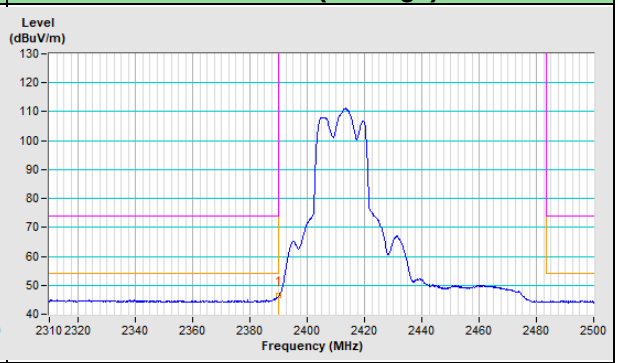
802.11b

Channel 1

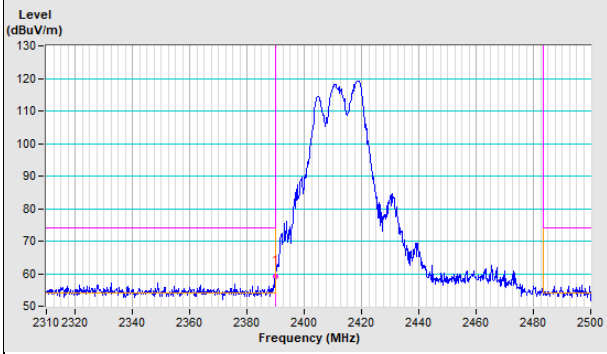
Horizontal (Peak)



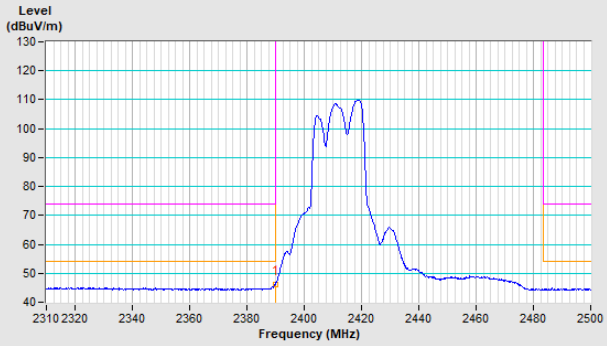
Horizontal (Average)



Vertical (Peak)

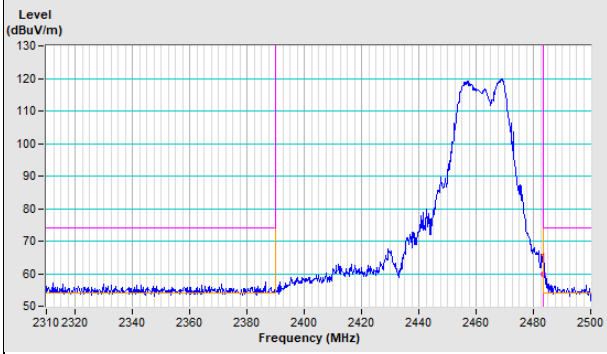


Vertical (Average)

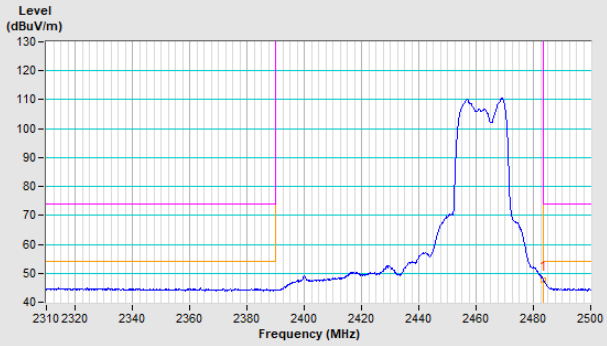


Channel 11

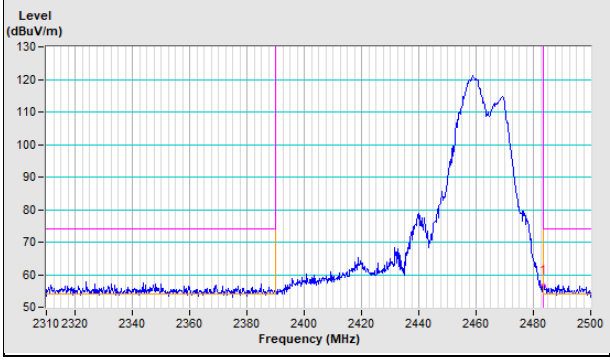
Horizontal (Peak)



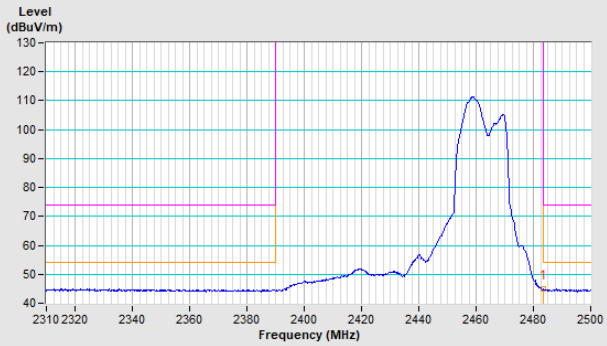
Horizontal (Average)



Vertical (Peak)



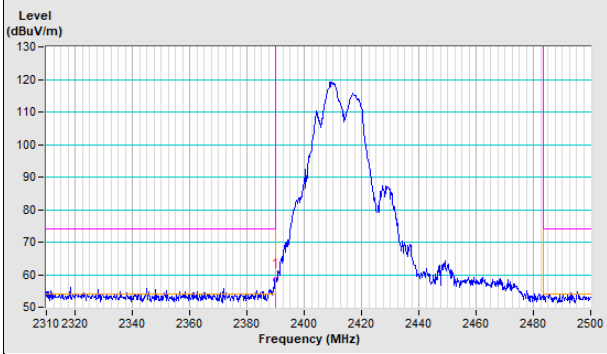
Vertical (Average)



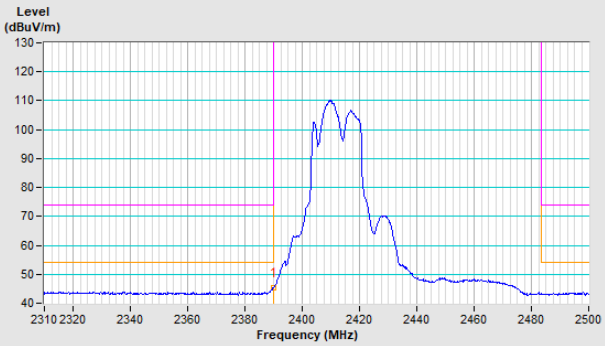
802.11g

Channel 1

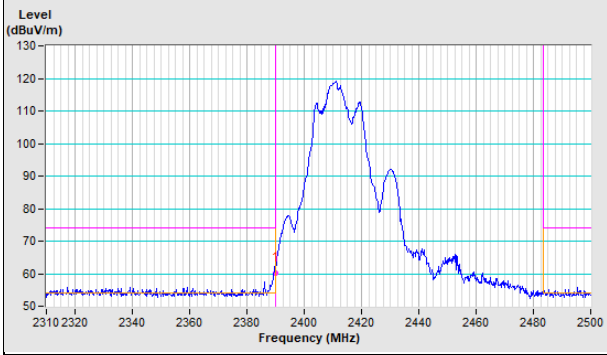
Horizontal (Peak)



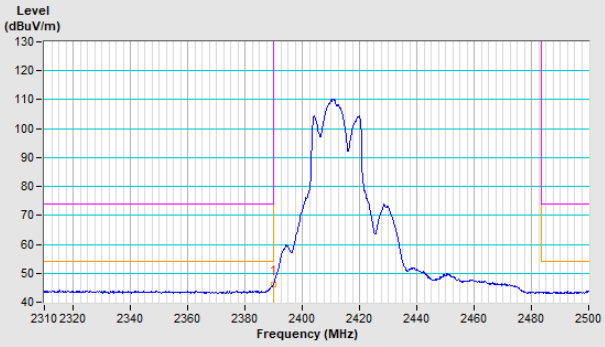
Horizontal (Average)



Vertical (Peak)

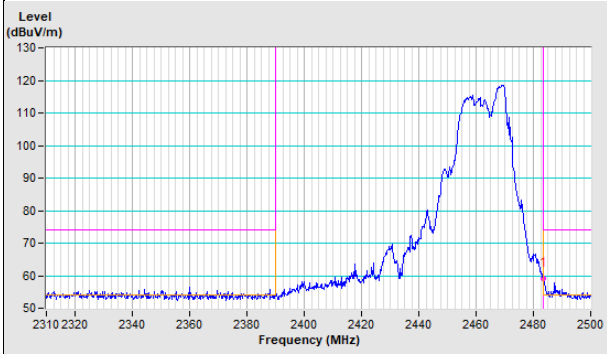


Vertical (Average)

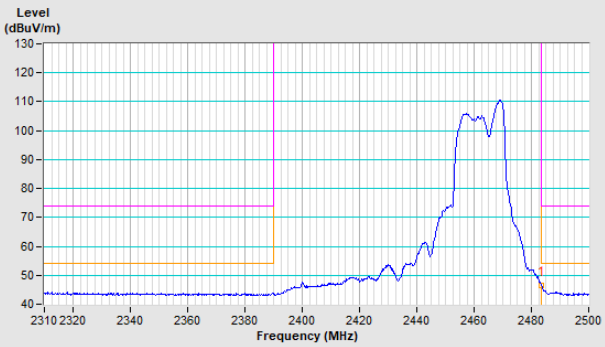


Channel 11

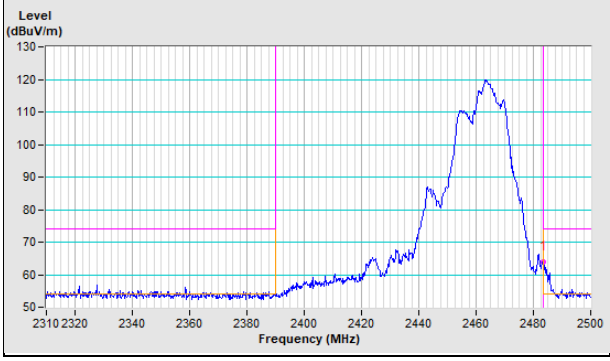
Horizontal (Peak)



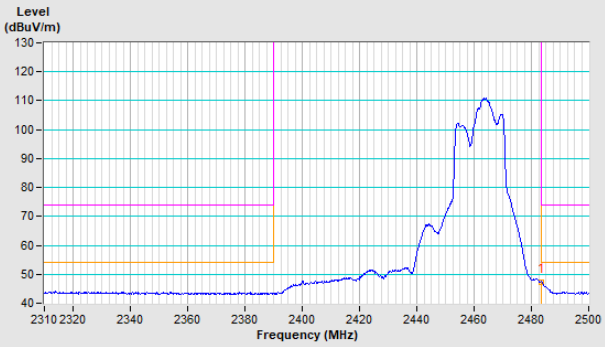
Horizontal (Average)



Vertical (Peak)



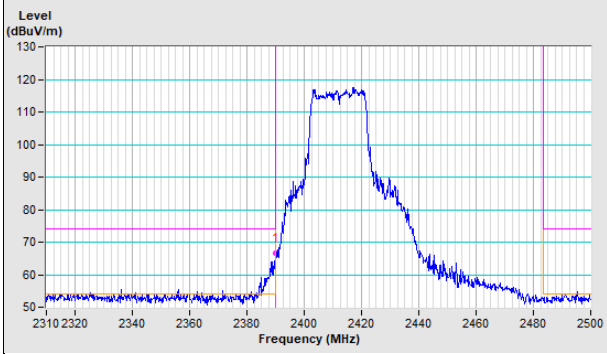
Vertical (Average)



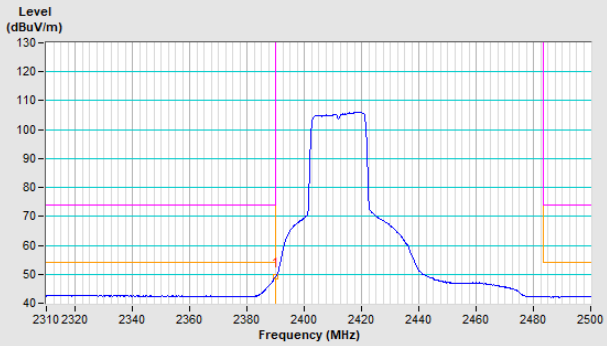
802.11ax (HE20)

Channel 1

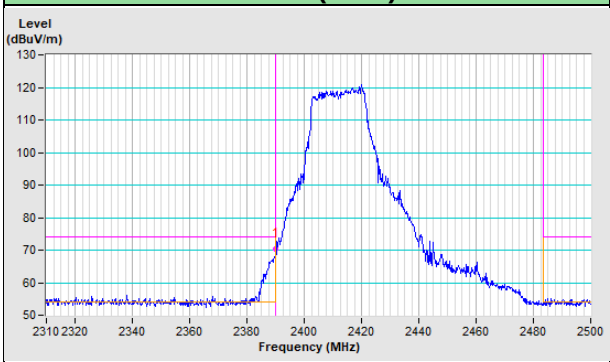
Horizontal (Peak)



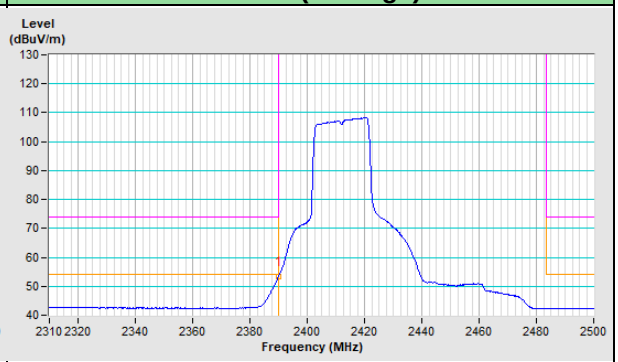
Horizontal (Average)



Vertical (Peak)

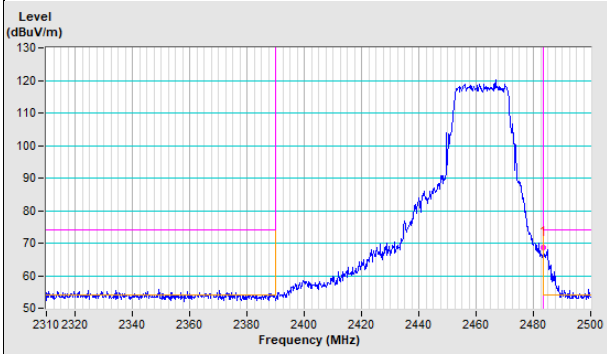


Vertical (Average)

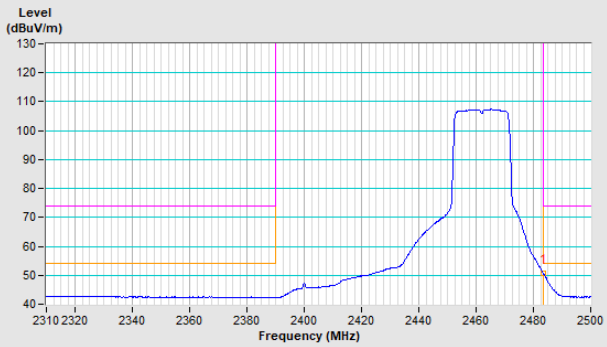


Channel 11

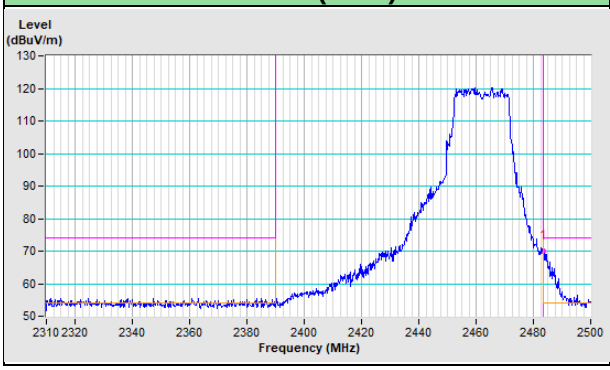
Horizontal (Peak)



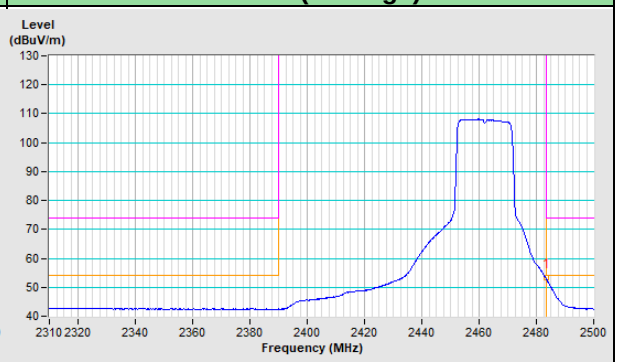
Horizontal (Average)



Vertical (Peak)



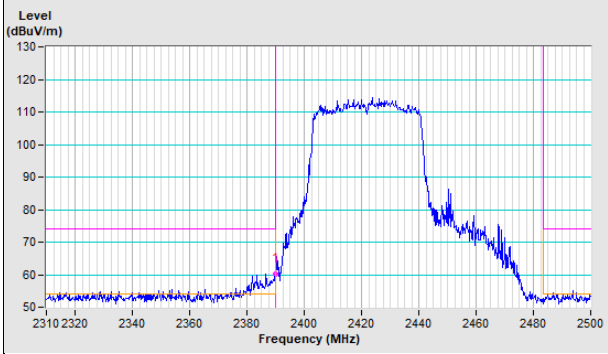
Vertical (Average)



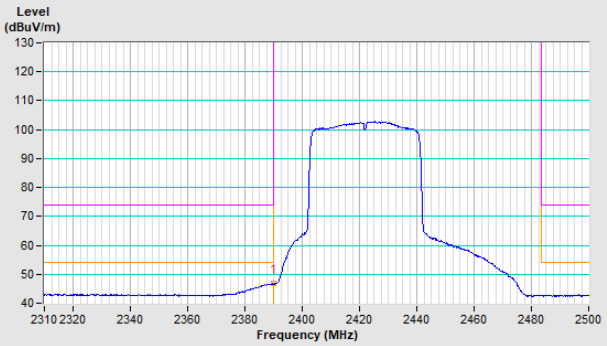
802.11ax (HE40)

Channel 3

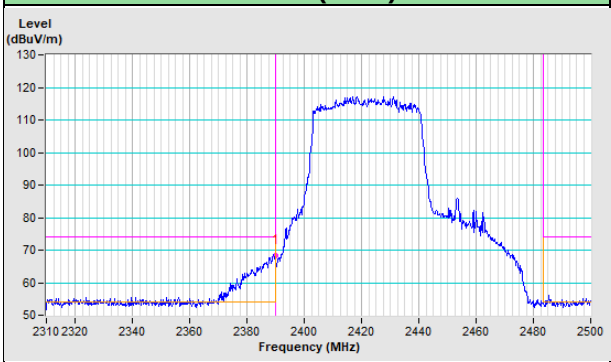
Horizontal (Peak)



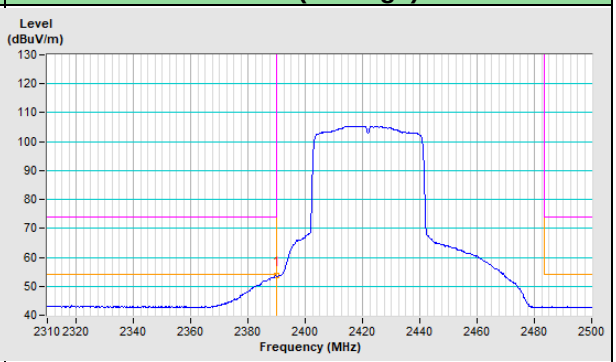
Horizontal (Average)



Vertical (Peak)

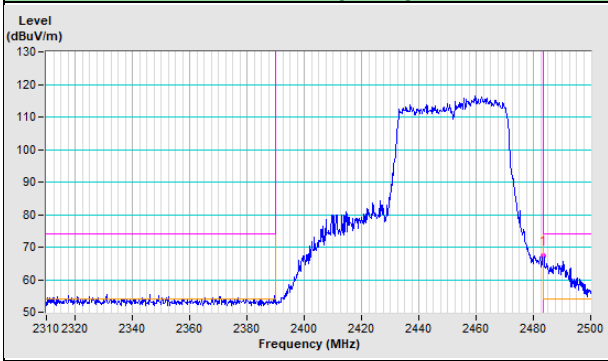


Vertical (Average)

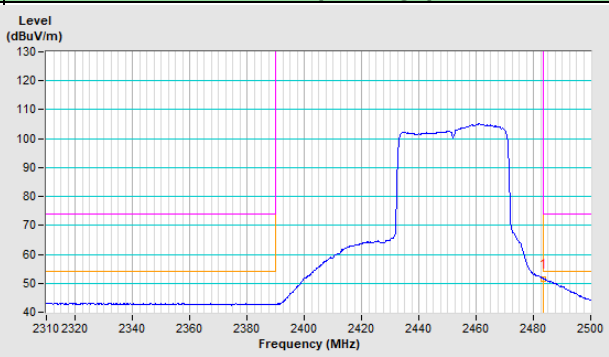


Channel 9

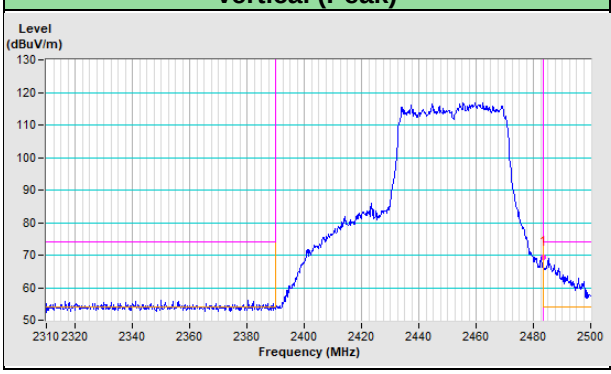
Horizontal (Peak)



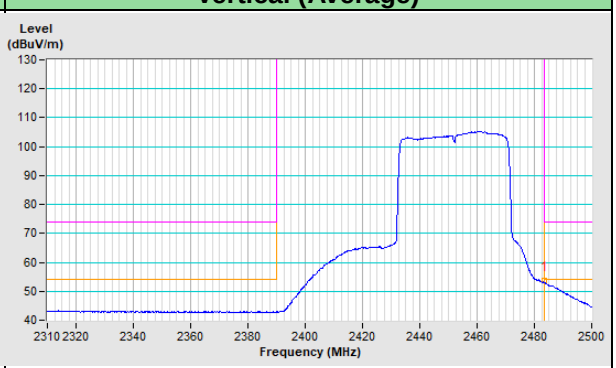
Horizontal (Average)



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 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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