

FCC Test Report

Report No.: RF190415E04-1

FCC ID: VW3FAST3686V2H

Test Model: F@ST 3686 V2.2 HP

Received Date: Apr. 15, 2019

Test Date: May 29 to Sep. 12, 2019

Issued Date: Sep. 23, 2019

Applicant: SAGEMCOM Broadband SAS

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
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**FCC Registration /
Designation Number:** 723255 / TW2022



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Release Control Record

Issue No.	Description	Date Issued
RF190415E04-1	Original release.	Sep. 23, 2019

1 Certificate of Conformity

Product: Euro-DOCSIS3.0

Brand: Sagemcom

Test Model: F@ST 3686 V2.2 HP

Sample Status: ENGINEERING SAMPLE

Applicant: SAGEMCOM Broadband SAS

Test Date: May 29 to Sep. 12, 2019

Standard: 47 CFR FCC Part 15, Subpart E (Section 15.407)
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 : Wendy Wu , **Date:** Sep. 23, 2019
Wendy Wu / Specialist

Approved by : May Chen , **Date:** Sep. 23, 2019
May Chen / Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart E (Section 15.407)			
FCC Clause	Test Item	Result	Remarks
15.407(b)(6)	AC Power Conducted Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -15.6dB at 0.15000MHz.
15.407(b)(1/2/3/4(i/ii)/6)	Radiated Emissions & Band Edge Measurement*	PASS	Meet the requirement of limit. Minimum passing margin is -0.1dB at 5150.00MHz.
15.407(a)(1/2/3)	Max Average Transmit Power	PASS	Meet the requirement of limit.
---	Occupied Bandwidth Measurement	-	Reference only.
15.407(a)(1/2/3)	Peak Power Spectral Density	PASS	Meet the requirement of limit.
15.407(e)	6dB bandwidth	PASS	Meet the requirement of limit. (U-NII-3 Band only)
15.407(g)	Frequency Stability	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	Antenna connector is i-pex(MHF) not a standard connector.

*For U-NII-3 band compliance with rule part 15.407(b)(4)(i), the OOB test plots were recorded in Annex A.

Note:

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	1.8 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.0 dB
	30MHz ~ 1GHz	4.9 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.1 dB
	6GHz ~ 18GHz	4.9 dB
	18GHz ~ 40GHz	5.2 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Euro-DOCSIS3.0
Brand	Sagemcom
Test Model	F@ST 3686 V2.2 HP
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	12Vdc from power adapter
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode only
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11b: up to 11Mbps 802.11a/g: up to 54Mbps 802.11n: up to 450Mbps 802.11ac: up to 1300Mbps
Operating Frequency	2.4GHz: 2.412 ~ 2.462 GHz 5GHz: 5.18~ 5.24 GHz, 5.745 ~ 5.825 GHz
Number of Channel	2.4GHz: 802.11b, 802.11g, 802.11n (HT20): 11 802.11n (HT40): 7 5GHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 9 802.11n (HT40), 802.11ac (VHT40): 4 802.11ac (VHT80): 2
Output Power	2.412 ~ 2.462GHz: 468.343 mW CDD Mode: 5.18 ~ 5.24GHz: 404.38 mW 5.745 ~ 5.825GHz: 405.907 mW Beamforming Mode: 5.18 ~ 5.24GHz: 403.299 mW 5.745 ~ 5.825GHz: 405.907 mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Adapter x 1
Data Cable Supplied	RJ-45 Cable x 1 (Unshielded, 1.5 m)

Note:

1. 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.

2. The EUT power needs to be supplied from a power adapters, the information is as below table:

No.	Brand	Model No.	Spec.
1	SAGEMCOM	MSG-V2500AR120-030A0-US	Input: 100-120Vac, 1.0A max, 50/60Hz Output: 12V, 2.5A DC output cable: Unshielded 2 m
2	SAGEMCOM	NBS30E120250VU	Input: 100-120Vac, 0.9A , 60Hz Output: 12V, 2.5A DC output cable: Unshielded 2 m

Note:

1. From the above conditions, the conducted emissions worse case was found in **Adapter No. 2**. Therefore only the test data of the mode was recorded in this report.
2. From the above conditions, the radiated emissions worse case was found in **Adapter No. 1**. Therefore only the test data of the mode was recorded in this report.

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

Ant. No.	Chain No.	Brand	Antenna Gain (dBi)	Frequency Range (MHz)	Antenna Type	Connector Type	Cable Length (mm)
1	Chain (0)	TSKY	3.13	2400~2500	PCB	i-pex(MHF)	56.5
			5.72	5150~5850			
2	Chain (1)	TSKY	3.57	5150~5850	PCB	i-pex(MHF)	250
3	Chain (2)	TSKY	3.54	2400~2500	PCB	i-pex(MHF)	40
			5.87	5150~5850			

Note: For 802.11b modulation the Max. gain was selected for the final test.

4. The EUT incorporates a MIMO function:

2.4GHz Band		
MODULATION MODE	TX & RX CONFIGURATION	
802.11b	1TX (Diversity)	2RX
802.11g	2TX	2RX
802.11n (HT20)	2TX	2RX
802.11n (HT40)	2TX	2RX
5GHz Band		
MODULATION MODE	TX & RX CONFIGURATION	
802.11a	3TX	3RX
802.11n (HT20)	3TX	3RX
802.11n (HT40)	3TX	3RX
802.11ac (VHT20)	3TX	3RX
802.11ac (VHT40)	3TX	3RX
802.11ac (VHT80)	3TX	3RX

Note:

1. All of modulation mode support beamforming function except 2.4GHz and 802.11a 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) and 802.11ac mode for 20MHz (40MHz), therefore investigated worst case to representative mode in test report. (Final test mode refer section 3.2.1)

5. 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.

3.2 Description of Test Modes

FOR 5180 ~ 5240MHz

4 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
36	5180 MHz	44	5220 MHz
40	5200 MHz	48	5240 MHz

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
42	5210 MHz

FOR 5745 ~ 5825MHz:

5 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
149	5745 MHz	161	5805 MHz
153	5765 MHz	165	5825 MHz
157	5785 MHz		

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
151	5755 MHz	159	5795 MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
155	5775 MHz

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To				Description
	RE $\geq$ 1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

Where **RE $\geq$ 1G**: Radiated Emission above 1GHz
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	FREQ. Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
802.11a	5180-5240	36 to 48	36, 40, 48	OFDM	BPSK	6
802.11ac (VHT20)		36 to 48	36, 40, 48	OFDM	BPSK	6.5
802.11ac (VHT40)		38 to 46	38, 46	OFDM	BPSK	13.5
802.11ac (VHT80)		42	42	OFDM	BPSK	29.3
802.11a	5745-5825	149 to 165	149, 157, 165	OFDM	BPSK	6
802.11ac (VHT20)		149 to 165	149, 157, 165	OFDM	BPSK	6.5
802.11ac (VHT40)		151 to 159	151, 159	OFDM	BPSK	13.5
802.11ac (VHT80)		155	155	OFDM	BPSK	29.3

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	FREQ. Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
802.11ac (VHT40)	5180-5240 5745-5825	38 to 46 151 to 159	151	OFDM	BPSK	13.5

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	FREQ. Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
802.11ac (VHT40)	5180-5240 5745-5825	38 to 46 151 to 159	151	OFDM	BPSK	13.5

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	FREQ. Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
802.11a	5180-5240	36 to 48	36, 40, 48	OFDM	BPSK	6
802.11ac (VHT20)		36 to 48	36, 40, 48	OFDM	BPSK	6.5
802.11ac (VHT40)		38 to 46	38, 46	OFDM	BPSK	13.5
802.11ac (VHT80)		42	42	OFDM	BPSK	29.3
802.11a	5745-5825	149 to 165	149, 157, 165	OFDM	BPSK	6
802.11ac (VHT20)		149 to 165	149, 157, 165	OFDM	BPSK	6.5
802.11ac (VHT40)		151 to 159	151, 159	OFDM	BPSK	13.5
802.11ac (VHT80)		155	155	OFDM	BPSK	29.3
Beamforming Mode (output power only)						
Mode	FREQ. Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
802.11ac (VHT20)	5180-5240	36 to 48	36, 40, 48	OFDM	BPSK	6.5
802.11ac (VHT40)		38 to 46	38, 46	OFDM	BPSK	13.5
802.11ac (VHT80)		42	42	OFDM	BPSK	29.3
802.11ac (VHT20)	5745-5825	149 to 165	149, 157, 165	OFDM	BPSK	6.5
802.11ac (VHT40)		151 to 159	151, 159	OFDM	BPSK	13.5
802.11ac (VHT80)		155	155	OFDM	BPSK	29.3

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested By
RE $\geq$ 1G	22deg. C, 73%RH	120Vac, 60Hz	Jeff Lee
RE<1G	21deg. C, 71%RH	120Vac, 60Hz	Jeff Lee
PLC	24deg. C, 76%RH	120Vac, 60Hz	Andy Ho
APCM	24deg. C, 66%RH	120Vac, 60Hz	Jyunchun Lin

3.3 Duty Cycle of Test Signal

If duty cycle of test signal is $\geq 98\%$, duty factor is not required.

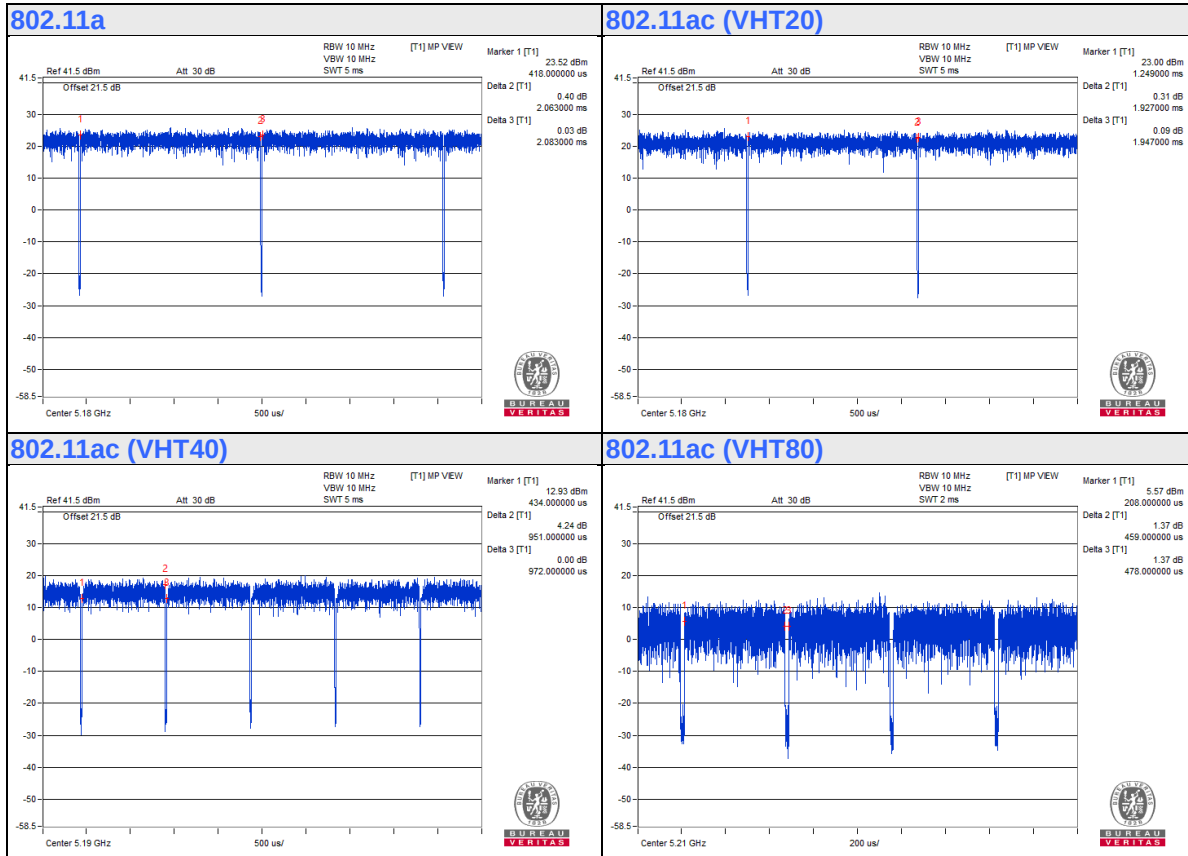
If duty cycle of test signal is $< 98\%$, duty factor shall be considered.

802.11a: Duty cycle = $2.063/2.083 = 0.99$

802.11ac (VHT20): Duty cycle = $1.927/1.947 = 0.99$

802.11ac (VHT40): Duty cycle = $0.951/0.972 = 0.978$, Duty factor = $10 * \log(1/ \text{Duty cycle}) = 0.09$

802.11ac (VHT80): Duty cycle = $0.459/0.478 = 0.96$, Duty factor = $10 * \log(1/ \text{Duty cycle}) = 0.18$



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.

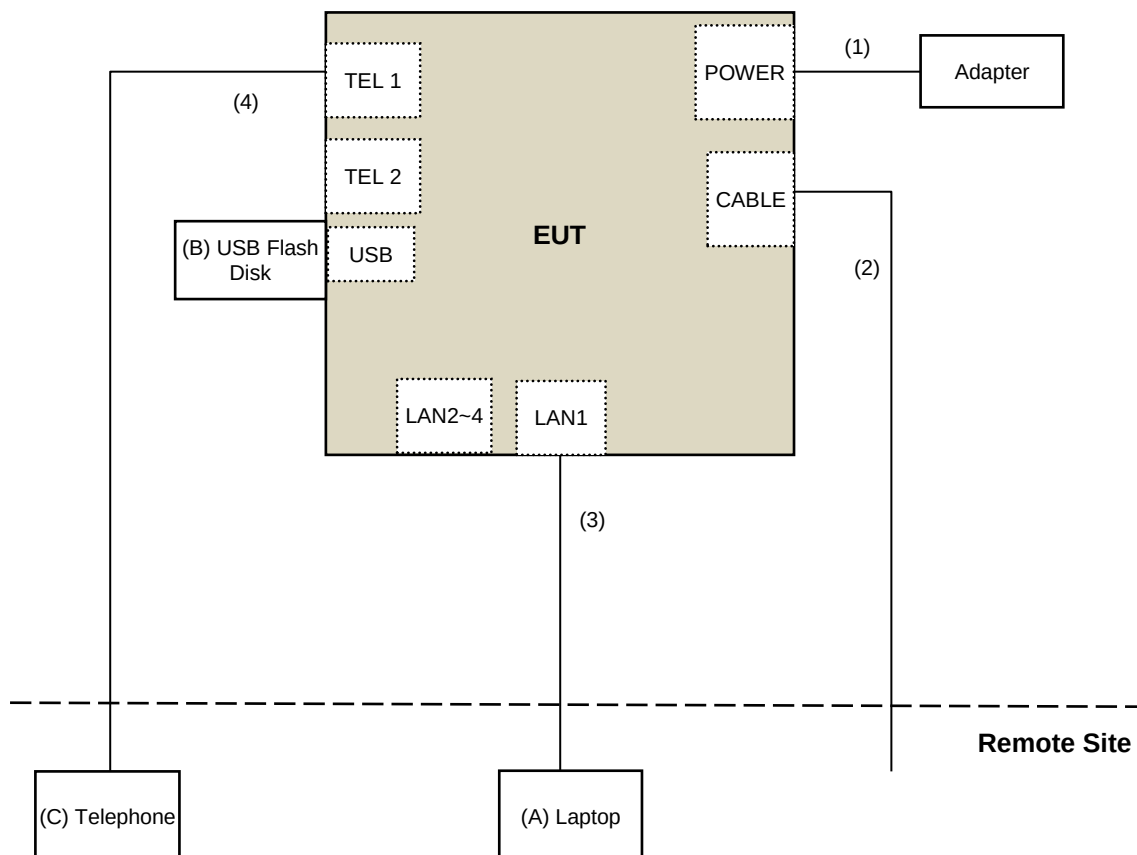
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Laptop	Lenovo	81A4	YD02YN7P	PD93165NGU	Provided by Lab
B.	USB Disk	SanDisk	Ultra Flair CZ73	NA	NA	Provided by Lab
C.	Telephone	WONDER	WD-303	7C17KA 04011	NA	Provided by Lab

Note:

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC Cable	1	2	No	0	Supplied by client
2.	Coaxial Cable	1	10	Yes	0	Provided by Lab
3.	RJ-45 Cable	1	10	No	0	Provided by Lab
4.	RJ-11 Cable	1	10	No	0	Supplied by client

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standard

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

FCC Part 15, Subpart E (15.407)

KDB 789033 D02 General UNII Test Procedure New Rules v02r01

KDB 662911 D01 Multiple Transmitter Output v02r01

ANSI C63.10-2013

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

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.

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.

Limits of unwanted emission out of the restricted bands

Applicable To		Limit	
789033 D02 General UNII Test Procedure New Rules v02r01		Field Strength at 3m	
		PK:74 (dBμV/m)	AV:54 (dBμV/m)
Frequency Band	Applicable To	EIRP Limit	Equivalent Field Strength at 3m
5150~5250 MHz	15.407(b)(1)	PK:-27 (dBm/MHz)	PK:68.2(dBμV/m)
5250~5350 MHz	15.407(b)(2)		
5470~5725 MHz	15.407(b)(3)		
5725~5850 MHz	☒ 15.407(b)(4)(i)	PK:-27 (dBm/MHz) ^{*1} PK:10 (dBm/MHz) ^{*2} PK:15.6 (dBm/MHz) ^{*3} PK:27 (dBm/MHz) ^{*4}	PK: 68.2(dBμV/m) ^{*1} PK:105.2 (dBμV/m) ^{*2} PK: 110.8(dBμV/m) ^{*3} PK:122.2 (dBμV/m) ^{*4}
	☐ 15.407(b)(4)(ii)	Emission limits in section 15.247(d)	
^{*1} beyond 75 MHz or more above of the band edge.		^{*2} below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above.	
^{*3} below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above.		^{*4} from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.	

Note:

The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000\sqrt{30P}}{3} \mu\text{V/m, where P is the eirp (Watts).}$$

4.1.2 Test Instruments

For OOB test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver ESR7 R&S	ESR7	102026	Apr. 24, 2019	Apr. 23, 2020
Spectrum Analyzer Keysight	N9030B	MY57141948	May 25, 2019	May 24, 2020
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-1819	Nov. 25, 2018	Nov. 24, 2019
Pre-Amplifier EMCI	EMC12630SE	980509	May 03, 2019	May 02, 2020
RF Cable EMCI	EMC104-SM-SM-1500	180503	May 03, 2019	May 02, 2020
RF Cable EMCI	EMC104-SM-SM-2000	180501	May 03, 2019	May 02, 2020
RF Cable EMCI	EMC104-SM-SM-6000	180505	May 03, 2019	May 02, 2020
Pre-Amplifier EMCI	EMC184045SE	980387	Jan. 28, 2019	Jan. 27, 2020
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170519	Nov. 25, 2018	Nov. 24, 2019
RF Cable	EMC102-KM-KM-1200	160924	Jan. 28, 2019	Jan. 27, 2020
RF Cable	EMC102-KM-KM-1200	160925	Jan. 28, 2019	Jan. 27, 2020
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: May 29, 2019

For other test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver ESR7 R&S	ESR7	102026	Apr. 24, 2019	Apr. 23, 2020
Spectrum Analyzer Keysight	N9030B	MY57141948	May 25, 2019	May 24, 2020
Pre-Amplifier EMCI	EMC001340	980142	May 30, 2019	May 29, 2020
Loop Antenna Electro-Metrics	EM-6879	264	Jan. 22, 2019	Jan. 21, 2020
RF Cable	NA	LOOPCAB-001	Jan. 14, 2019	Jan. 13, 2020
RF Cable	NA	LOOPCAB-002	Jan. 14, 2019	Jan. 13, 2020
Pre-Amplifier EMCI	EMC330N	980538	Apr. 30, 2019	Apr. 29, 2020
Trilog Broadband Antenna SCHWARZBECK	VULB9168	9168-0842	Nov. 21, 2018	Nov. 20, 2019
RF Cable	8D	966-5-1	May 03, 2019	May 02, 2020
RF Cable	8D	966-5-2	May 03, 2019	May 02, 2020
RF Cable	8D	966-5-3	May 03, 2019	May 02, 2020
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-ATT5-02	Jan. 28, 2019	Jan. 27, 2020
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-1819	Nov. 25, 2018	Nov. 24, 2019
Pre-Amplifier EMCI	EMC12630SE	980509	May 03, 2019	May 02, 2020
RF Cable EMCI	EMC104-SM-SM-1500	180503	May 03, 2019	May 02, 2020
RF Cable EMCI	EMC104-SM-SM-2000	180501	May 03, 2019	May 02, 2020
RF Cable EMCI	EMC104-SM-SM-6000	180505	May 03, 2019	May 02, 2020
Pre-Amplifier EMCI	EMC184045SE	980387	Jan. 28, 2019	Jan. 27, 2020
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170519	Nov. 25, 2018	Nov. 24, 2019
RF Cable	EMC102-KM-KM-1200	160924	Jan. 28, 2019	Jan. 27, 2020
RF Cable	EMC102-KM-KM-1200	160925	Jan. 28, 2019	Jan. 27, 2020
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	NA	NA
Spectrum Analyzer R&S	FSV40	100964	June 04, 2019	June 03, 2020
Power meter Anritsu	ML2495A	1014008	May 13, 2019	May 12, 2020
Power sensor Anritsu	MA2411B	0917122	May 13, 2019	May 12, 2020
Fixed Attenuator Mini-Circuits	MDCS18N-10	MDCS18N-10-01	Apr. 15, 2019	Apr. 14, 2020
Temperature & Humidity Chamber Giant Force	GTH-150-40-SP-AR	MAA0812-008	Jan. 09, 2019	Jan. 08, 2020
AC Power Source Extech Electronics	6205	1440452	NA	NA
True RMS Clamp Meter FLUKE	325	31130711WS	May 21, 2019	May 20, 2020

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: Sep. 11 to 12, 2019

4.1.3 Test Procedure

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:

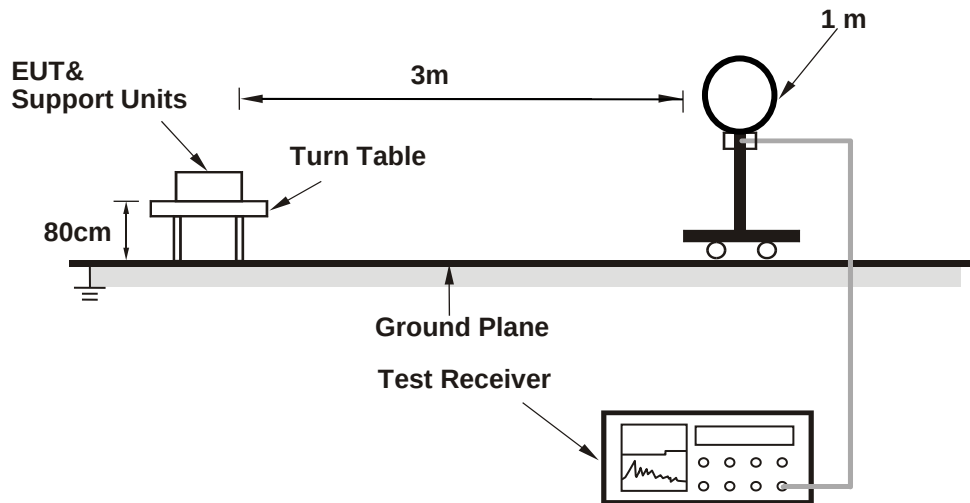
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98%) or 10Hz (Duty cycle $\geq 98\%$) 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

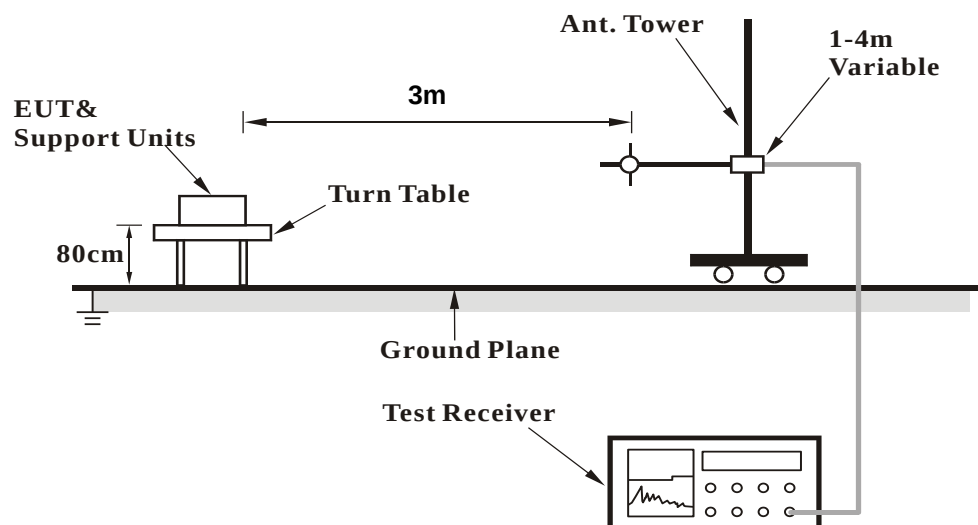
No deviation.

4.1.5 Test Setup

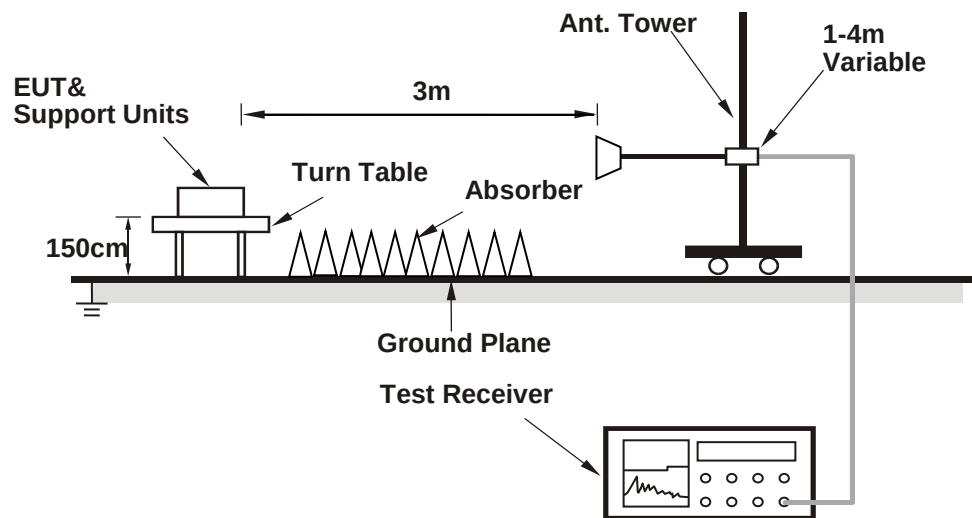
For Radiated emission below 30MHz



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 Condition

- Connected the EUT with the Laptop which is placed on remote site.
- Controlling software (Mtool[2.0.1.0]) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1GHz Data:

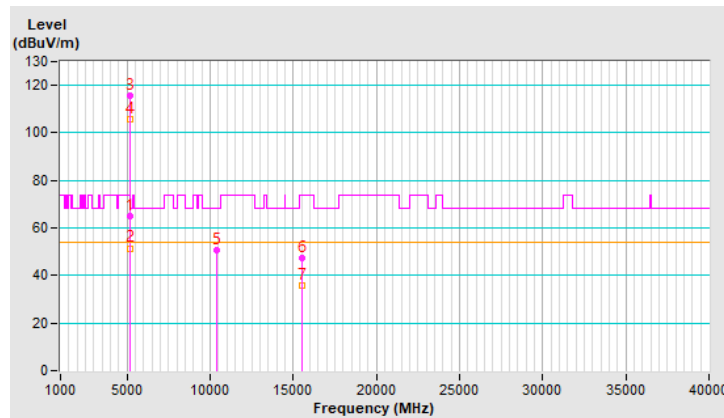
802.11a

CHANNEL	TX Channel 36	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	5150.00	64.9 PK	74.0	-9.1	3.04 H	152	62.8	2.1
2	5150.00	51.5 AV	54.0	-2.5	3.04 H	152	49.4	2.1
3	*5180.00	115.9 PK			3.04 H	152	114.1	1.8
4	*5180.00	105.9 AV			3.04 H	152	104.1	1.8
5	#10360.00	50.9 PK	68.2	-17.3	2.40 H	235	38.8	12.1
6	15540.00	47.2 PK	74.0	-26.8	1.47 H	303	35.0	12.2
7	15540.00	35.9 AV	54.0	-18.1	1.47 H	303	23.7	12.2

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.
6. " # ": The radiated frequency is out of the restricted band.

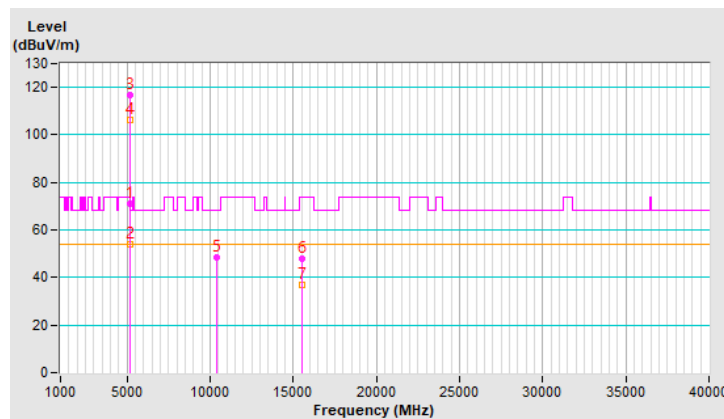


CHANNEL	TX Channel 36	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	5150.00	70.8 PK	74.0	-3.2	2.40 V	235	68.7	2.1
2	5150.00	53.9 AV	54.0	-0.1	2.40 V	235	51.8	2.1
3	*5180.00	116.7 PK			2.40 V	235	114.9	1.8
4	*5180.00	106.1 AV			2.40 V	235	104.3	1.8
5	#10360.00	48.6 PK	68.2	-19.6	1.55 V	281	36.5	12.1
6	15540.00	47.7 PK	74.0	-26.3	1.61 V	300	35.5	12.2
7	15540.00	36.8 AV	54.0	-17.2	1.61 V	300	24.6	12.2

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.
6. " # ": The radiated frequency is out of the restricted band.

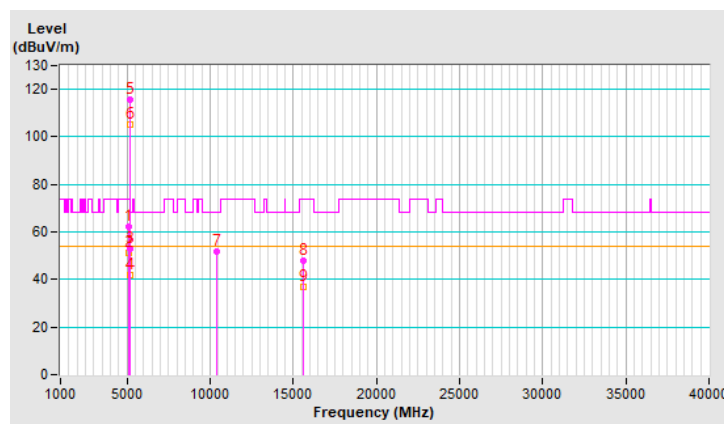


CHANNEL	TX Channel 40	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	5122.00	62.3 PK	74.0	-11.7	2.97 H	149	60.2	2.1
2	5122.00	51.3 AV	54.0	-2.7	2.97 H	149	49.2	2.1
3	5150.00	52.8 PK	74.0	-21.2	2.52 H	145	50.7	2.1
4	5150.00	41.6 AV	54.0	-12.4	2.52 H	145	39.5	2.1
5	*5200.00	115.5 PK			2.97 H	149	113.8	1.7
6	*5200.00	105.4 AV			2.97 H	149	103.7	1.7
7	#10400.00	51.6 PK	68.2	-16.6	2.49 H	229	39.2	12.4
8	15600.00	47.9 PK	74.0	-26.1	1.53 H	310	35.9	12.0
9	15600.00	36.7 AV	54.0	-17.3	1.53 H	310	24.7	12.0

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.
6. " # ": The radiated frequency is out of the restricted band.

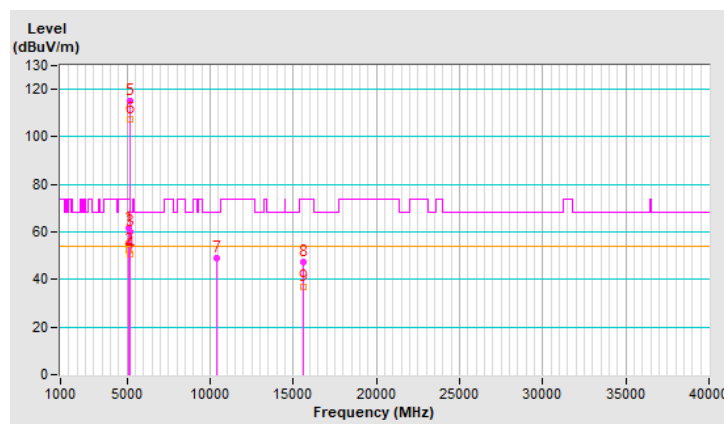


CHANNEL	TX Channel 40	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	5122.00	61.5 PK	74.0	-12.5	2.86 V	28	59.4	2.1
2	5122.00	52.2 AV	54.0	-1.8	2.86 V	28	50.1	2.1
3	5150.00	60.2 PK	74.0	-13.8	2.86 V	28	58.1	2.1
4	5150.00	50.9 AV	54.0	-3.1	2.86 V	28	48.8	2.1
5	*5200.00	114.9 PK			2.86 V	28	113.2	1.7
6	*5200.00	107.4 AV			2.86 V	28	105.7	1.7
7	#10400.00	49.2 PK	68.2	-19.0	1.53 V	290	36.8	12.4
8	15600.00	47.5 PK	74.0	-26.5	1.66 V	314	35.5	12.0
9	15600.00	36.8 AV	54.0	-17.2	1.66 V	314	24.8	12.0

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.
6. " # ": The radiated frequency is out of the restricted band.

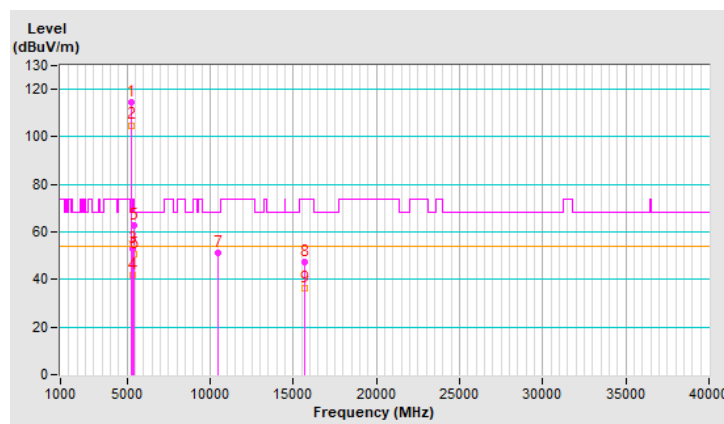


CHANNEL	TX Channel 48	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5240.00	114.7 PK			3.05 H	153	113.3	1.4
2	*5240.00	104.9 AV			3.05 H	153	103.5	1.4
3	5350.00	52.8 PK	74.0	-21.2	2.52 H	145	51.3	1.5
4	5350.00	41.6 AV	54.0	-12.4	2.52 H	145	40.1	1.5
5	5403.00	62.6 PK	74.0	-11.4	3.05 H	153	60.9	1.7
6	5403.00	50.9 AV	54.0	-3.1	3.05 H	153	49.2	1.7
7	#10480.00	51.1 PK	68.2	-17.1	2.55 H	246	38.3	12.8
8	15720.00	47.5 PK	74.0	-26.5	1.43 H	299	35.9	11.6
9	15720.00	36.2 AV	54.0	-17.8	1.43 H	299	24.6	11.6

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.
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

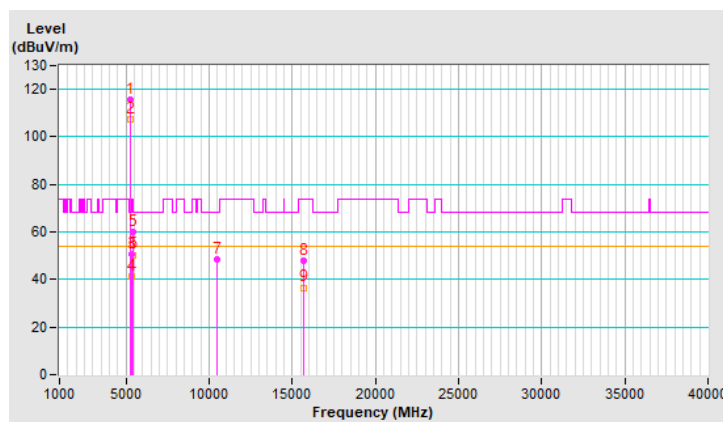


CHANNEL	TX Channel 48	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5240.00	115.7 PK			2.94 V	360	114.3	1.4
2	*5240.00	107.3 AV			2.94 V	360	105.9	1.4
3	5350.00	50.8 PK	74.0	-23.2	3.84 V	37	49.3	1.5
4	5350.00	41.3 AV	54.0	-12.7	3.84 V	37	39.8	1.5
5	5403.00	60.2 PK	74.0	-13.8	2.94 V	360	58.5	1.7
6	5403.00	50.4 AV	54.0	-3.6	2.94 V	360	48.7	1.7
7	#10480.00	48.6 PK	68.2	-19.6	1.54 V	281	35.8	12.8
8	15720.00	47.8 PK	74.0	-26.2	1.66 V	287	36.2	11.6
9	15720.00	36.6 AV	54.0	-17.4	1.66 V	287	25.0	11.6

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.
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

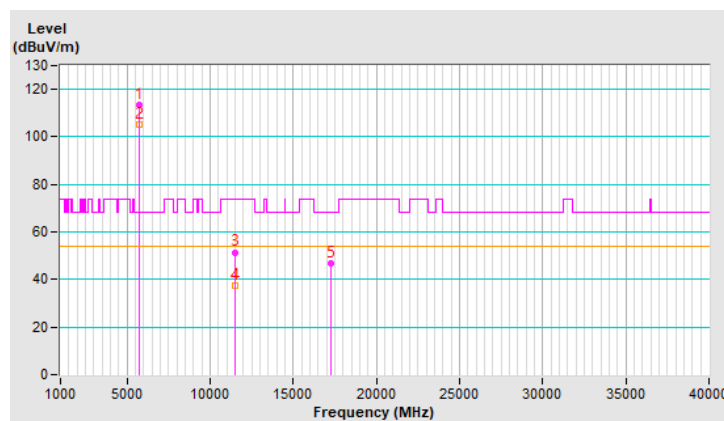


CHANNEL	TX Channel 149	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5745.00	113.7 PK			3.76 H	127	111.4	2.3
2	*5745.00	105.2 AV			3.76 H	127	102.9	2.3
3	11490.00	51.5 PK	74.0	-22.5	2.35 H	293	37.4	14.1
4	11490.00	37.6 AV	54.0	-16.4	2.35 H	293	23.5	14.1
5	#17235.00	46.7 PK	68.2	-21.5	1.48 H	312	29.0	17.7

REMARKS:

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

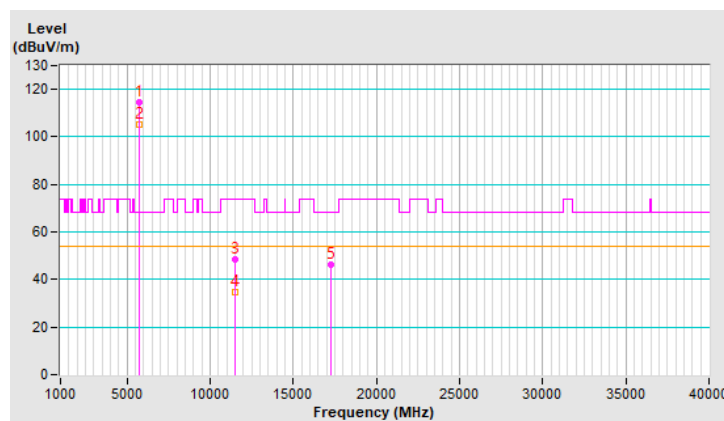


CHANNEL	TX Channel 149	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5745.00	114.4 PK			2.46 V	244	112.1	2.3
2	*5745.00	105.4 AV			2.46 V	244	103.1	2.3
3	11490.00	48.3 PK	74.0	-25.7	1.51 V	301	34.2	14.1
4	11490.00	34.9 AV	54.0	-19.1	1.51 V	301	20.8	14.1
5	#17235.00	46.3 PK	68.2	-21.9	1.69 V	302	28.6	17.7

REMARKS:

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

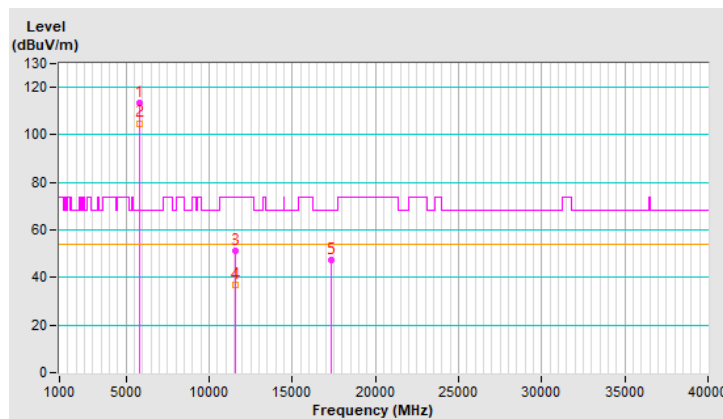


CHANNEL	TX Channel 157	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5785.00	113.6 PK			3.73 H	129	111.2	2.4
2	*5785.00	104.9 AV			3.73 H	129	102.5	2.4
3	11570.00	51.3 PK	74.0	-22.7	2.39 H	288	37.2	14.1
4	11570.00	37.0 AV	54.0	-17.0	2.39 H	288	22.9	14.1
5	#17355.00	47.4 PK	68.2	-20.8	1.49 H	316	29.1	18.3

REMARKS:

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

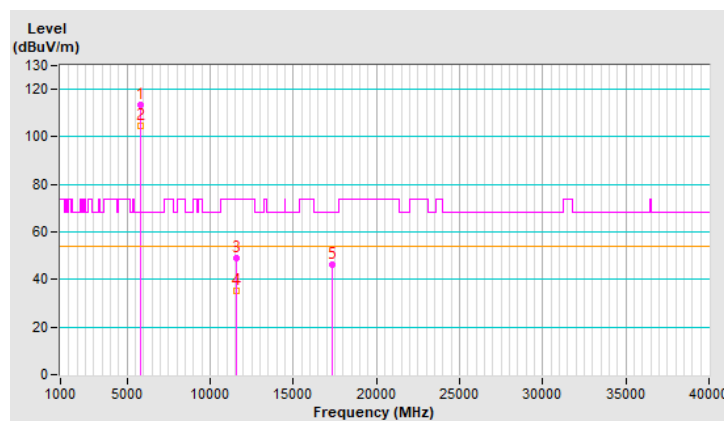


CHANNEL	TX Channel 157	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5785.00	113.3 PK			2.44 V	250	110.9	2.4
2	*5785.00	104.7 AV			2.44 V	250	102.3	2.4
3	11570.00	48.9 PK	74.0	-25.1	1.52 V	292	34.8	14.1
4	11570.00	35.3 AV	54.0	-18.7	1.52 V	292	21.2	14.1
5	#17355.00	46.5 PK	68.2	-21.7	1.73 V	309	28.2	18.3

REMARKS:

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

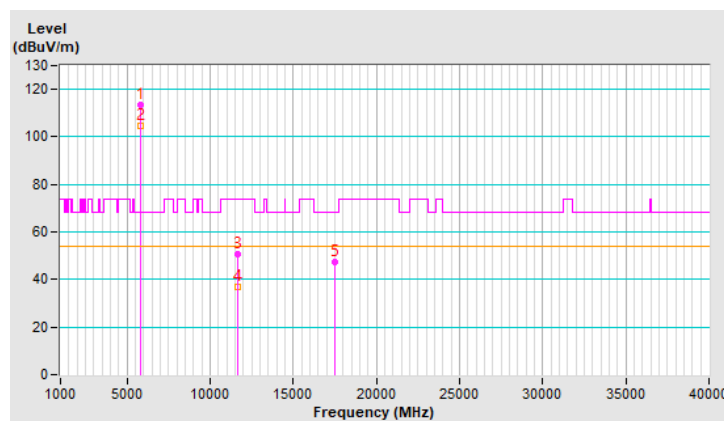


CHANNEL	TX Channel 165	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5825.00	113.2 PK			3.97 H	134	110.7	2.5
2	*5825.00	104.5 AV			3.97 H	134	102.0	2.5
3	11650.00	50.6 PK	74.0	-23.4	2.46 H	296	36.7	13.9
4	11650.00	36.8 AV	54.0	-17.2	2.46 H	296	22.9	13.9
5	#17475.00	47.4 PK	68.2	-20.8	1.54 H	330	27.9	19.5

REMARKS:

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

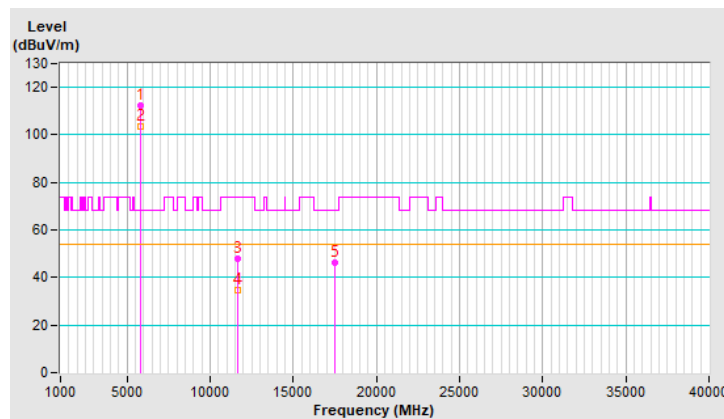


CHANNEL	TX Channel 165	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5825.00	112.5 PK			2.85 V	246	110.0	2.5
2	*5825.00	103.6 AV			2.85 V	246	101.1	2.5
3	11650.00	47.8 PK	74.0	-26.2	1.55 V	295	33.9	13.9
4	11650.00	34.5 AV	54.0	-19.5	1.55 V	295	20.6	13.9
5	#17475.00	46.2 PK	68.2	-22.0	1.75 V	288	26.7	19.5

REMARKS:

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



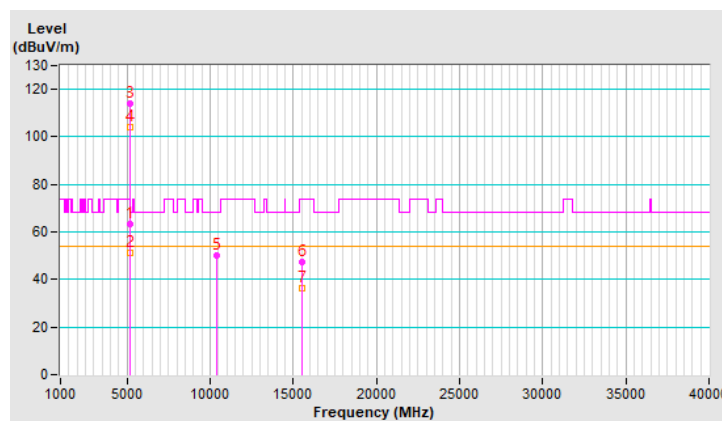
802.11ac (VHT20)

CHANNEL	TX Channel 36	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	5150.00	63.1 PK	74.0	-10.9	3.12 H	155	61.0	2.1
2	5150.00	51.1 AV	54.0	-2.9	3.12 H	155	49.0	2.1
3	*5180.00	113.9 PK			3.12 H	155	112.1	1.8
4	*5180.00	104.1 AV			3.12 H	155	102.3	1.8
5	#10360.00	50.3 PK	68.2	-17.9	2.41 H	233	38.2	12.1
6	15540.00	47.3 PK	74.0	-26.7	1.47 H	303	35.1	12.2
7	15540.00	36.1 AV	54.0	-17.9	1.47 H	303	23.9	12.2

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.
6. " # ": The radiated frequency is out of the restricted band.

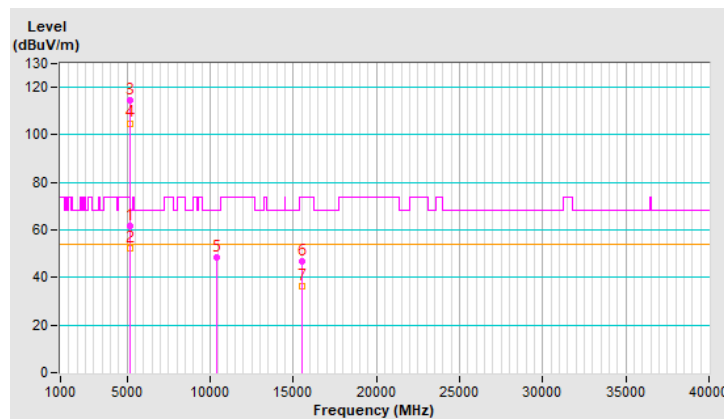


CHANNEL	TX Channel 36	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	5150.00	61.9 PK	74.0	-12.1	2.36 V	211	59.8	2.1
2	5150.00	52.1 AV	54.0	-1.9	2.36 V	211	50.0	2.1
3	*5180.00	114.7 PK			2.36 V	211	112.9	1.8
4	*5180.00	104.9 AV			2.36 V	211	103.1	1.8
5	#10360.00	48.4 PK	68.2	-19.8	1.52 V	275	36.3	12.1
6	15540.00	47.0 PK	74.0	-27.0	1.65 V	298	34.8	12.2
7	15540.00	36.3 AV	54.0	-17.7	1.65 V	298	24.1	12.2

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.
6. " # ": The radiated frequency is out of the restricted band.

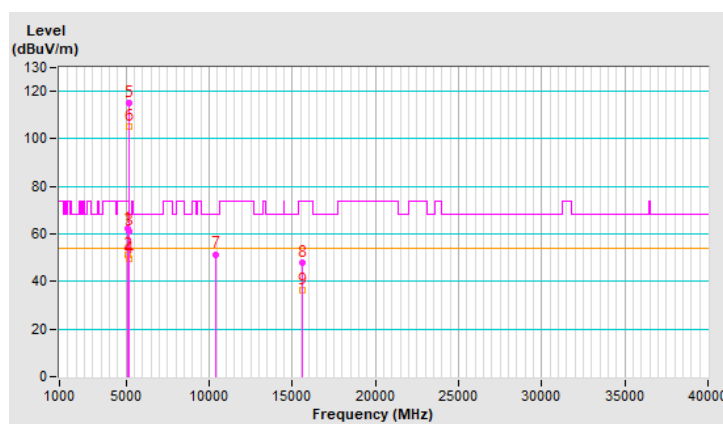


CHANNEL	TX Channel 40	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	5122.00	62.3 PK	74.0	-11.7	2.98 H	149	60.2	2.1
2	5122.00	51.2 AV	54.0	-2.8	2.98 H	149	49.1	2.1
3	5150.00	61.2 PK	74.0	-12.8	2.98 H	149	59.1	2.1
4	5150.00	49.8 AV	54.0	-4.2	2.98 H	149	47.7	2.1
5	*5200.00	115.3 PK			2.98 H	149	113.6	1.7
6	*5200.00	105.1 AV			2.98 H	149	103.4	1.7
7	#10400.00	51.5 PK	68.2	-16.7	2.33 H	243	39.1	12.4
8	15600.00	47.7 PK	74.0	-26.3	1.53 H	309	35.7	12.0
9	15600.00	36.5 AV	54.0	-17.5	1.53 H	309	24.5	12.0

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.
6. " # ": The radiated frequency is out of the restricted band.

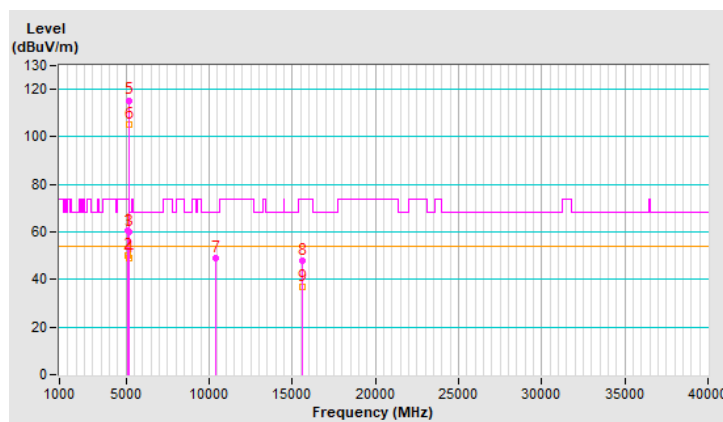


CHANNEL	TX Channel 40	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	5122.00	60.5 PK	74.0	-13.5	2.89 V	47	58.4	2.1
2	5122.00	50.2 AV	54.0	-3.8	2.89 V	47	48.1	2.1
3	5150.00	59.8 PK	74.0	-14.2	2.98 V	47	57.7	2.1
4	5150.00	49.2 AV	54.0	-4.8	2.98 V	47	47.1	2.1
5	*5200.00	115.4 PK			3.89 V	47	113.7	1.7
6	*5200.00	105.3 AV			3.89 V	47	103.6	1.7
7	#10400.00	48.8 PK	68.2	-19.4	1.53 V	276	36.4	12.4
8	15600.00	48.1 PK	74.0	-25.9	1.59 V	289	36.1	12.0
9	15600.00	37.1 AV	54.0	-16.9	1.59 V	289	25.1	12.0

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.
6. " # ": The radiated frequency is out of the restricted band.

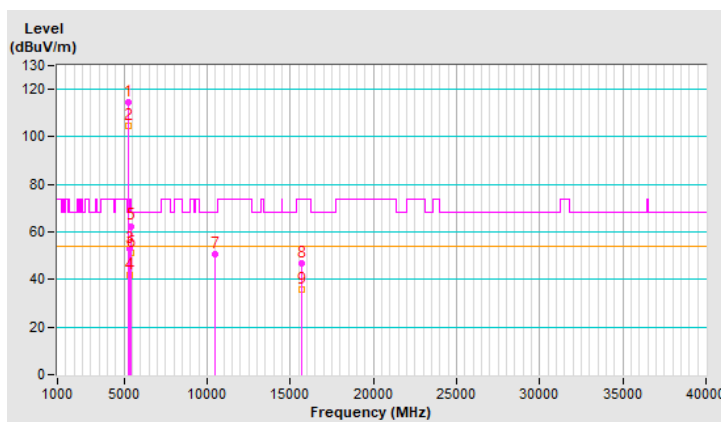


CHANNEL	TX Channel 48	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5240.00	114.8 PK			2.78 H	149	113.4	1.4
2	*5240.00	104.8 AV			2.78 H	149	103.4	1.4
3	5350.00	52.9 PK	74.0	-21.1	2.51 H	160	51.4	1.5
4	5350.00	41.7 AV	54.0	-12.3	2.51 H	160	40.2	1.5
5	5397.00	62.5 PK	74.0	-11.5	2.78 H	149	60.8	1.7
6	5397.00	51.1 AV	54.0	-2.9	2.78 H	149	49.4	1.7
7	#10480.00	50.8 PK	68.2	-17.4	2.51 H	250	38.0	12.8
8	15720.00	46.7 PK	74.0	-27.3	1.49 H	289	35.1	11.6
9	15720.00	35.9 AV	54.0	-18.1	1.49 H	289	24.3	11.6

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.
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

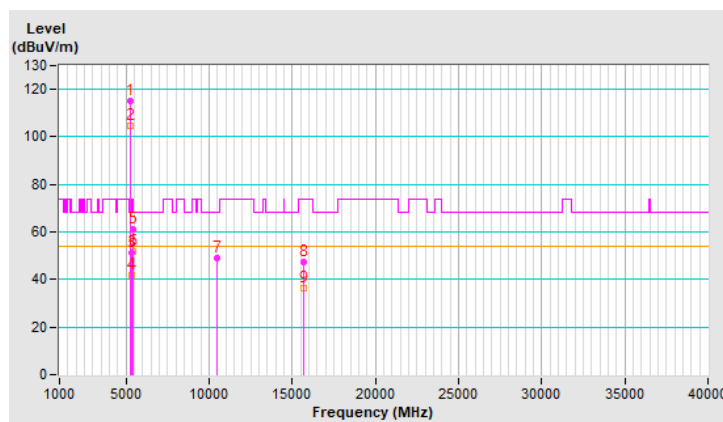


CHANNEL	TX Channel 48	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5240.00	115.1 PK			3.98 V	43	113.7	1.4
2	*5240.00	104.8 AV			3.98 V	43	103.4	1.4
3	5350.00	51.0 PK	74.0	-23.0	3.82 V	30	49.5	1.5
4	5350.00	41.7 AV	54.0	-12.3	3.82 V	30	40.2	1.5
5	5397.00	61.1 PK	74.0	-12.9	3.98 V	43	59.4	1.7
6	5397.00	51.8 AV	54.0	-2.2	3.98 V	43	50.1	1.7
7	#10480.00	49.2 PK	68.2	-19.0	1.58 V	269	36.4	12.8
8	15720.00	47.1 PK	74.0	-26.9	1.56 V	299	35.5	11.6
9	15720.00	36.4 AV	54.0	-17.6	1.56 V	299	24.8	11.6

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.
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

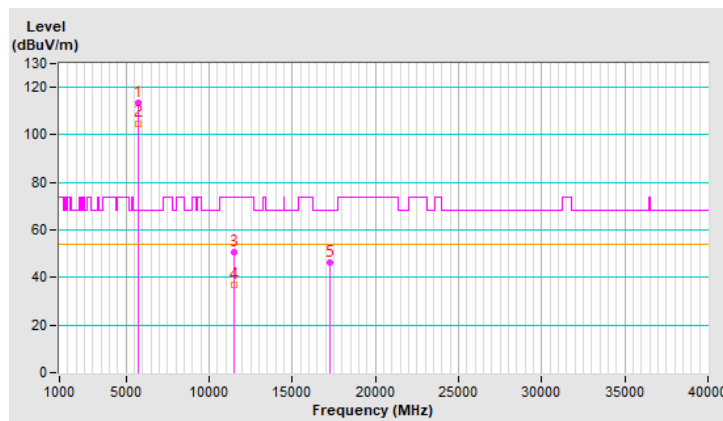


CHANNEL	TX Channel 149	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5745.00	113.5 PK			3.85 H	138	111.2	2.3
2	*5745.00	104.9 AV			3.85 H	138	102.6	2.3
3	11490.00	50.5 PK	74.0	-23.5	2.60 H	240	36.4	14.1
4	11490.00	36.7 AV	54.0	-17.3	2.60 H	240	22.6	14.1
5	#17235.00	46.1 PK	68.2	-22.1	1.62 H	295	28.4	17.7

REMARKS:

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

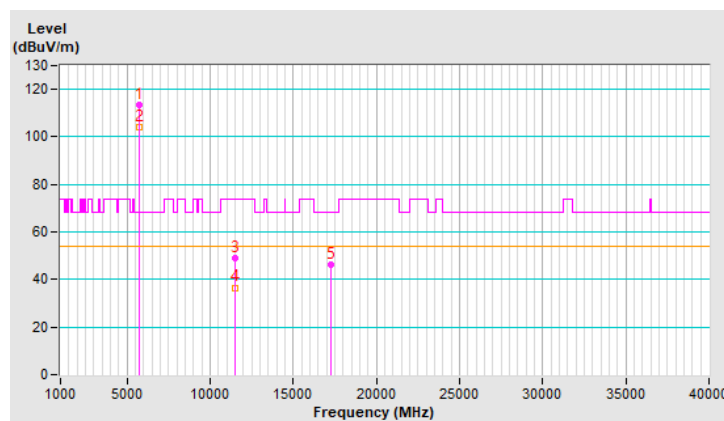


CHANNEL	TX Channel 149	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5745.00	113.2 PK			2.43 V	235	110.9	2.3
2	*5745.00	104.1 AV			2.43 V	235	101.8	2.3
3	11490.00	48.9 PK	74.0	-25.1	1.74 V	235	34.8	14.1
4	11490.00	36.6 AV	54.0	-17.4	1.74 V	235	22.5	14.1
5	#17235.00	46.3 PK	68.2	-21.9	1.54 V	280	28.6	17.7

REMARKS:

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

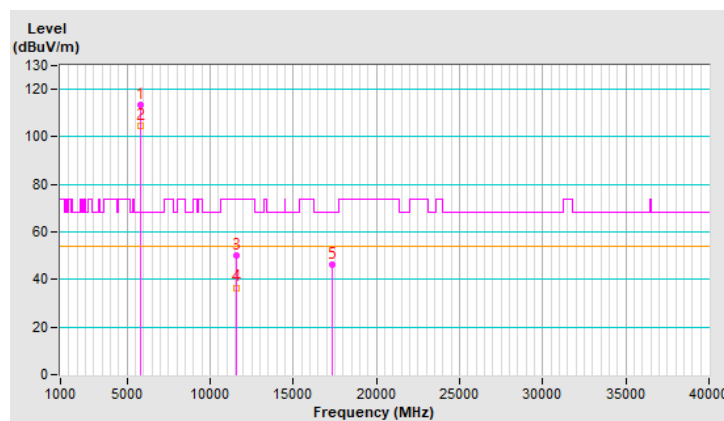


CHANNEL	TX Channel 157	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5785.00	113.3 PK			3.91 H	140	110.9	2.4
2	*5785.00	104.5 AV			3.91 H	140	102.1	2.4
3	11570.00	50.2 PK	74.0	-23.8	2.63 H	257	36.1	14.1
4	11570.00	36.6 AV	54.0	-17.4	2.63 H	257	22.5	14.1
5	#17355.00	46.3 PK	68.2	-21.9	1.60 H	310	28.0	18.3

REMARKS:

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

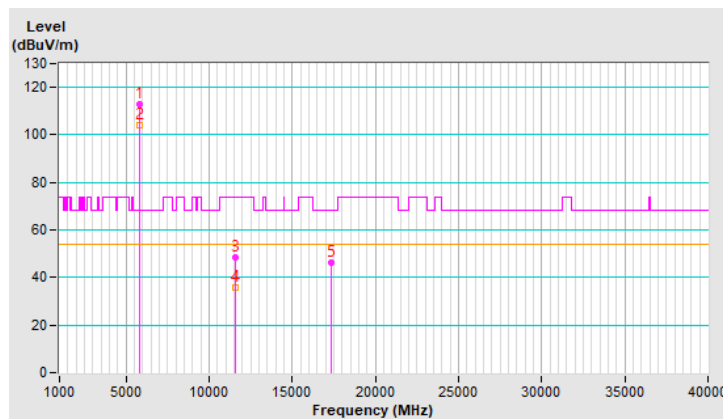


CHANNEL	TX Channel 157	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5785.00	113.0 PK			2.47 V	242	110.6	2.4
2	*5785.00	103.9 AV			2.47 V	242	101.5	2.4
3	11570.00	48.3 PK	74.0	-25.7	1.68 V	247	34.2	14.1
4	11570.00	36.0 AV	54.0	-18.0	1.68 V	247	21.9	14.1
5	#17355.00	46.1 PK	68.2	-22.1	1.53 V	299	27.8	18.3

REMARKS:

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

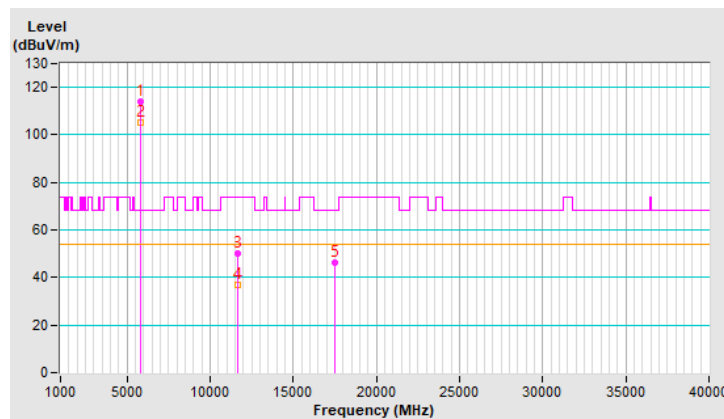


CHANNEL	TX Channel 165	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5825.00	114.2 PK			3.79 H	139	111.7	2.5
2	*5825.00	105.1 AV			3.79 H	139	102.6	2.5
3	11650.00	50.3 PK	74.0	-23.7	2.60 H	257	36.4	13.9
4	11650.00	36.7 AV	54.0	-17.3	2.60 H	257	22.8	13.9
5	#17475.00	46.5 PK	68.2	-21.7	1.59 H	296	27.0	19.5

REMARKS:

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

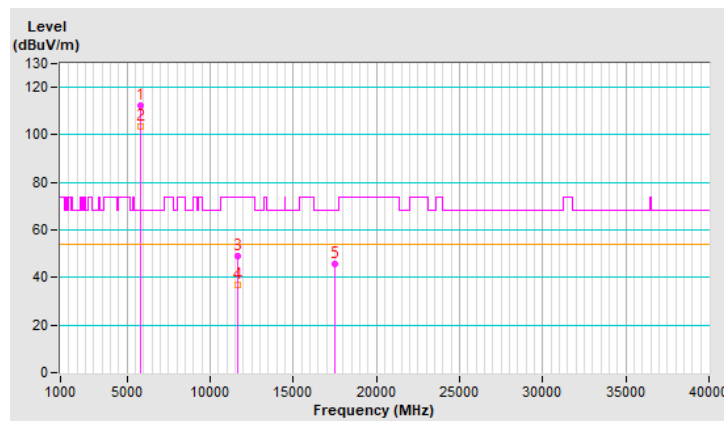


CHANNEL	TX Channel 165	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5825.00	112.6 PK			2.07 V	247	110.1	2.5
2	*5825.00	103.5 AV			2.07 V	247	101.0	2.5
3	11650.00	49.2 PK	74.0	-24.8	1.68 V	236	35.3	13.9
4	11650.00	36.7 AV	54.0	-17.3	1.68 V	236	22.8	13.9
5	#17475.00	45.6 PK	68.2	-22.6	1.55 V	277	26.1	19.5

REMARKS:

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



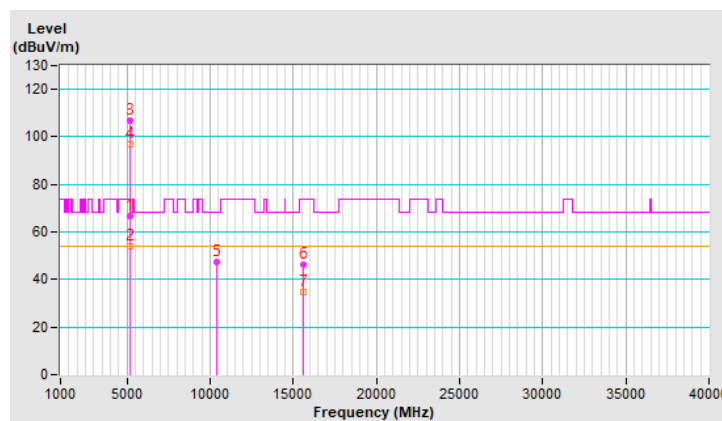
802.11ac (VHT40)

CHANNEL	TX Channel 38	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	5150.00	66.7 PK	74.0	-7.3	2.51 H	148	64.6	2.1
2	5150.00	53.8 AV	54.0	-0.2	2.51 H	148	51.7	2.1
3	*5190.00	106.8 PK			2.51 H	148	105.0	1.8
4	*5190.00	96.9 AV			2.51 H	148	95.1	1.8
5	#10380.00	47.3 PK	68.2	-20.9	2.43 H	239	35.0	12.3
6	15570.00	46.1 PK	74.0	-27.9	1.51 H	293	33.9	12.2
7	15570.00	34.9 AV	54.0	-19.1	1.51 H	293	22.7	12.2

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.
6. " # ": The radiated frequency is out of the restricted band.

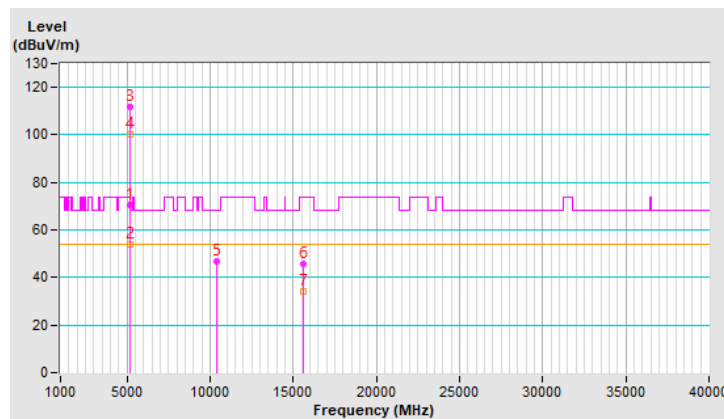


CHANNEL	TX Channel 38	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	5150.00	70.4 PK	74.0	-3.6	1.37 V	39	68.3	2.1
2	5150.00	53.9 AV	54.0	-0.1	1.37 V	39	51.8	2.1
3	*5190.00	111.6 PK			1.37 V	39	109.8	1.8
4	*5190.00	100.2 AV			1.37 V	39	98.4	1.8
5	#10380.00	46.7 PK	68.2	-21.5	1.58 V	267	34.4	12.3
6	15570.00	45.9 PK	74.0	-28.1	1.70 V	306	33.7	12.2
7	15570.00	34.3 AV	54.0	-19.7	1.70 V	306	22.1	12.2

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.
6. " # ": The radiated frequency is out of the restricted band.

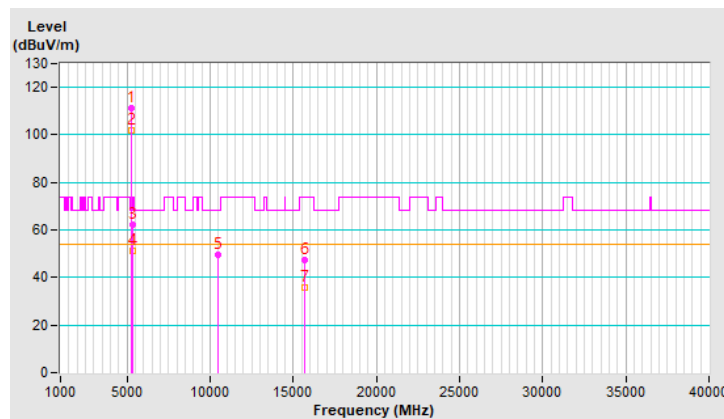


CHANNEL	TX Channel 46	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5230.00	111.4 PK			2.49 H	154	109.9	1.5
2	*5230.00	102.0 AV			2.49 H	154	100.5	1.5
3	5350.00	62.3 PK	74.0	-11.7	2.49 H	154	60.8	1.5
4	5350.00	51.3 AV	54.0	-2.7	2.49 H	154	49.8	1.5
5	#10460.00	49.7 PK	68.2	-18.5	2.51 H	238	37.0	12.7
6	15690.00	47.1 PK	74.0	-26.9	1.47 H	309	35.5	11.6
7	15690.00	35.8 AV	54.0	-18.2	1.47 H	309	24.2	11.6

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.
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

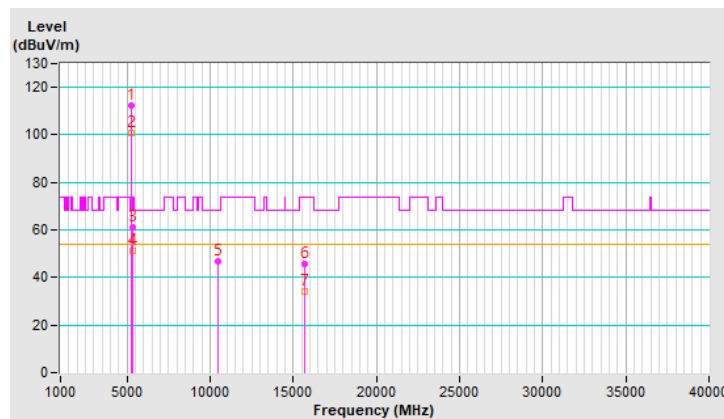


CHANNEL	TX Channel 46	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5230.00	112.3 PK			3.86 V	40	110.8	1.5
2	*5230.00	100.7 AV			3.86 V	40	99.2	1.5
3	5350.00	60.9 PK	74.0	-13.1	3.86 V	40	59.4	1.5
4	5350.00	51.1 AV	54.0	-2.9	3.86 V	40	49.6	1.5
5	#10460.00	46.9 PK	68.2	-21.3	1.53 V	260	34.2	12.7
6	15690.00	45.7 PK	74.0	-28.3	1.70 V	302	34.1	11.6
7	15690.00	34.1 AV	54.0	-19.9	1.70 V	302	22.5	11.6

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.
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

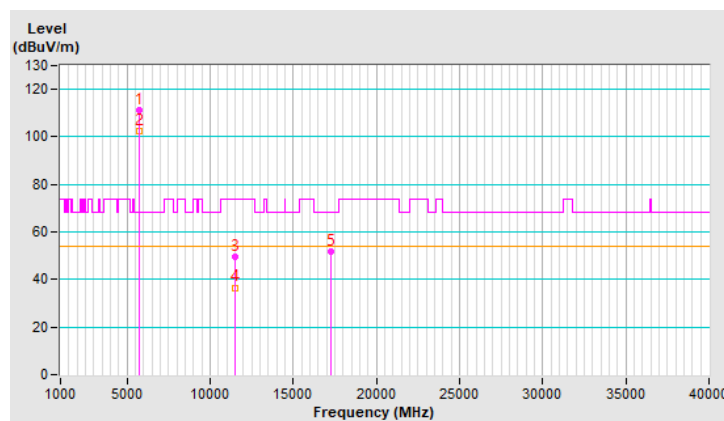


CHANNEL	TX Channel 151	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5755.00	111.4 PK			3.82 H	140	109.1	2.3
2	*5755.00	102.2 AV			3.82 H	140	99.9	2.3
3	11510.00	49.6 PK	74.0	-24.4	2.49 H	222	35.5	14.1
4	11510.00	36.6 AV	54.0	-17.4	2.49 H	222	22.5	14.1
5	#17265.00	51.6 PK	68.2	-16.6	1.88 H	282	33.8	17.8

REMARKS:

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

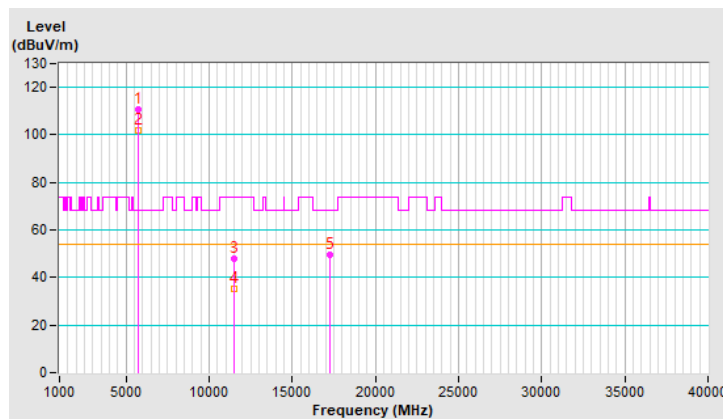


CHANNEL	TX Channel 151	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5755.00	110.9 PK			2.78 V	241	108.6	2.3
2	*5755.00	102.0 AV			2.78 V	241	99.7	2.3
3	11510.00	47.8 PK	74.0	-26.2	1.59 V	244	33.7	14.1
4	11510.00	35.1 AV	54.0	-18.9	1.59 V	244	21.0	14.1
5	#17265.00	49.8 PK	68.2	-18.4	1.70 V	294	32.0	17.8

REMARKS:

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

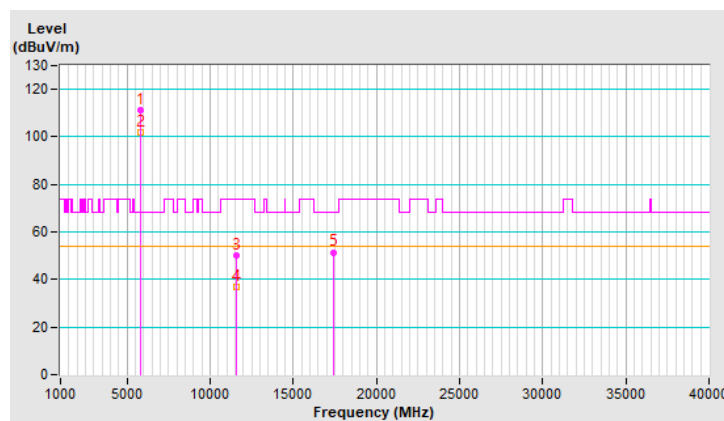


CHANNEL	TX Channel 159	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5795.00	111.1 PK			3.61 H	143	108.6	2.5
2	*5795.00	102.1 AV			3.61 H	143	99.6	2.5
3	11590.00	49.9 PK	74.0	-24.1	2.44 H	233	35.8	14.1
4	11590.00	36.8 AV	54.0	-17.2	2.44 H	233	22.7	14.1
5	#17385.00	51.5 PK	68.2	-16.7	1.88 H	291	33.0	18.5

REMARKS:

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

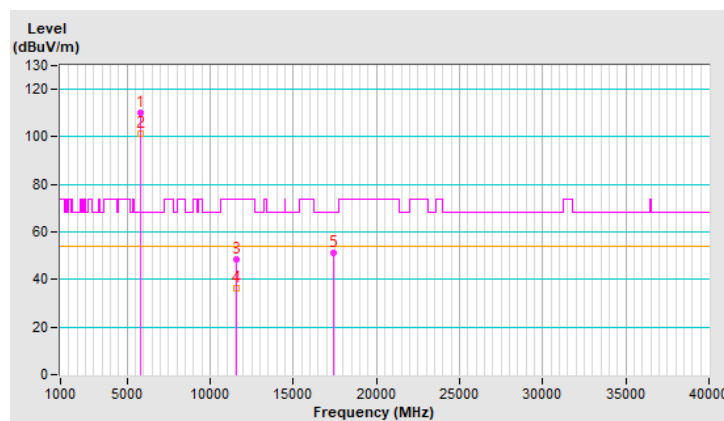


CHANNEL	TX Channel 159	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5795.00	110.3 PK			2.07 V	245	107.8	2.5
2	*5795.00	101.4 AV			2.07 V	245	98.9	2.5
3	11590.00	48.7 PK	74.0	-25.3	1.77 V	289	34.6	14.1
4	11590.00	36.1 AV	54.0	-17.9	1.77 V	289	22.0	14.1
5	#17385.00	51.1 PK	68.2	-17.1	1.85 V	322	32.6	18.5

REMARKS:

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



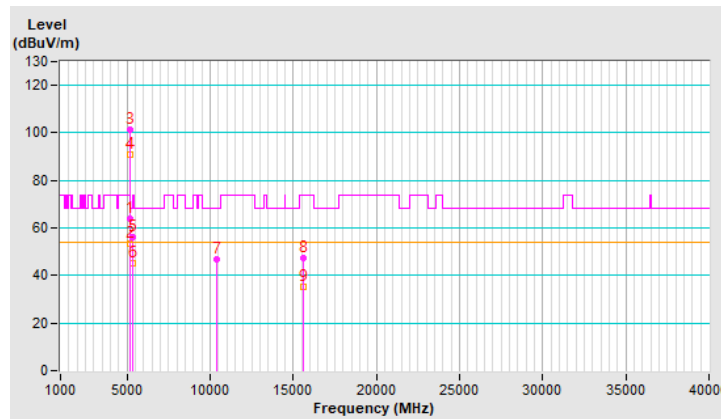
802.11ac (VHT80)

CHANNEL	TX Channel 42	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	5150.00	64.1 PK	74.0	-9.9	2.56 H	155	62.0	2.1
2	5150.00	53.5 AV	54.0	-0.5	2.56 H	155	51.4	2.1
3	*5210.00	101.2 PK			2.56 H	155	99.6	1.6
4	*5210.00	90.8 AV			2.56 H	155	89.2	1.6
5	5350.00	56.3 PK	74.0	-17.7	2.56 H	155	54.8	1.5
6	5350.00	45.1 AV	54.0	-8.9	2.56 H	155	43.6	1.5
7	#10420.00	46.9 PK	68.2	-21.3	2.55 H	236	34.5	12.4
8	15630.00	47.1 PK	74.0	-26.9	1.55 H	315	35.3	11.8
9	15630.00	35.4 AV	54.0	-18.6	1.55 H	315	23.6	11.8

REMARKS:

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

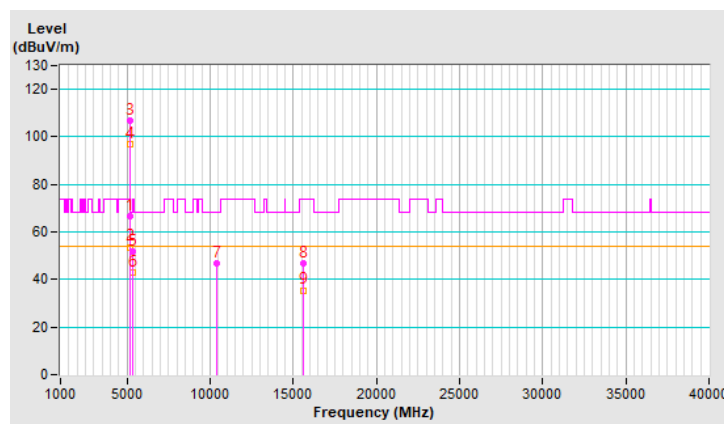


CHANNEL	TX Channel 42	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	5150.00	66.5 PK	74.0	-7.5	1.34 V	38	64.4	2.1
2	5150.00	53.7 AV	54.0	-0.3	1.34 V	38	51.6	2.1
3	*5210.00	106.8 PK			1.34 V	38	105.2	1.6
4	*5210.00	97.0 AV			1.34 V	38	95.4	1.6
5	5350.00	52.0 PK	74.0	-22.0	1.34 V	38	50.5	1.5
6	5350.00	43.1 AV	54.0	-10.9	1.34 V	38	41.6	1.5
7	#10420.00	46.9 PK	68.2	-21.3	1.69 V	289	34.5	12.4
8	15630.00	46.9 PK	74.0	-27.1	1.60 V	313	35.1	11.8
9	15630.00	35.5 AV	54.0	-18.5	1.60 V	313	23.7	11.8

REMARKS:

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

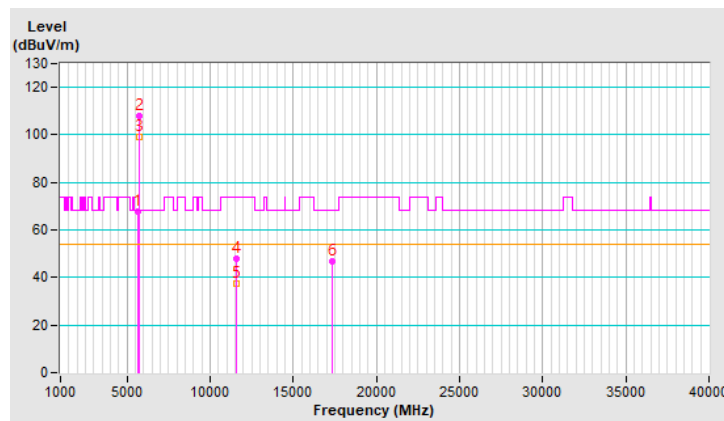


CHANNEL	TX Channel 155	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	#5641.00	67.9 PK	68.2	-0.3	2.44 H	143	65.9	2.0
2	*5775.00	107.9 PK			2.44 H	143	105.5	2.4
3	*5775.00	98.9 AV			2.44 H	143	96.5	2.4
4	11550.00	48.0 PK	74.0	-26.0	2.54 H	231	33.8	14.2
5	11550.00	37.2 AV	54.0	-16.8	2.54 H	231	23.0	14.2
6	#17325.00	46.6 PK	68.2	-21.6	1.55 H	315	28.5	18.1

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.
6. " # ": The radiated frequency is out of the restricted band.

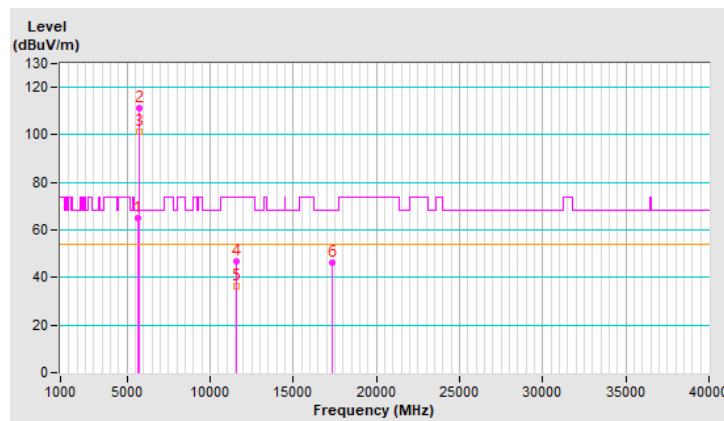


CHANNEL	TX Channel 155	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	#5641.00	65.0 PK	68.2	-3.2	1.37 V	50	63.0	2.0
2	*5775.00	111.0 PK			1.37 V	50	108.6	2.4
3	*5775.00	101.5 AV			1.37 V	50	99.1	2.4
4	11550.00	46.7 PK	74.0	-27.3	1.63 V	299	32.5	14.2
5	11550.00	36.2 AV	54.0	-17.8	1.63 V	299	22.0	14.2
6	#17325.00	46.5 PK	68.2	-21.7	1.67 V	311	28.4	18.1

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.
6. " # ": The radiated frequency is out of the restricted band.



Below 1GHz Data:

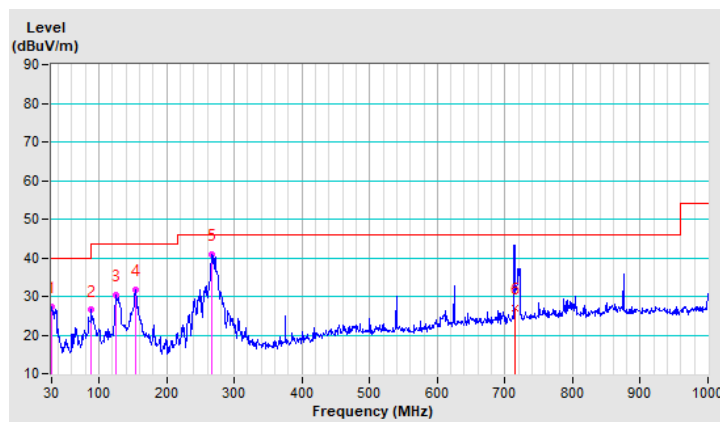
802.11ac (VHT40)

CHANNEL	TX Channel 151	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	30.19	27.4 QP	40.0	-12.6	1.50 H	78	42.0	-14.6
2	89.12	26.5 QP	43.5	-17.0	3.00 H	275	44.8	-18.3
3	124.97	30.3 QP	43.5	-13.2	1.50 H	281	44.9	-14.6
4	154.07	31.7 QP	43.5	-11.8	2.00 H	270	44.4	-12.7
5	267.32	40.9 QP	46.0	-5.1	1.00 H	131	54.3	-13.4
6	714.32	27.0 QP	46.0	-19.0	1.00 H	176	30.7	-3.7

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. 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.

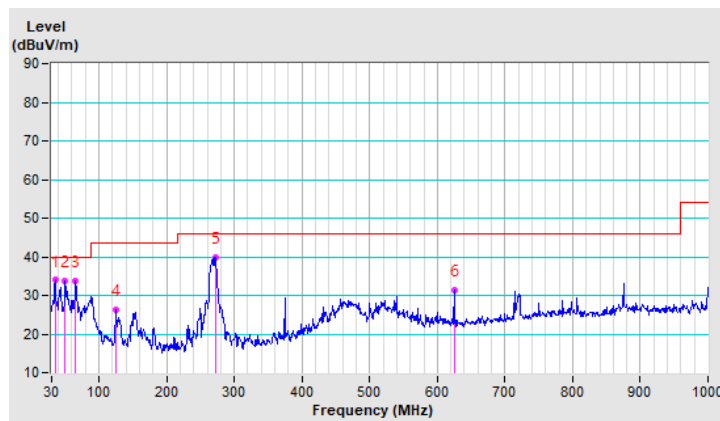


CHANNEL	TX Channel 151	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

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	35.53	33.9 QP	40.0	-6.1	1.00 V	131	47.9	-14.0
2	49.89	33.9 QP	40.0	-6.1	1.00 V	223	46.9	-13.0
3	65.46	33.9 QP	40.0	-6.1	1.00 V	8	48.5	-14.6
4	124.97	26.3 QP	43.5	-17.2	1.00 V	360	40.9	-14.6
5	271.83	39.9 QP	46.0	-6.1	1.50 V	150	53.1	-13.2
6	625.03	31.4 QP	46.0	-14.6	1.50 V	278	36.4	-5.0

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 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. 24, 2018	Oct. 23, 2019
Line-Impedance Stabilization Network (for EUT) R&S	ESH3-Z5	848773/004	Oct. 22, 2018	Oct. 21, 2019
Line-Impedance Stabilization Network (for Peripheral) R&S	ESH3-Z5	835239/001	Mar. 17, 2019	Mar. 16, 2020
50 ohms Terminator	N/A	3	Oct. 22, 2018	Oct. 21, 2019
RF Cable	5D-FB	COCCAB-001	Sep. 28, 2018	Sep. 27, 2019
Fixed attenuator EMCI	STI02-2200-10	003	Mar. 14, 2019	Mar. 13, 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: Sep. 12, 2019

4.2.3 Test Procedure

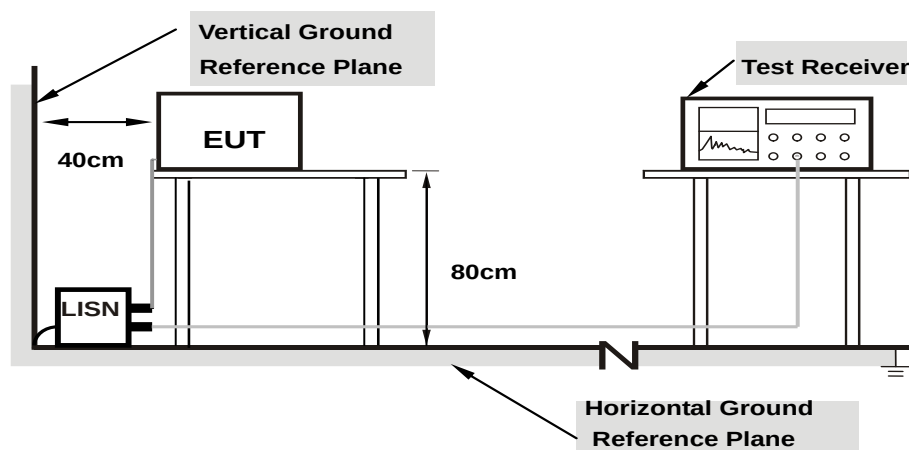
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

NOTE: All modes of operation were investigated and the worst-case emissions are reported.

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 Condition

Same as 4.1.6.

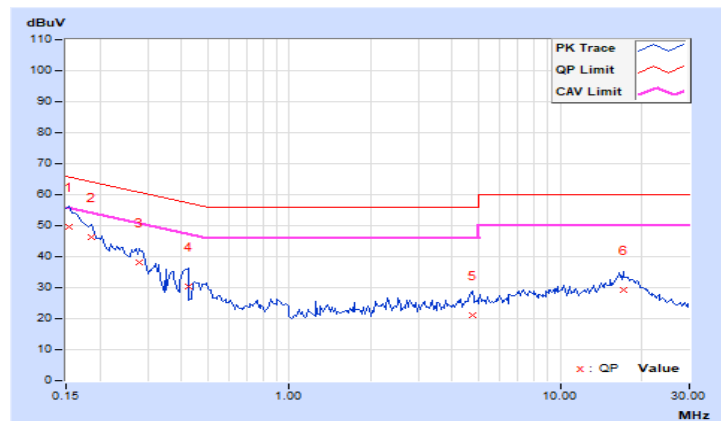
4.2.7 Test Results

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

No	Freq. [MHz]	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	9.97	39.55	25.12	49.52	35.09	65.79	55.79	-16.27	-20.70
2	0.18516	9.98	36.20	21.54	46.18	31.52	64.25	54.25	-18.07	-22.73
3	0.27891	9.98	28.27	16.69	38.25	26.67	60.85	50.85	-22.60	-24.18
4	0.42344	9.99	20.38	7.62	30.37	17.61	57.38	47.38	-27.01	-29.77
5	4.73047	10.32	10.71	2.70	21.03	13.02	56.00	46.00	-34.97	-32.98
6	17.18750	11.17	17.99	11.96	29.16	23.13	60.00	50.00	-30.84	-26.87

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.

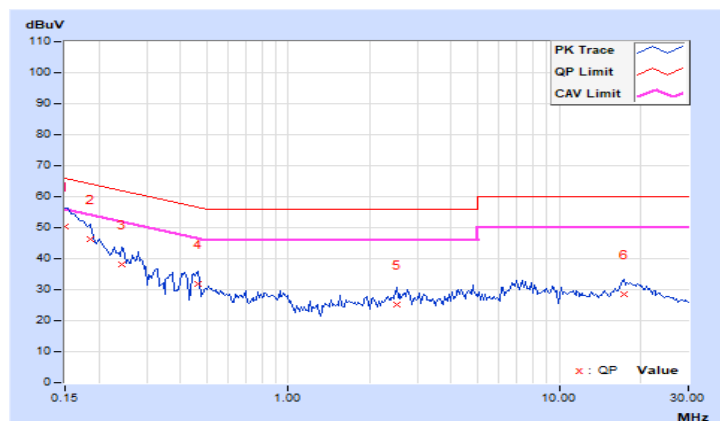


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
-------	-------------	-------------------	--------------------------------

No	Freq. [MHz]	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.95	40.45	26.81	50.40	36.76	66.00	56.00	-15.60	-19.24
2	0.18516	9.96	36.28	22.63	46.24	32.59	64.25	54.25	-18.01	-21.66
3	0.24375	9.96	28.23	18.61	38.19	28.57	61.97	51.97	-23.78	-23.40
4	0.46641	9.98	21.77	11.29	31.75	21.27	56.58	46.58	-24.83	-25.31
5	2.50781	10.13	14.91	7.79	25.04	17.92	56.00	46.00	-30.96	-28.08
6	17.32813	10.96	17.50	11.61	28.46	22.57	60.00	50.00	-31.54	-27.43

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 Transmit Power Measurement

4.3.1 Limits of Transmit Power Measurement

Operation Band	EUT Category		Limit
U-NII-1		Outdoor Access Point	1 Watt (30 dBm) (Max. e.i.r.p $\leq$ 125mW(21 dBm) at any elevation angle above 30 degrees as measured from the horizon)
		Fixed point-to-point Access Point	1 Watt (30 dBm)
	√	Indoor Access Point	1 Watt (30 dBm)
		Client device	250mW (24 dBm)
U-NII-2A	---		250mW (24 dBm) or 11 dBm+10 log B*
U-NII-2C	---		250mW (24 dBm) or 11 dBm+10 log B*
U-NII-3	√		1 Watt (30 dBm)

*B is the 26 dB emission bandwidth in megahertz

Per KDB 662911 Method of conducted output power measurement on IEEE 802.11 devices,

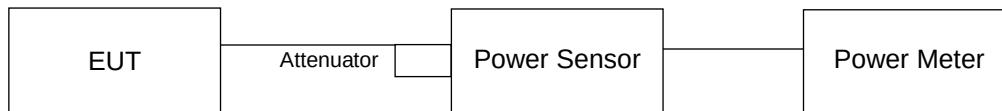
Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

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.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

Method PM is used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Condition

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

4.3.7 Test Result

CDD Mode

802.11a

Chan.	Chan. Freq. (MHz)	Maximum Conducted Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
36	5180	21.63	20.14	21.23	381.561	25.82	30	Pass
40	5200	21.52	21.11	21.25	404.38	26.07	30	Pass
48	5240	20.94	21.16	21.37	391.87	25.93	30	Pass
149	5745	21.22	21.03	21.16	389.816	25.91	30	Pass
157	5785	21.31	21.22	21.24	400.686	26.03	30	Pass
165	5825	21.31	21.46	21.13	404.884	26.07	30	Pass

802.11ac (VHT20)

Chan.	Chan. Freq. (MHz)	Maximum Conducted Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
36	5180	21.10	21.16	21.28	393.718	25.95	30	Pass
40	5200	21.01	21.11	21.32	390.824	25.92	30	Pass
48	5240	21.13	21.29	21.43	403.299	26.06	30	Pass
149	5745	21.53	21.26	21.07	403.831	26.06	30	Pass
157	5785	21.35	21.06	21.44	403.418	26.06	30	Pass
165	5825	21.26	21.12	21.37	400.168	26.02	30	Pass

802.11ac (VHT40)

Chan.	Chan. Freq. (MHz)	Maximum Conducted Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
38	5190	16.58	16.67	16.98	141.839	21.52	30	Pass
46	5230	21.22	21.31	21.11	396.763	25.99	30	Pass
151	5755	21.48	21.09	21.36	405.907	26.08	30	Pass
159	5795	21.53	21.04	21.31	404.497	26.07	30	Pass

802.11ac (VHT80)

Chan.	Chan. Freq. (MHz)	Maximum Conducted Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
42	5210	14.83	14.72	15.02	91.826	19.63	30	Pass
155	5775	20.23	20.41	20.39	324.736	25.12	30	Pass

Beamforming Mode

802.11ac (VHT20)

Chan.	Chan. Freq. (MHz)	Maximum Conducted Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
36	5180	21.10	21.16	21.28	393.718	25.95	26.11	Pass
40	5200	21.01	21.11	21.32	390.824	25.92	26.11	Pass
48	5240	21.13	21.29	21.43	403.299	26.06	26.11	Pass
149	5745	21.53	21.26	21.07	403.831	26.06	26.11	Pass
157	5785	21.35	21.06	21.44	403.418	26.06	26.11	Pass
165	5825	21.26	21.12	21.37	400.168	26.02	26.11	Pass

Note: 1. Directional gain = $10 \log[(10^{G0/20} + 10^{G1/20} + 10^{G2/20})^2 / 3] = 9.89\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $30 - (9.89 - 6) = 26.11\text{dBm}$.

802.11ac (VHT40)

Chan.	Chan. Freq. (MHz)	Maximum Conducted Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
38	5190	16.58	16.67	16.98	141.839	21.52	26.11	Pass
46	5230	21.22	21.31	21.11	396.763	25.99	26.11	Pass
151	5755	21.48	21.09	21.36	405.907	26.08	26.11	Pass
159	5795	21.53	21.04	21.31	404.497	26.07	26.11	Pass

Note: 1. Directional gain = $10 \log[(10^{G0/20} + 10^{G1/20} + 10^{G2/20})^2 / 3] = 9.89\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $30 - (9.89 - 6) = 26.11\text{dBm}$.

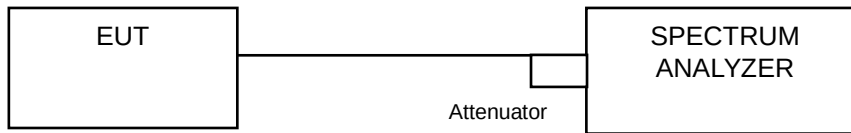
802.11ac (VHT80)

Chan.	Chan. Freq. (MHz)	Maximum Conducted Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
42	5210	14.83	14.72	15.02	91.826	19.63	26.11	Pass
155	5775	20.23	20.41	20.39	324.736	25.12	26.11	Pass

Note: 1. Directional gain = $10 \log[(10^{G0/20} + 10^{G1/20} + 10^{G2/20})^2 / 3] = 9.89\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $30 - (9.89 - 6) = 26.11\text{dBm}$.

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 SAMPLE. 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 Test Results

802.11a

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)		
		Chain 0	Chain 1	Chain 2
36	5180	18.36	17.40	17.40
40	5200	18.00	17.40	17.28
48	5240	18.36	17.16	17.40
149	5745	27.24	18.96	25.68
157	5785	27.72	19.20	25.44
165	5825	28.56	22.20	25.32

802.11ac (VHT20)

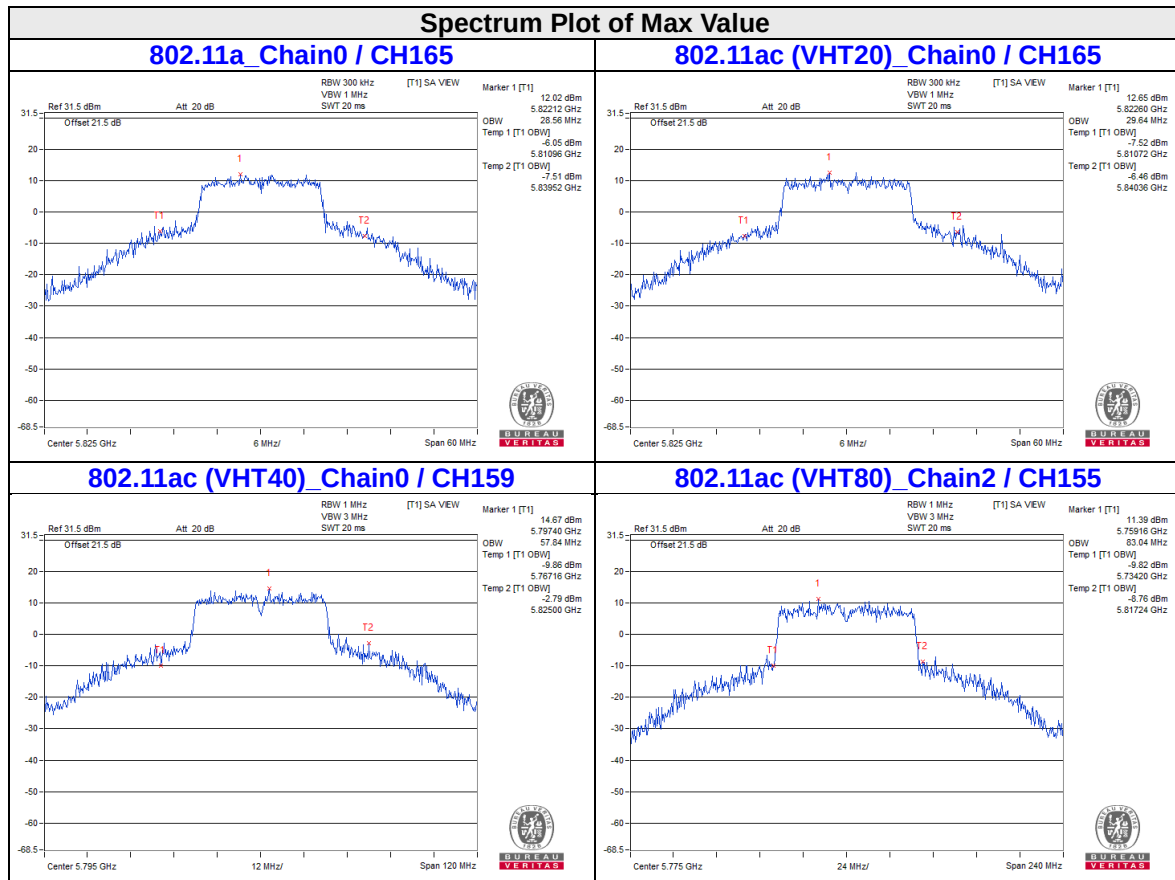
Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)		
		Chain 0	Chain 1	Chain 2
36	5180	18.60	18.24	18.36
40	5200	18.60	18.36	18.36
48	5240	18.84	18.36	18.60
149	5745	28.20	19.92	27.24
157	5785	28.92	20.16	27.48
165	5825	29.64	21.00	27.60

802.11ac (VHT40)

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)		
		Chain 0	Chain 1	Chain 2
38	5190	36.72	36.72	36.72
46	5230	38.40	37.44	37.20
151	5755	56.88	38.40	52.32
159	5795	57.84	38.88	54.72

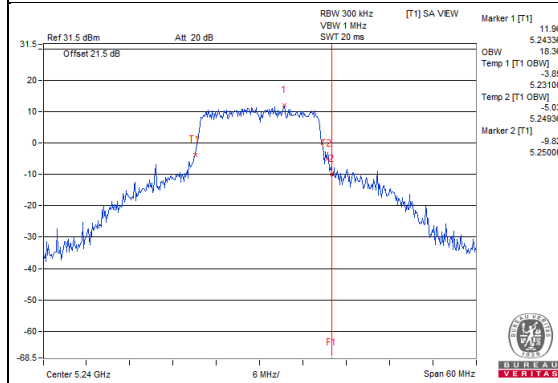
802.11ac (VHT80)

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)		
		Chain 0	Chain 1	Chain 2
42	5210	75.84	75.84	75.84
155	5775	81.12	77.28	83.04

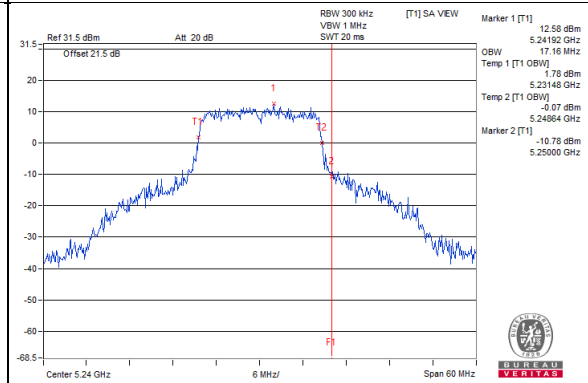


Spectrum Plot for near by DFS band (DFS is required, if 99% OCP straddle into U-NII-2A band)

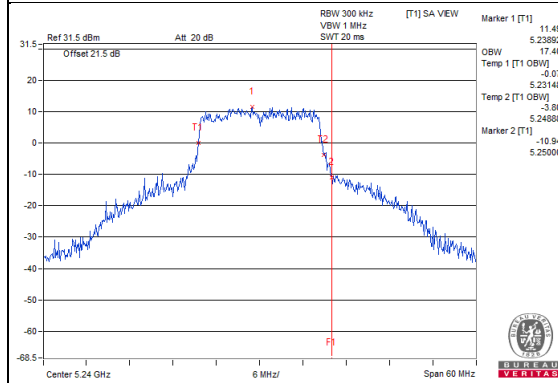
802.11a_Chain0 / CH48



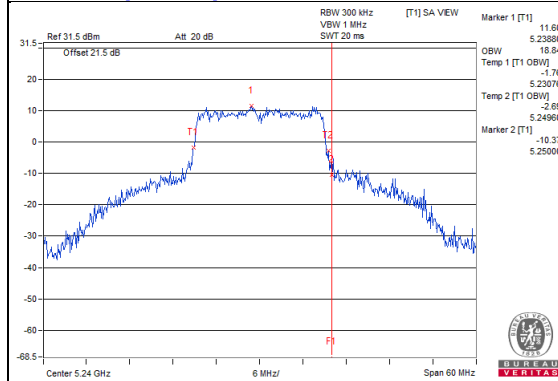
802.11a_Chain1 / CH48



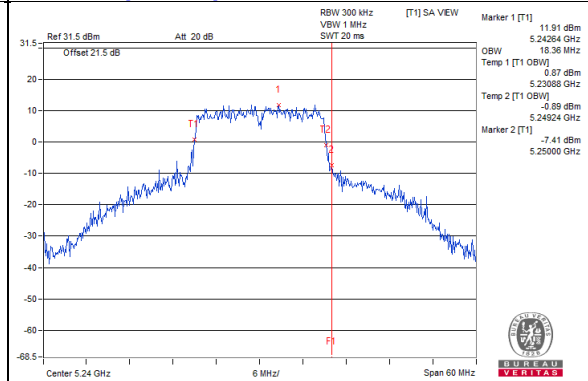
802.11a_Chain2 / CH48



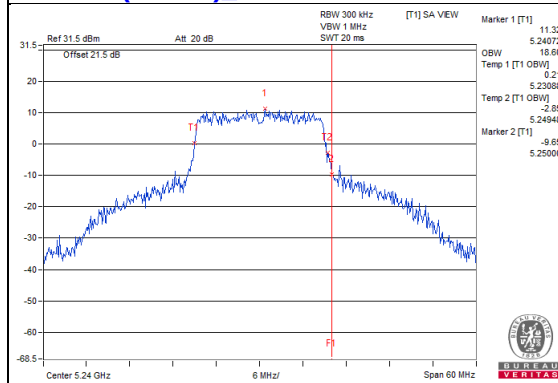
802.11ac(VHT20)_Chain0 / CH48



802.11ac(VHT20)_Chain1 / CH48

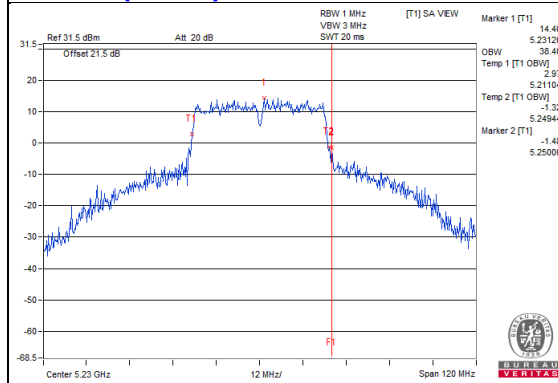


802.11ac(VHT20)_Chain2 / CH48

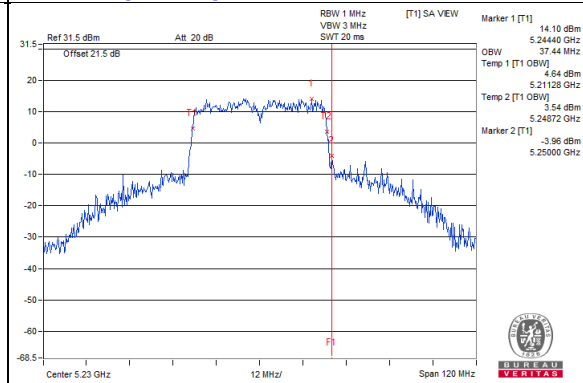


Spectrum Plot for near by DFS band (DFS is required, if 99% OCP straddle into U-NII-2A band)

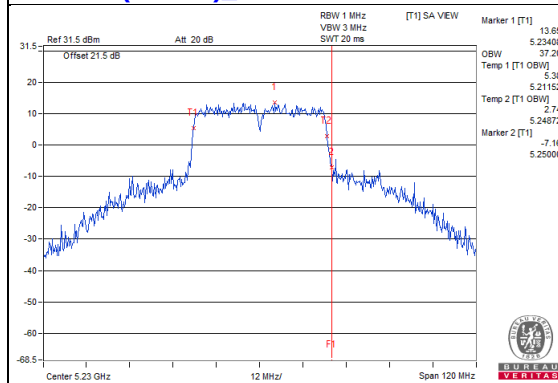
802.11ac(VHT40)_Chain0 / CH46



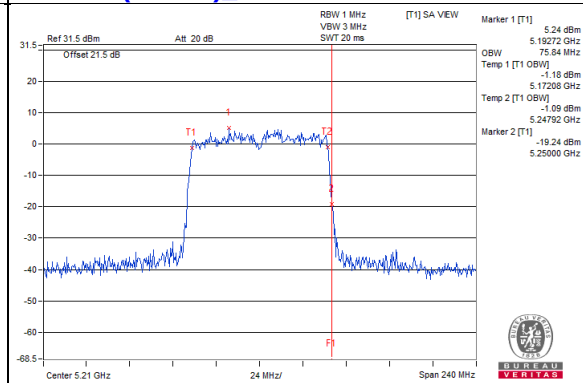
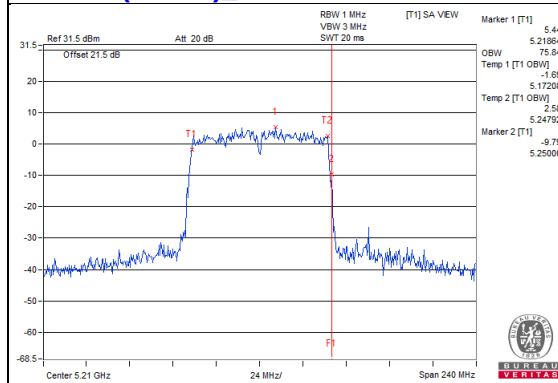
802.11ac(VHT40)_Chain1 / CH46



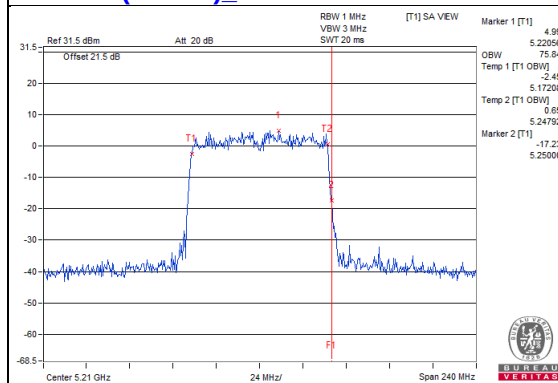
802.11ac(VHT40)_Chain2 / CH46



802.11ac(VHT80)_Chain0 / CH42

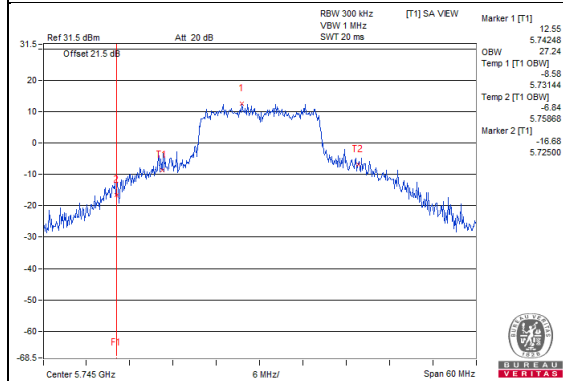


802.11ac(VHT80)_Chain2 / CH42

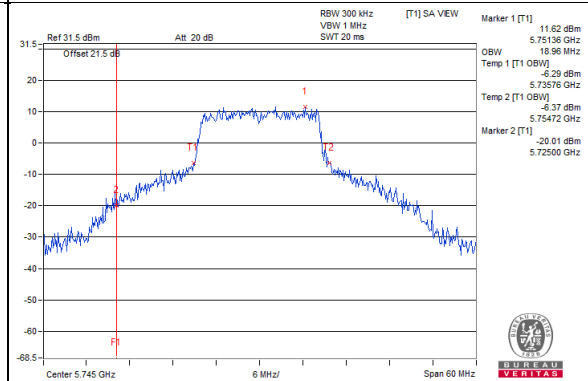


Spectrum Plot for near by DFS band (DFS is required, if 99% OCP straddle into U-NII-2C band)

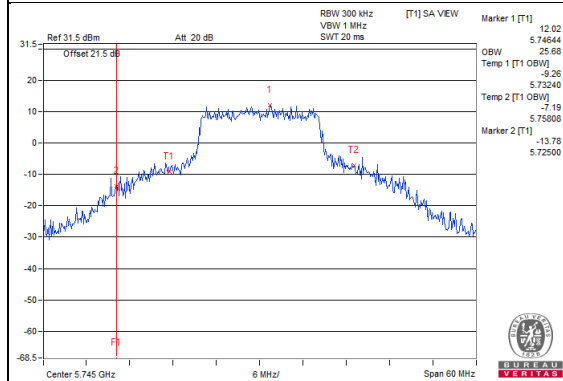
802.11a_Chain0 / CH149



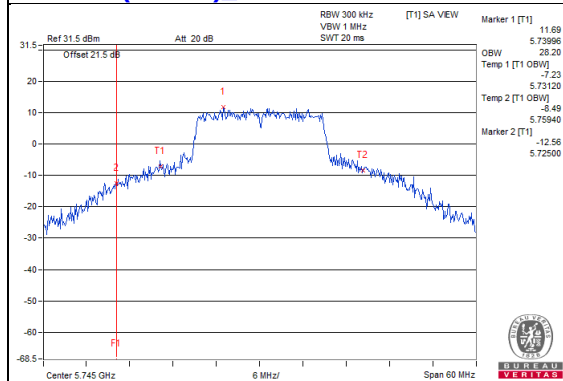
802.11a_Chain1 / CH149



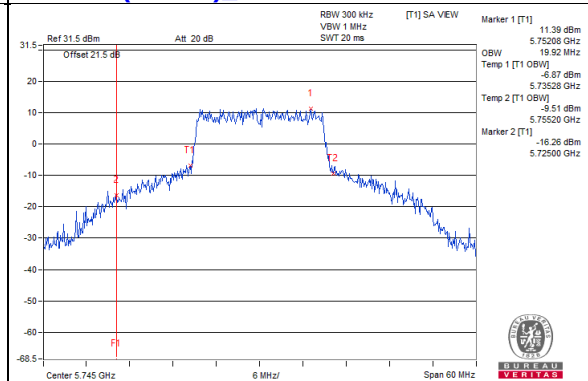
802.11a_Chain2 / CH149



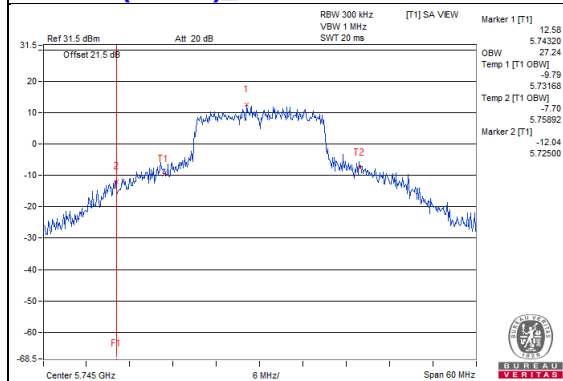
802.11ac(VHT20)_Chain0 / CH149



802.11ac(VHT20)_Chain1 / CH149

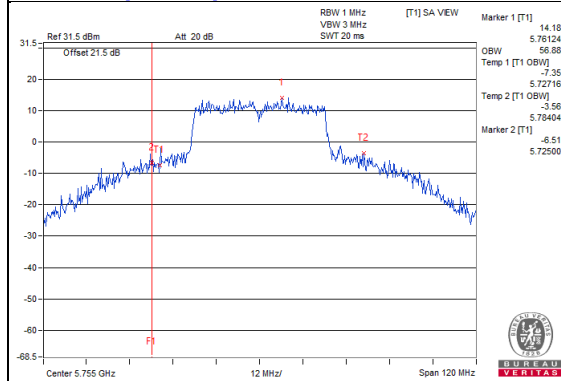


802.11ac(VHT20)_Chain2 / CH149

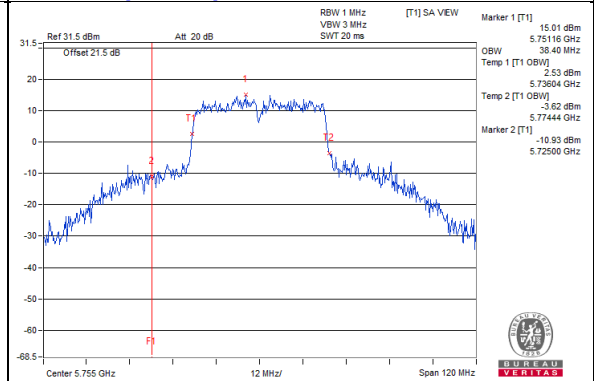


Spectrum Plot for near by DFS band (DFS is required, if 99% OCP straddle into U-NII-2C band)

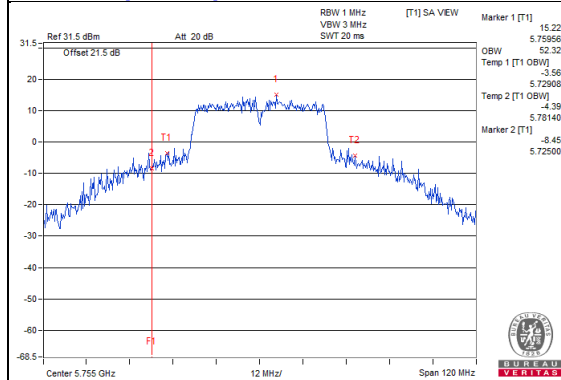
802.11ac(VHT40)_Chain0 / CH151



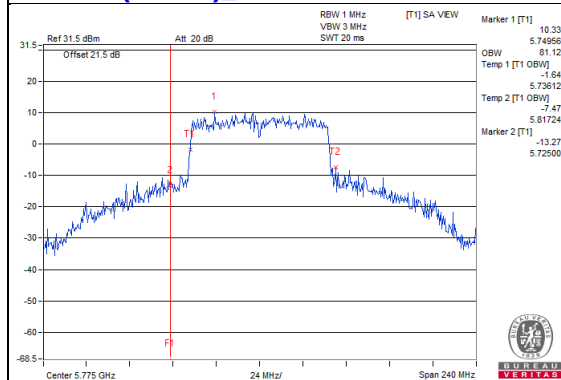
802.11ac(VHT40)_Chain1 / CH151



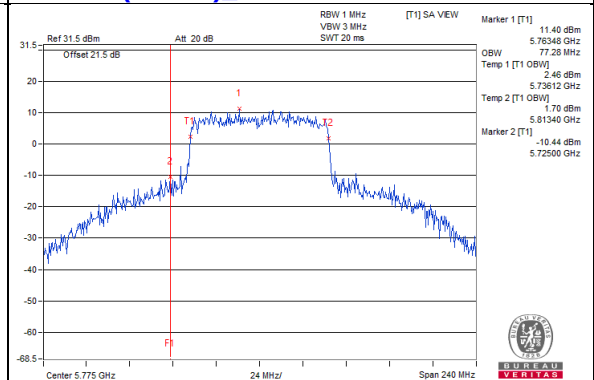
802.11ac(VHT40)_Chain2 / CH151



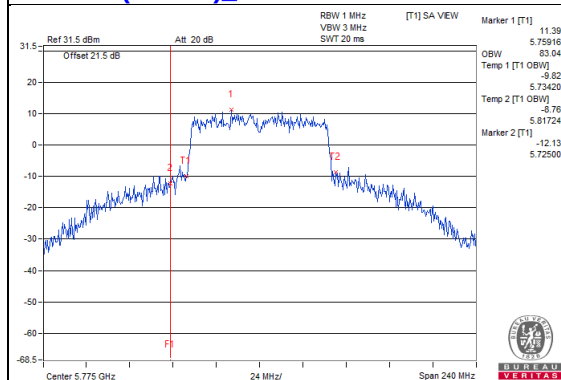
802.11ac(VHT80)_Chain0 / CH155



802.11ac(VHT80)_Chain1 / CH155



802.11ac(VHT80)_Chain2 / CH155



4.5 Peak Power Spectral Density Measurement

4.5.1 Limits of Peak Power Spectral Density Measurement

Operation Band	EUT Category		Limit
U-NII-1		Outdoor Access Point	17dBm/ MHz
		Fixed point-to-point Access Point	
	√	Indoor Access Point	
		Client device	11dBm/ MHz
U-NII-2A			11dBm/ MHz
U-NII-2C			11dBm/ MHz
U-NII-3	√		30dBm/ 500kHz

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedure

For 802.11a, 802.11ac (VHT20):

For U-NII-1:

Using method SA-1

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 1 MHz, Set VBW ≥ 3 MHz, Detector = RMS
3. Sweep time = auto, trigger set to "free run".
4. Trace average at least 100 traces in power averaging mode.
5. Record the max value

For U-NII-3:

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 300 kHz, Set VBW ≥ 1 MHz, Detector = RMS
3. Use the peak marker function to determine the maximum power level in any 300 kHz band segment within the fundamental EBW.
4. Scale the observed power level to an equivalent value in 500 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where $BWCF = 10\log(500\text{ kHz}/300\text{ kHz})$
5. Sweep time = auto, trigger set to "free run".
6. Trace average at least 100 traces in power averaging mode.
7. Record the max value

For 802.11ac (VHT40), 802.11ac (VHT80):

For U-NII-1:

Using method SA-2

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 1 MHz, Set VBW $\geq$ 3 MHz, Detector = RMS
3. Sweep time = auto, trigger set to "free run".
4. Trace average at least 100 traces in power averaging mode.
5. Record the max value and add 10 log (1/duty cycle)

For U-NII-3:

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 300 kHz, Set VBW $\geq$ 1 MHz, Detector = RMS
3. Use the peak marker function to determine the maximum power level in any 300 kHz band segment within the fundamental EBW.
4. Scale the observed power level to an equivalent value in 500 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where $BWCF = 10\log(500 \text{ kHz}/300\text{kHz})$
5. Sweep time = auto, trigger set to "free run".
6. Trace average at least 100 traces in power averaging mode.
7. Record the max value and add 10 log (1/duty cycle)

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Condition

Same as Item 4.3.6.

4.5.7 Test Results

For U-NII-1:

802.11a

Chan.	Freq. (MHz)	PSD (dBm/MHz)			Total Power Density (dBm/MHz)	MAX. Limit (dBm/MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2			
36	5180	8.19	7.19	7.80	12.52	13.11	Pass
40	5200	8.19	7.37	7.17	12.37	13.11	Pass
48	5240	8.67	8.08	7.64	12.92	13.11	Pass

- Note:** 1. Method a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = $10 \log[(10^{G0/20} + 10^{G1/20} + 10^{G2/20})^2 / 3] = 9.89\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $17-(9.89-6) = 13.11\text{dBm}$.

802.11ac (VHT20)

Chan.	Freq. (MHz)	PSD (dBm/MHz)			Total Power Density (dBm/MHz)	MAX. Limit (dBm/MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2			
36	5180	7.34	7.13	7.04	11.94	13.11	Pass
40	5200	7.48	7.40	6.75	11.99	13.11	Pass
48	5240	7.79	7.74	7.28	12.38	13.11	Pass

- Note:** 1. Method a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = $10 \log[(10^{G0/20} + 10^{G1/20} + 10^{G2/20})^2 / 3] = 9.89\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $17-(9.89-6) = 13.11\text{dBm}$.

802.11ac (VHT40)

Chan.	Freq. (MHz)	PSD (dBm/MHz)			Duty Factor (dB)	Total Power Density (dBm/MHz)	MAX. Limit (dBm/MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
38	5190	0.07	0.28	-0.30	0.09	4.88	13.11	Pass
46	5230	4.64	4.68	4.18	0.09	9.37	13.11	Pass

- Note:** 1. Method a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = $10 \log[(10^{G0/20} + 10^{G1/20} + 10^{G2/20})^2 / 3] = 9.89\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $17-(9.89-6) = 13.11\text{dBm}$.
3. Refer to section 3.3 for duty cycle spectrum plot.

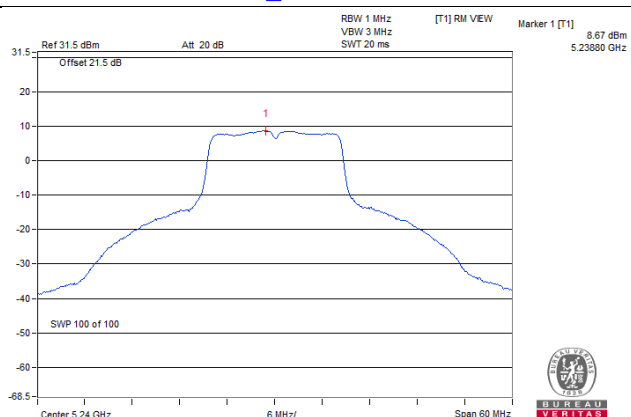
802.11ac (VHT80)

Chan.	Freq. (MHz)	PSD (dBm/MHz)			Duty Factor (dB)	Total Power Density (dBm/MHz)	MAX. Limit (dBm/MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
42	5210	-4.12	-4.79	-5.05	0.18	0.32	13.11	Pass

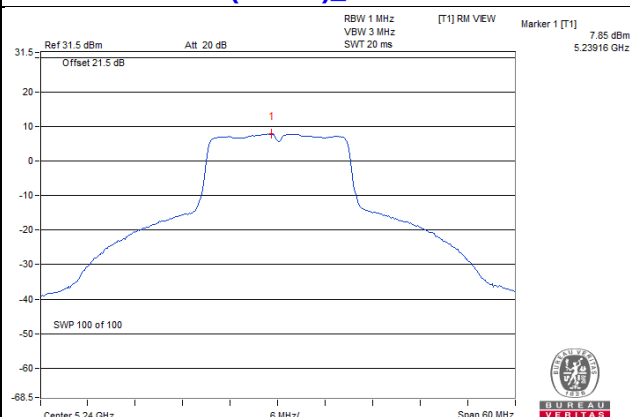
- Note:**
1. Method a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
 2. Directional gain = $10 \log[(10^{G0/20} + 10^{G1/20} + 10^{G2/20})^2 / 3] = 9.89\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $17-(9.89-6) = 13.11\text{dBm}$.
 3. Refer to section 3.3 for duty cycle spectrum plot.

Spectrum Plot of Worst Value

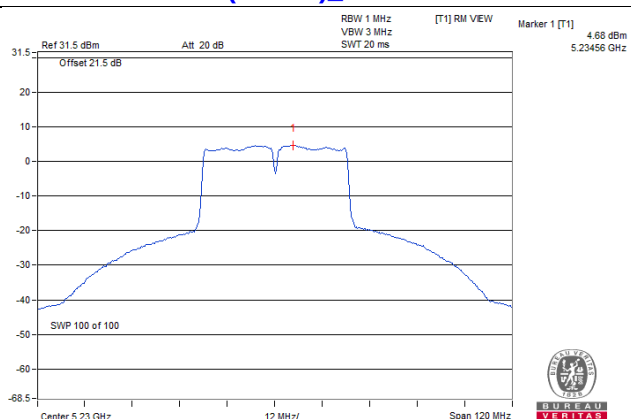
802.11a_Chain 0 / CH48



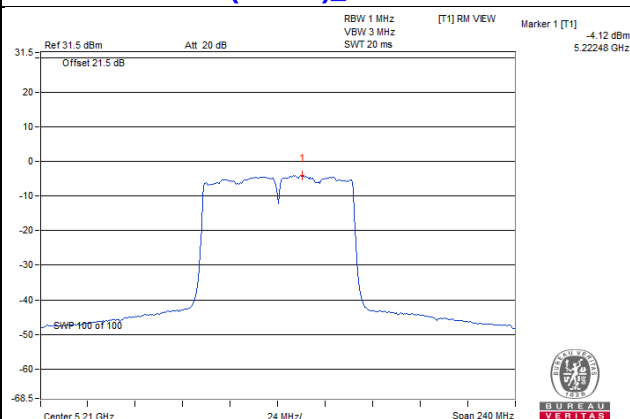
802.11ac (VHT20)_Chain 0 / CH48



802.11ac (VHT40)_Chain 1 / CH46



802.11ac (VHT80)_Chain 0 / CH42



For U-NII-3:
802.11a

Chan.	Freq. (MHz)	PSD (dBm/300kHz)			Total PSD		Total PSD (dBm/500kHz)	Limit (dBm/ 500kHz)	Pass /Fail
		Chain 0	Chain 1	Chain 2	mW/ 300kHz	dBm/ 300kHz			
149	5745	-0.59	-0.40	-0.15	2.751	4.39	6.61	26.11	Pass
157	5785	-0.61	-0.29	-0.27	2.7441	4.38	6.60	26.11	Pass
165	5825	-0.64	-0.20	-0.48	2.7133	4.33	6.55	26.11	Pass

- Note:** 1. Method b) Measure and sum spectral maxima across the outputs of KDB 662911 is using for calculating total power density.
2. Directional gain = $10 \log[(10^{G0/20} + 10^{G1/20} + 10^{G2/20})^2 / 3] = 9.89\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $30-(9.89-6) = 26.11\text{dBm}$.

802.11ac (VHT20)

Chan.	Freq. (MHz)	PSD (dBm/300kHz)			Total PSD		Total PSD (dBm/500kHz)	Limit (dBm/ 500kHz)	Pass /Fail
		Chain 0	Chain 1	Chain 2	mW/ 300kHz	dBm/ 300kHz			
149	5745	-1.01	-0.98	-0.76	2.43	3.86	6.08	26.11	Pass
157	5785	-1.10	-0.90	-0.84	2.4132	3.83	6.05	26.11	Pass
165	5825	-0.82	-0.86	-0.94	2.4537	3.90	6.12	26.11	Pass

- Note:** 1. Method b) Measure and sum spectral maxima across the outputs of KDB 662911 is using for calculating total power density.
2. Directional gain = $10 \log[(10^{G0/20} + 10^{G1/20} + 10^{G2/20})^2 / 3] = 9.89\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $30-(9.89-6) = 26.11\text{dBm}$.

802.11ac (VHT40)

Chan.	Freq. (MHz)	PSD (dBm/300kHz)			Total PSD		Duty Factor (dB)	Total PSD (dBm/500kHz)	Limit (dBm/ 500kHz)	Pass /Fail
		Chain 0	Chain 1	Chain 2	mW/ 300kHz	dBm/ 300kHz				
151	5755	-3.91	-4.19	-4.03	1.209	0.82	0.09	3.04	26.11	Pass
159	5795	-4.42	-4.49	-4.46	1.0989	0.41	0.09	2.63	26.11	Pass

- Note:** 1. Method b) Measure and sum spectral maxima across the outputs of KDB 662911 is using for calculating total power density.
2. Directional gain = $10 \log[(10^{G0/20} + 10^{G1/20} + 10^{G2/20})^2 / 3] = 9.89\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $30-(9.89-6) = 26.11\text{dBm}$.
3. Refer to section 3.3 for duty cycle spectrum plot.

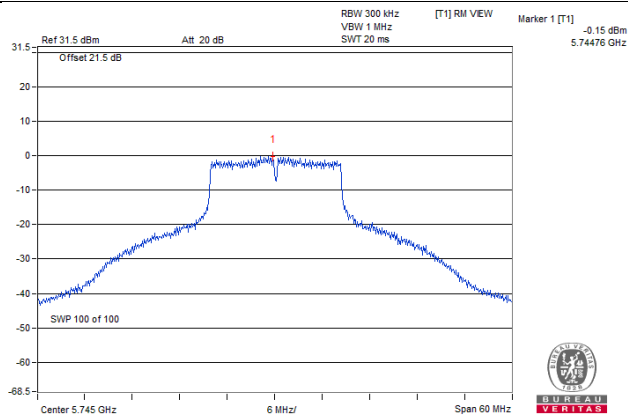
802.11ac (VHT80)

Chan.	Freq. (MHz)	PSD (dBm/300kHz)			Total PSD		Duty Factor (dB)	Total PSD (dBm/500kHz)	Limit (dBm/ 500kHz)	Pass /Fail
		Chain 0	Chain 1	Chain 2	mW/ 300kHz	dBm/ 300kHz				
155	5775	-8.29	-7.98	-7.93	0.4879	-3.12	0.18	-0.90	26.11	Pass

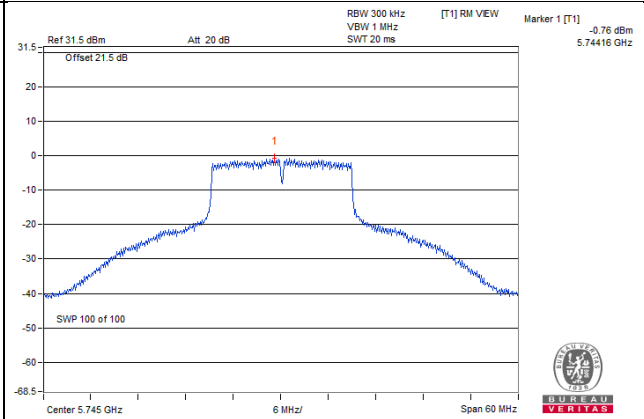
- Note:**
1. Method b) Measure and sum spectral maxima across the outputs of KDB 662911 is using for calculating total power density.
 2. Directional gain = $10 \log[(10^{G0/20} + 10^{G1/20} + 10^{G2/20})^2 / 3] = 9.89\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $30 - (9.89 - 6) = 26.11\text{dBm}$.
 3. Refer to section 3.3 for duty cycle spectrum plot.

Spectrum Plot of Worst Value

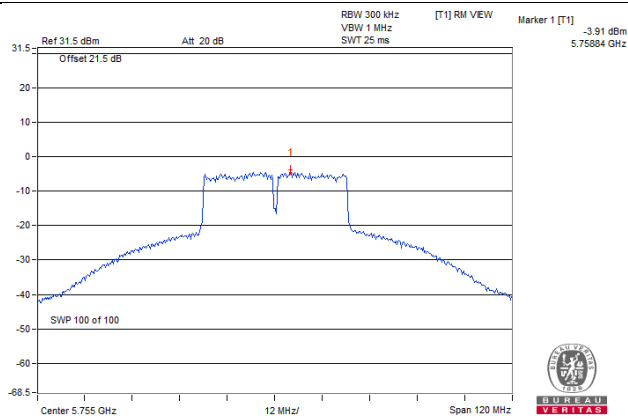
802.11a_Chain 2 / CH149



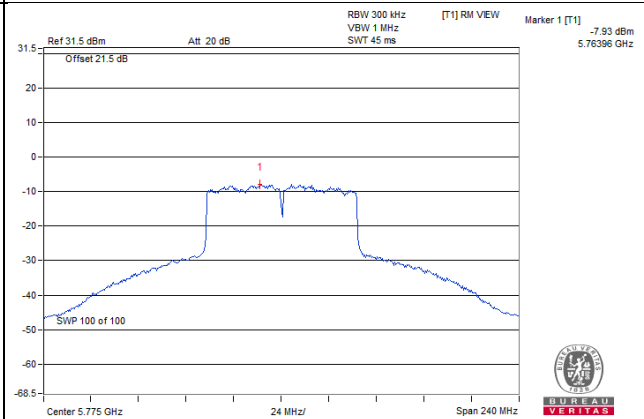
802.11ac (VHT20)_Chain 2 / CH149



802.11ac (VHT40)_Chain 0 / CH151



802.11ac (VHT80)_Chain 2 / CH155

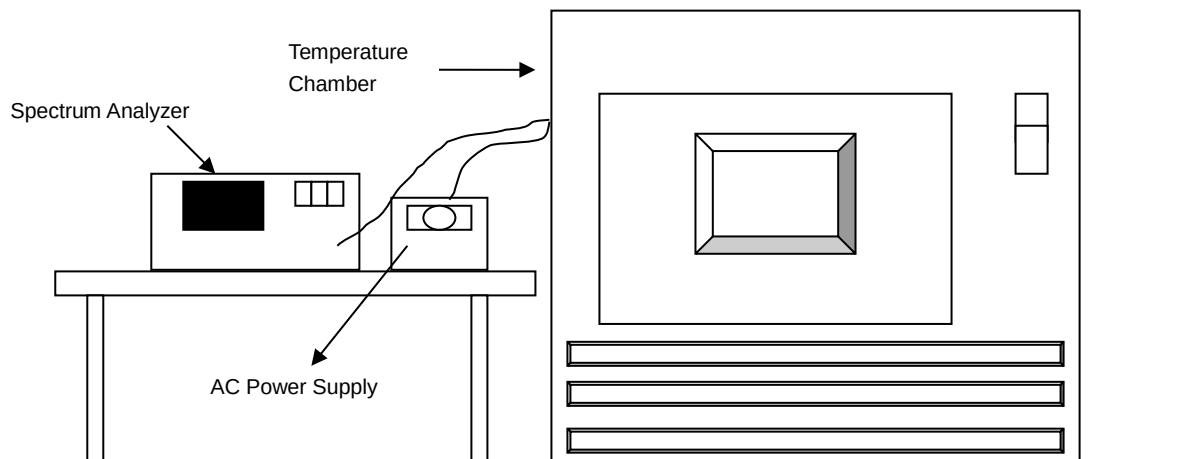


4.6 Frequency Stability Measurement

4.6.1 Limits of Frequency Stability Measurement

The frequency of the carrier signal shall be maintained within band of operation

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

- The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
- Turn the EUT on and couple its output to a spectrum analyzer.
- Turn the EUT off and set the chamber to the highest temperature specified.
- Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 Minutes.
- Repeat step (d) with the temperature chamber set to the next desired temperature until measurements down to the lowest specified temperature have been completed..
- The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 Minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

Set the EUT transmit at un-modulation mode to test frequency stability.

4.6.7 Test Results

Frequency Stability Versus Temp.									
Operating Frequency: 5180 MHz									
TEMP. (°C)	Power Supply (Vac)	0 Minute		2 Minutes		5 Minutes		10 Minutes	
		Measured Frequency (MHz)	Pass/Fail	Measured Frequency (MHz)	Pass/Fail	Measured Frequency (MHz)	Pass/Fail	Measured Frequency (MHz)	Pass/Fail
50	120	5179.9853	Pass	5179.9878	Pass	5179.9841	Pass	5179.9876	Pass
40	120	5179.9796	Pass	5179.9799	Pass	5179.9822	Pass	5179.9802	Pass
30	120	5180.0212	Pass	5180.0226	Pass	5180.0193	Pass	5180.0227	Pass
20	120	5180.024	Pass	5180.0224	Pass	5180.0264	Pass	5180.0244	Pass
10	120	5179.9925	Pass	5179.995	Pass	5179.9942	Pass	5179.9957	Pass
0	120	5179.9831	Pass	5179.9809	Pass	5179.9826	Pass	5179.9813	Pass
-10	120	5179.9891	Pass	5179.9891	Pass	5179.9868	Pass	5179.9909	Pass
-20	120	5180.0063	Pass	5180.0049	Pass	5180.0064	Pass	5180.0069	Pass
-30	120	5179.9821	Pass	5179.9864	Pass	5179.9852	Pass	5179.9835	Pass

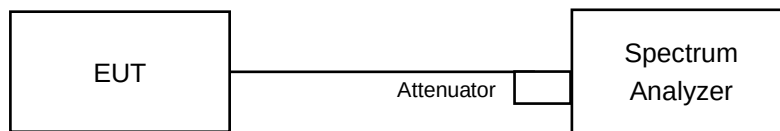
Frequency Stability Versus Voltage									
Operating Frequency: 5180 MHz									
TEMP. (°C)	Power Supply (Vac)	0 Minute		2 Minutes		5 Minutes		10 Minutes	
		Measured Frequency (MHz)	Pass/Fail	Measured Frequency (MHz)	Pass/Fail	Measured Frequency (MHz)	Pass/Fail	Measured Frequency (MHz)	Pass/Fail
20	138	5180.024	Pass	5180.0225	Pass	5180.0267	Pass	5180.0238	Pass
	120	5180.024	Pass	5180.0224	Pass	5180.0264	Pass	5180.0244	Pass
	102	5180.0235	Pass	5180.0225	Pass	5180.0258	Pass	5180.025	Pass

4.7 6dB Bandwidth Measurement

4.7.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5MHz.

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

- Set resolution bandwidth (RBW) = 100kHz
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

4.7.5 Deviation from Test Standard

No deviation.

4.7.6 EUT Operating Condition

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

4.7.7 Test Results

802.11a

Channel	Frequency (MHz)	6dB Bandwidth (MHz)			Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2		
149	5745	16.36	16.33	15.78	0.5	PASS
157	5785	16.07	16.32	15.74	0.5	PASS
165	5825	16.32	16.31	15.75	0.5	PASS

802.11ac (VHT20)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)			Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2		
149	5745	17.22	17.60	17.57	0.5	PASS
157	5785	16.93	17.61	15.79	0.5	PASS
165	5825	16.68	17.59	15.39	0.5	PASS

802.11ac (VHT40)

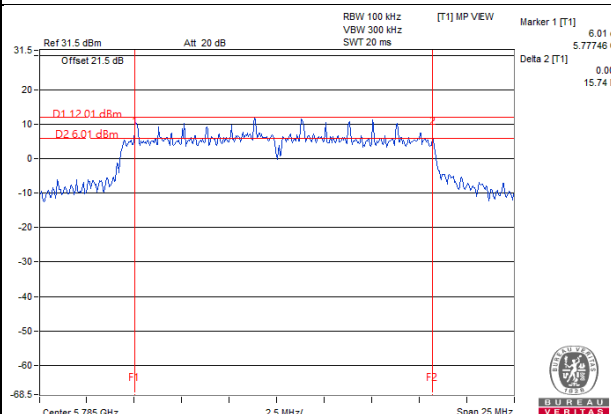
Channel	Frequency (MHz)	6dB Bandwidth (MHz)			Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2		
151	5755	35.75	36.42	35.53	0.5	PASS
159	5795	35.73	36.48	36.11	0.5	PASS

802.11ac (VHT80)

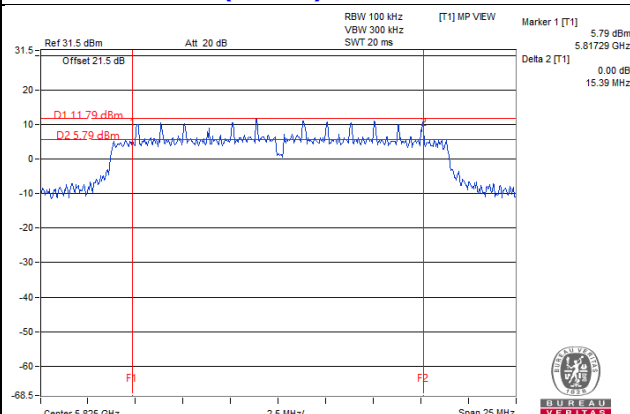
Channel	Frequency (MHz)	6dB Bandwidth (MHz)			Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2		
155	5775	75.63	75.16	75.67	0.5	PASS

Spectrum Plot of Worst Value

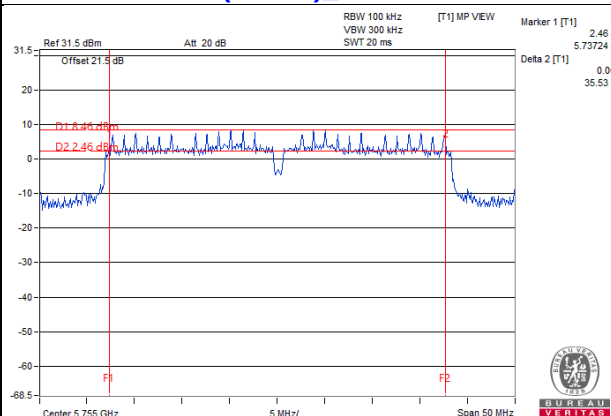
802.11a_Chain 2 / CH157



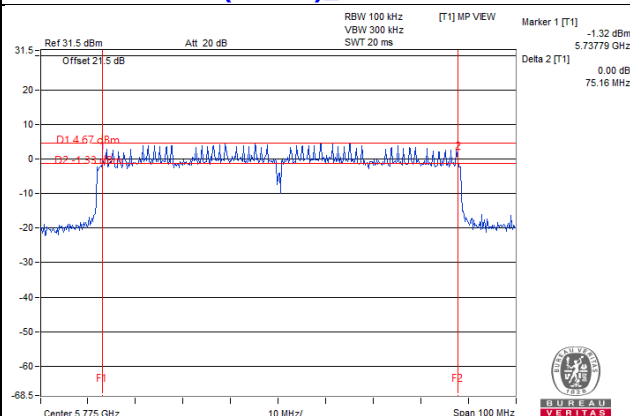
802.11ac (VHT20)_Chain 2 / CH165



802.11ac (VHT40)_Chain 2 / CH151



802.11ac (VHT80)_Chain 1 / CH155

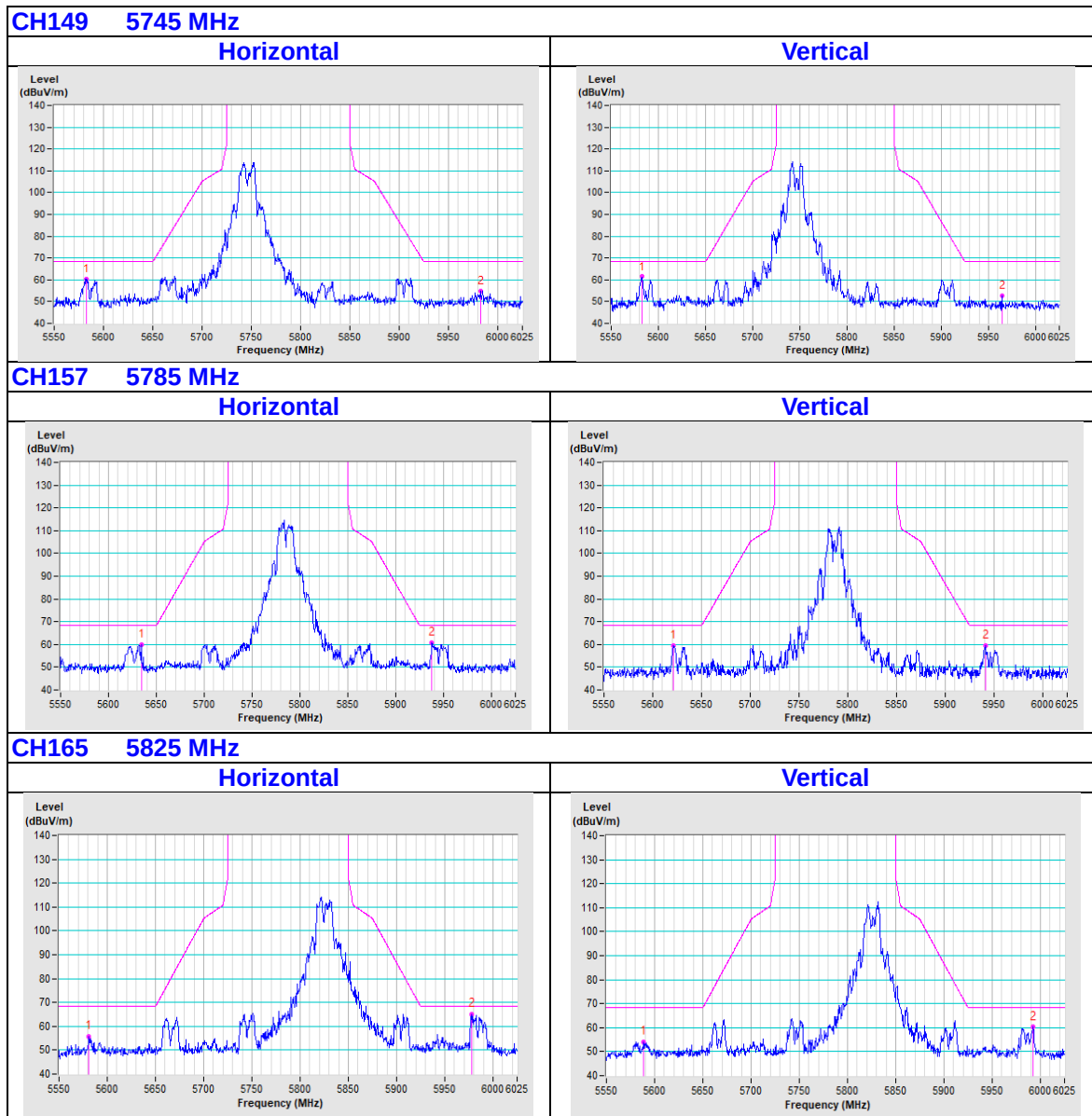


5 Pictures of Test Arrangements

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

Annex A- Radiated Out of Band Emission (OOBE) Measurement (For U-NII-3 band)

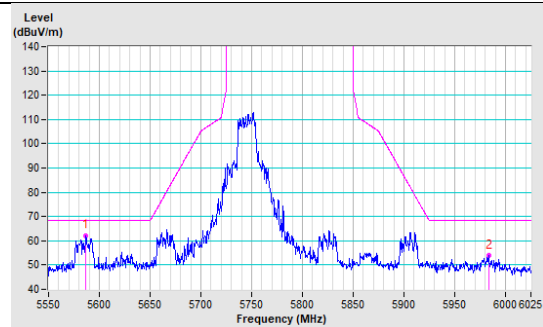
802.11a



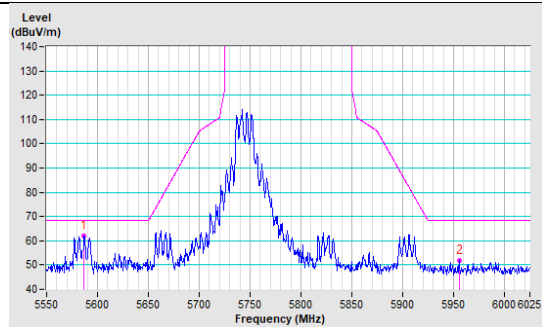
802.11ac (VHT20)

CH149 5745 MHz

Horizontal

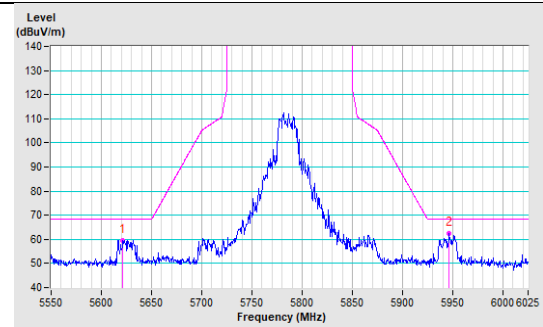


Vertical

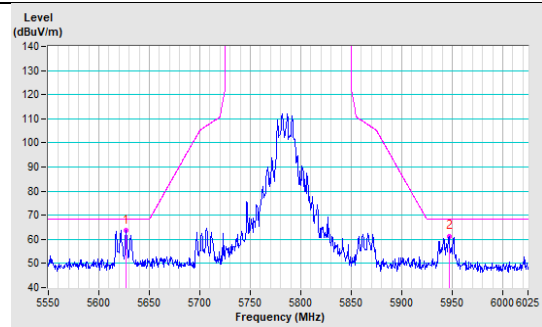


CH157 5785 MHz

Horizontal

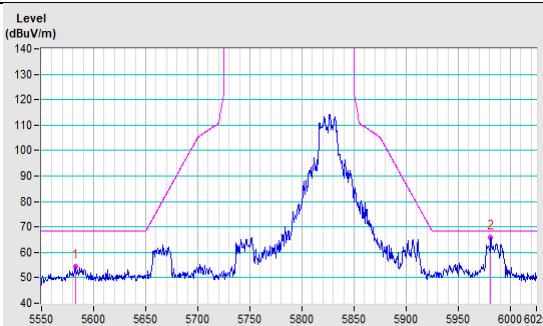


Vertical

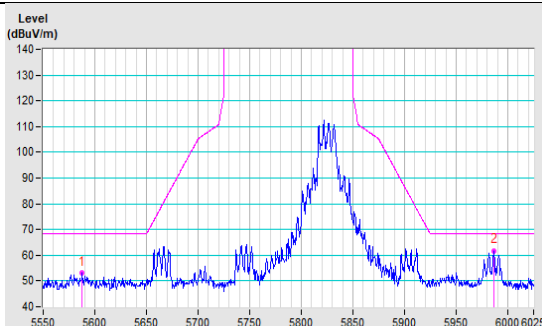


CH165 5825 MHz

Horizontal



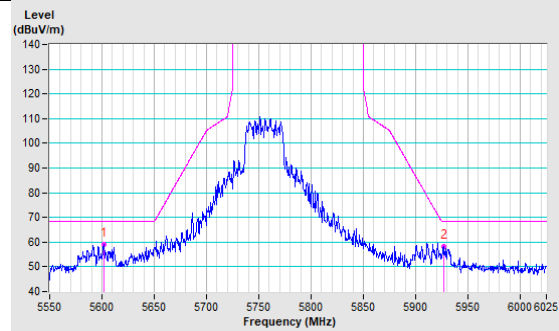
Vertical



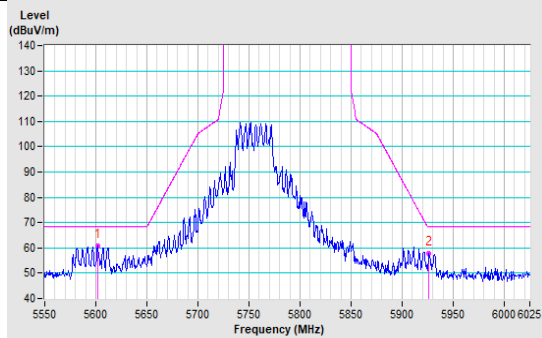
802.11ac (VHT40)

CH151 5755 MHz

Horizontal

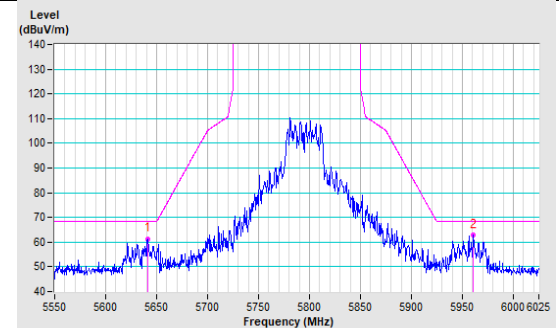


Vertical

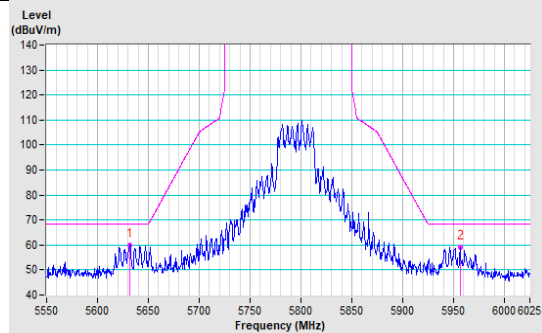


CH159 5795 MHz

Horizontal



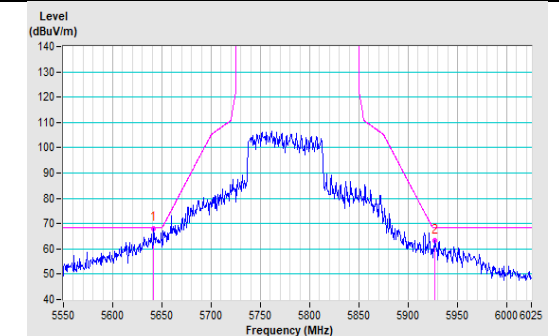
Vertical



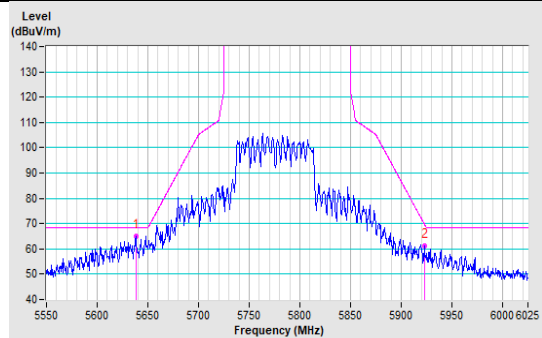
802.11ac (VHT80)

CH155 5775 MHz

Horizontal



Vertical



Appendix – Information of the Testing Laboratories

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

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

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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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