

RADIO TEST REPORT

Product : Wireless HD Transmitter & Receiver Kit

Model Name : WTR-1500C

FCC ID : BY4WTR1500C

Test Regulation : FCC 47 CFR Part 15 Subpart E (Section 15.407)

Received Date : 2024/6/7

Test Date : 2024/6/12 ~ 2024/6/17

Issued Date : 2024/9/19

Applicant : Trans Electric Co., Ltd
771 Sec.2 Chungshan Rd, Huatang, Changhua, Taiwan 503

Issued By : Underwriters Laboratories Taiwan Co., Ltd.
Building A, B and E, No. 372-7, Sec. 4, Zhongxing Rd.,
Zhudong Township, Hsinchu County, Taiwan

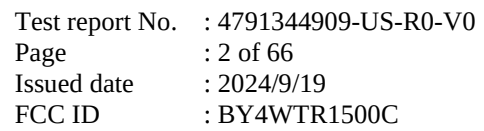


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Doc No: Form-ULID-004739 (DCS:17-EM-F0878) / 6.1



Original Test Report No.: 4791344909-US-R0-V0

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1. Attestation of Test Results

APPLICANT: Trans Electric Co., Ltd
771 Sec.2 Chungsan Rd, Huatang, Changhua, Taiwan 503

MANUFACTURER: Trans Electric Co., Ltd
771 Sec.2 Chungsan Rd, Huatang, Changhua, Taiwan 503

EUT DESCRIPTION: Wireless HD Transmitter & Receiver Kit

BRAND: PX

MODEL: WTR-1500C

SAMPLE STAGE: Engineering Verification Test Sample

DATE of TESTED: 2024/6/12 ~ 2024/6/17

APPLICABLE STANDARDS	
STANDARD	Test Results
FCC 47 CFR PART 15 Subpart E (Section 15.407)	PASS

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:



Sally Lu
Project Handler

Date : 2024/9/19

Approved and Authorized By:



Eric Lee
Senior Laboratory Engineer

Date : 2024/9/19

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2. Summary of Test Results

Summary of Test Results		
FCC Clause	Test Items	Result
15.407(e)	6dB Bandwidth	PASS
15.403(i)	26dB Bandwidth	PASS
2.1049	Occupied Bandwidth	See Note1
15.407(a)(1/3)	Conducted Output Power	PASS
15.407(a)(1/3)	Power Spectral Density	PASS
15.407(g)	Frequency Stability	PASS
15.407(b) (1/4/9)	Radiated Emissions and Band Edge Measurement	PASS
15.407(b)(9)	AC Power Conducted Emission	PASS
15.203	Antenna Requirement	PASS
15.407(h)	Dynamic Frequency Selection & Transmit power control	N/A

Note:

1. The Occupied Bandwidth was reference only.

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3. Test Methodology and Reference Procedures

The tests documented in this report were performed in accordance with 47 CFR FCC Part 2, KDB 789033 D02 General UNII Test Procedure New Rules v02r01, KDB414788 D01 Radiated Test Site v01r01, ANSI C63.10-2013.

4. Facilities and Accreditation

Test Location	Underwriters Laboratories Taiwan Co., Ltd.
Address	Building A, B and E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan
Accreditation Certificate	Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398.

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5. Measurement Uncertainty

For statement of conformity, Simple acceptance (Section 3.1.4 of IEC Guide 115) was applied as decision rule for measurement in this test report.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k=2$.

Determining compliance based on the results of the compliance measurement, not considering measurement instrumentation uncertainty.

Measurement	Frequency	Uncertainty
Conducted disturbance at mains terminals ports	150kHz ~ 30MHz	3.1 dB
RF Conducted	9 kHz - 40GHz	2.3 dB
Radiated disturbance below 30MHz	9 kHz - 30 MHz	3.2 dB
Radiated disturbance below 1 GHz	30MHz ~ 1GHz	6.1 dB
Radiated disturbance above 1 GHz	1GHz ~ 40GHz	5.1 dB

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6. Equipment under Test

6.1. Description of EUT

Product	Wireless HD Transmitter & Receiver Kit
Brand Name	PX
Model Name	WTR-1500C
Normal Voltage	5Vdc from USB

Operating Frequency	5180 ~ 5240 MHz, 5745 ~ 5825 MHz
Modulation	64QAM, 16QAM, QPSK, BPSK
Transfer Rate	802.11a: up to 54 Mbps 802.11n: up to MCS7
Maximum Output Power	5180 ~ 5240 MHz: 16.59 dBm 5745 ~ 5825 MHz: 17.91 dBm
Sample ID	Conducted Test: 7283619 Radiated Test: 7283618

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Note:

1. The EUT incorporates a SISO function. Physically, the EUT provides one completed transmitters and one receivers.

Modulation Mode	Tx,Rx Function
802.11a	1TX,1RX
802.11n (HT20)	1TX,1RX

2. The EUT contains following accessory devices.

Product	Brand	Model	Description
HDMI cable	PX	F1742G	0.17 meter
Type C cable	PX	F1743G	0.17 meter

3. The products are offered for sale in a bundled configuration. The pertinent details are as follows:

Product	Brand	Model	Description
Wireless HD Transmitter & Receiver Kit	PX	WTR-1500C	Transmitter Kit only Tx Function
Wireless HD Transmitter & Receiver Kit	PX	WTR-1500C	Receiver Kit only Rx Function

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

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6.2. Channel List

FOR 5180 ~ 5240MHz

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

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

FOR 5745 ~ 5825MHz:

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

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

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6.3. Test Condition

Test Item	Test Site No.	Environmental Condition	Input Power	Test Date	Tested by
Antenna Port Conducted Measurement	SR4	23~°C/ 68~%RH	5Vdc	2024/06/17~ 2024/06/17	WaterNil Guan
Radiated Spurious Emission	966-2	21~27°C/ 53~69%RH	5Vdc	2024/06/12~ 2024/06/14	WaterNil Guan
AC power Line Conducted Emission	SR1	23~°C/ 65~%RH	120Vac/ 60Hz	2024/06/14~ 2024/06/14	WaterNil Guan

FCC Test Firm Registration Number: 498077

IC Company Number: 23421

Sample Calculation:

Antenna Port Conducted Measurement:

- Where relevant, the follow sample calculation is provided:
Result Value (dBm) = Reading Value (dBm) + Attenuator Factor (dB) + Cable Loss (dB).
Example: Result Value (10dBm) = Reading Value (-2dBm) + Attenuator Factor (10dB) + Cable Loss(2dB).
*Test plot only shown the “Result Value”.

Radiated Spurious Emission:

- Where relevant, the follow sample calculation is provided:
Result Value (dBuV/m) = Reading Value (dBuV) + Correction Factor (dB/m).
Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB) - Preamp Factor (dB).
Example: Result Value (34.5dBuV/m) = Reading Value (40.1dBuV) + Antenna Factor (18.7dB/m) + Cable Loss (4.2dB) - Preamp Factor (28.5dB).

AC power Line Conducted Emission:

- Where relevant, the follow sample calculation is provided:
Result Value (dBuV) = Reading Value (dBuV) + Correction Factor (dB).
Correction Factor (dB) = Insertion loss(dB) + Cable loss(dB).
Example: Result Value (53.7dBuV) = Reading Value (35.1dBuV) + Insertion loss(18.1dB) + Cable loss(0.5dB).

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6.4. Description of Available Antennas

Ant. No.	Transmitter Circuit	Brand Name	Model Name	Ant. Type	Frequency Band (MHz)	Maximum Gain (dBi)
TX	Chain 0	RedbirdTek	ANT000088	Dipole PCB	5150~5250	1.76
					5700~5850	2.03

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer's specification or user's manual, the laboratory shall not be held responsible.

6.5. Test Mode Applicability and Tested Channel Detail

- The fundamental of the EUT was investigated in three orthogonal axes X-Y/Y-Z/X-Z, it was determined that X-Z plane was worst-case. Therefore, all final radiated testing was performed with the EUT in X-Z plane.
- For Antenna Port Conducted Measurement, this item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.
- For below 1 GHz radiated emission and AC power line conducted emission have performed all modes of operation were investigated and the worst-case emissions are reported.
- 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).

Test Item	Mode	Modulation Technology	Modulation Type	Available Channel	Test Channel	Data Rate
Radiated Bandedge	802.11a	5180-5240	OFDM	36 to 48	36, 44, 48	6Mbps
	802.11n20		OFDM	36 to 48	36, 44, 48	MCS 0
	802.11a	5745-5825	OFDM	149 to 165	149, 157, 165	6Mbps
	802.11n20		OFDM	149 to 165	149, 157, 165	MCS 0
Radiated Emissions (Above 1GHz)	802.11a	5180-5240	OFDM	36 to 48	36, 44, 48	6Mbps
	802.11a	5745-5825	OFDM	149 to 165	149, 157, 165	6Mbps
Radiated Emissions (Below 1GHz)	802.11a	5745-5825	OFDM	149 to 165	149	6Mbps
AC Power Line Conducted Emission	802.11a	5745-5825	OFDM	149 to 165	149	6Mbps
Antenna Port Conducted Measurement	802.11a	5180-5240	OFDM	36 to 48	36, 44, 48	6Mbps
	802.11n20		OFDM	36 to 48	36, 44, 48	MCS 0
	802.11a	5745-5825	OFDM	149 to 165	149, 157, 165	6Mbps
	802.11n20		OFDM	149 to 165	149, 157, 165	MCS 0

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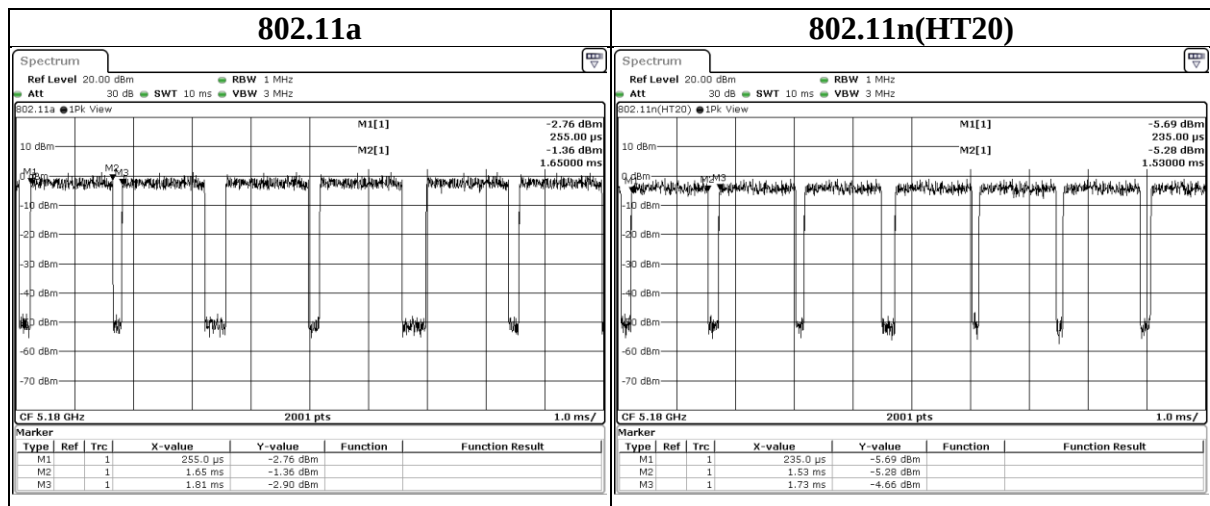
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6.6. Duty cycle

Mode	On Time (ms)	On+Off Time (ms)	Duty Cycle	Duty Factor (dB)	VBW Set (above 1GHz)
802.11a	1.395	1.555	0.8971	0.47	1kHz
802.11n(HT20)	1.295	1.495	0.8662	0.62	1kHz



7. Test Equipment

Test Equipment List					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Expired date
Radiated Spurious Emission					
Spectrum Analyzer	Keysight	N9010A	MY56070827	2024/3/29	2025/3/28
EMI Test Receiver	Rohde & Schwarz	ESR7	101754	2023/11/22	2024/11/21
Loop Antenna	ETS lindgren	6502	00213440	2023/12/13	2024/12/12
Trilog-Broadband Antenna with 5dB Attenuator	Schwarzbeck & EMCI	VULB 9168 & N-6-05	774 & AT-N0538	2024/1/5	2025/1/4
Horn Antenna (1-18 GHz)	Schwarzbeck	BBHA 9120 D	01690	2023/12/8	2024/12/7
Horn Antenna (18-40 GHz)	Schwarzbeck	BBHA 9170	781	2023/12/27	2024/12/26
Preamplifier (30-1000 MHz)	EMCI	EMC330E	980405	2024/5/28	2025/5/27
Preamplifier (1-18 GHz)	EMCI	EMC051835BE	980406	2024/1/23	2025/1/22
Preamplifier (18-40GHz)	EMCI	EMC184040SEE	980426	2024/4/16	2025/4/15
Cables (9k-18 GHz)	Hanyitek	K1K50-UP0264-K1K50-2500	170214-4 & 170425-2	2023/11/29	2024/11/28
Cables (18-40GHz)	Hanyitek	K1K50-UP0264-K1K50-2500	170214-1 & 170214-2	2023/11/29	2024/11/28

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Test Equipment List					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Expired date
Antenna Port Conducted Measurement					
Signal Analyzer	Rohde & Schwarz	FSVA3044	101281	2024/3/18	2025/3/17
Signal Analyzer	Rohde & Schwarz	FSV40	101490	2023/9/13	2024/9/12
Attenuator	EMCI	EMC-40ATK2W10	17002	2023/11/15	2024/11/14
USB Power Sensor	Anritsu	MA24408A	12031	2023/7/12	2024/7/11
Temperature & Humidity Test Chamber	GIANT FORCE	GTH-150- 40-CP-AR	MAA1701-010	2024/3/6	2025/3/5
AC power Line Conducted Emission					
EMI Test Receiver	Rohde & Schwarz	ESR7	101753	2023/10/23	2024/10/22
Two-Line V-Network	Rohde & Schwarz	ENV216	102136	2024/5/14	2025/5/13
Impuls-Begrenzer Pulse Limiter	Rohde & Schwarz	ESH3-Z2	102219-Qt	2023/9/7	2024/9/6
Cables	TITAN	CFD200	T0732ACFD 20020A300-2	2024/5/14	2025/5/13

UL Software		
Description	Name	Version
Radiated measurement	e3	6.191211 (V6)
Conducted measurement	RF-Conducted-FCC 15407	ver 1.1
AC power Line Conducted Emission	EZ EMC	UL-3A1.2

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8. Description of Test Setup

Support Equipment

ID	Equipment	Brand Name	Model Name	S/N	Remark
A	Laptop	Lenovo	T430	PB-8XTP2	Provided by LAB
B	USB OTG Plug Adapter	UGREEN	US157	N/A	Provided by LAB

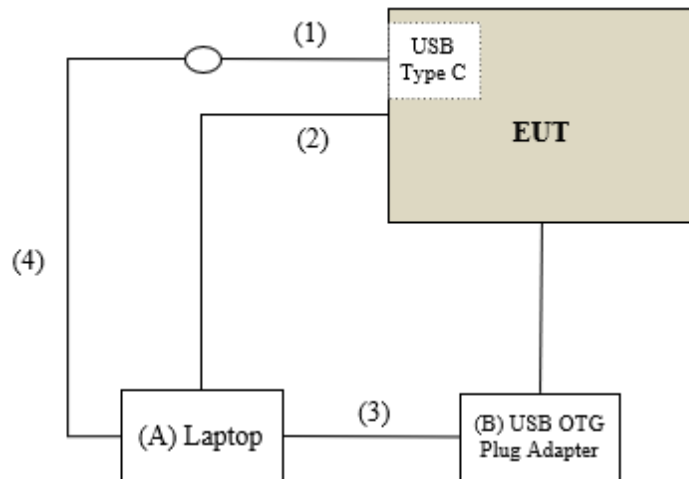
I/O Cables

ID	Equipment	Brand Name	Model Name	Length (m)	Remark
1	Type C cable	PX	F1743G	0.17	Provided by Client
2	USB RF Console Cable	PX	USB A to B 4 芯	0.2	Provided by Client
3	USB Standard Type A Male to Female Cable	I - wiz	US-44	1	Provided by LAB
4	USB Standard Type A Male to Female Cable	I - wiz	US-44	1	Provided by LAB

Test Setup

Controlled using a bespoke application (RTL8723FU MP Version 0.0001.1020.2018) on a test Notebook. The application was used to enable a continuous transmission mode and to select the test channels, data rates, modulation schemes and power setting as required.

Setup Diagram for Test



Under Table

Remote Site

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9. Test Results

9.1. 6dB Bandwidth

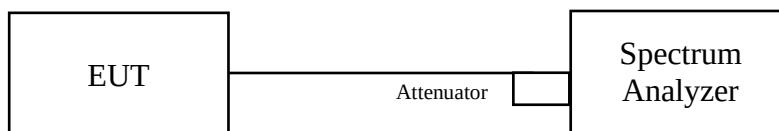
Requirements

The minimum 6 dB bandwidth shall be at least 500 kHz.

Test procedure

- 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.
- The plot of the test result only shows the worst case of channels as a representative.

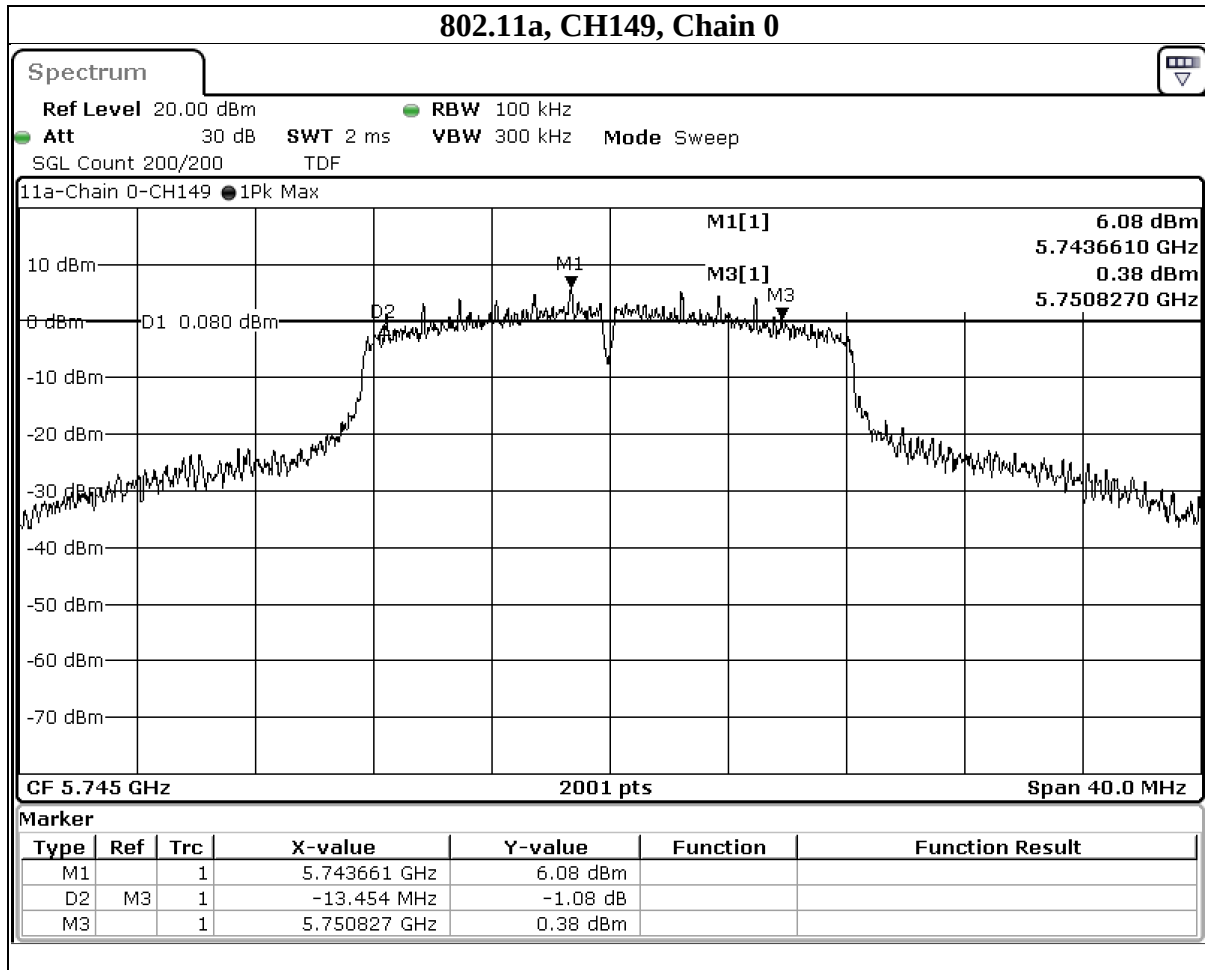
Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

Test Data

Mode	CH	Freq (MHz)	6dB BW (MHz)	Limit (MHz)	Result
			Chain 0		
802.11a	149	5745	13.454	0.5	PASS
	157	5785	15.104	0.5	PASS
	165	5825	13.839	0.5	PASS



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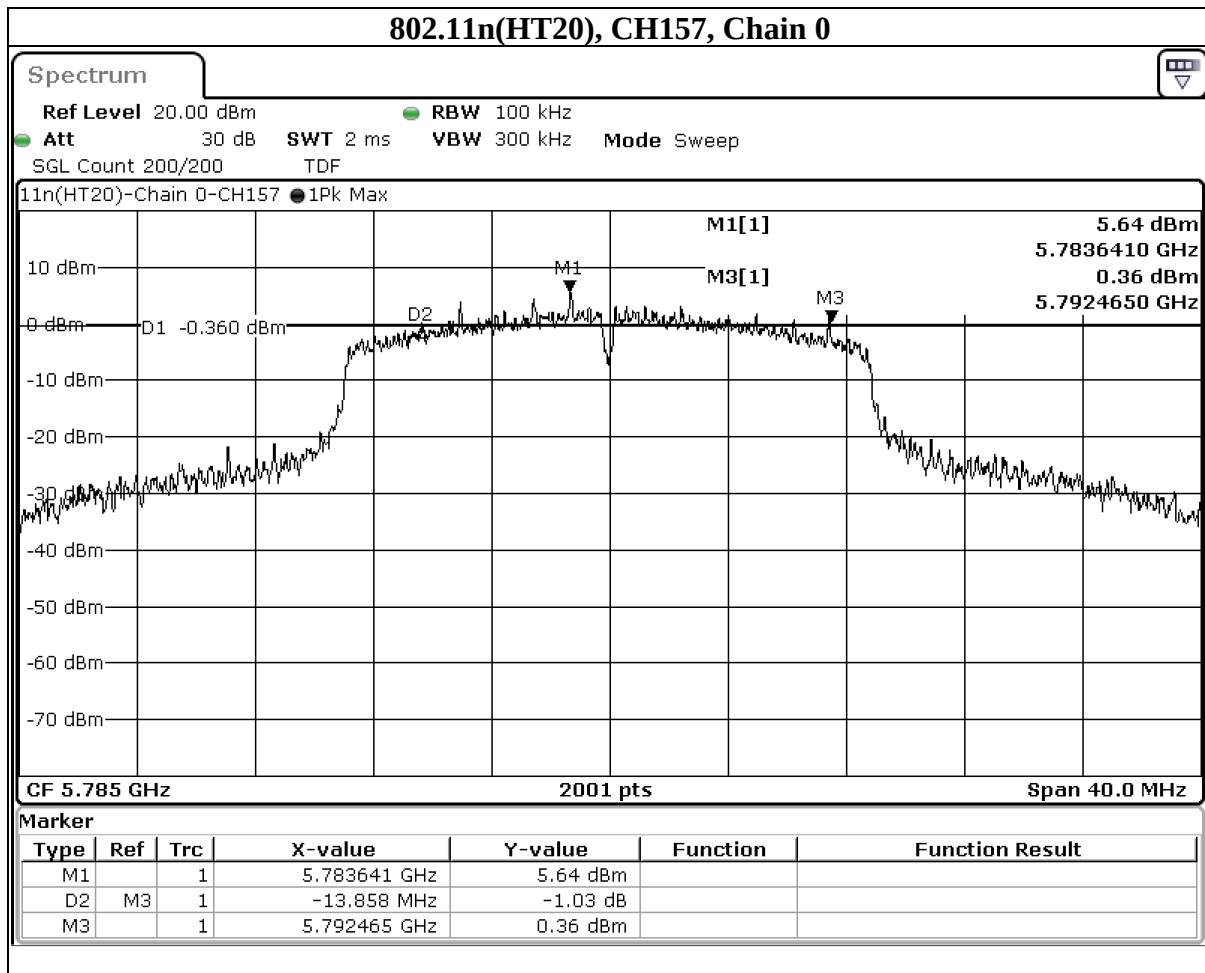
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Mode	CH	Freq (MHz)	6dB BW (MHz)	Limit (MHz)	Result
			Chain 0		
802.11n(HT20)	149	5745	13.863	0.5	PASS
	157	5785	13.858	0.5	PASS
	165	5825	15.104	0.5	PASS

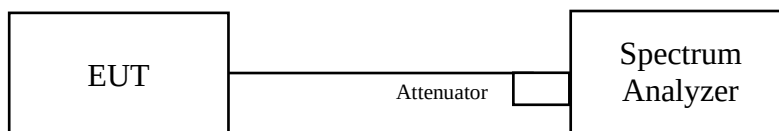


9.2. 26dB Bandwidth

Test procedure

- Set RBW = approximately 1% of the emission bandwidth.
- Set the VBW > RBW.
- Detector = Peak.
- Trace mode = max hold.
- Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.
- The plot of the test result only shows the worst case of channels as a representative.

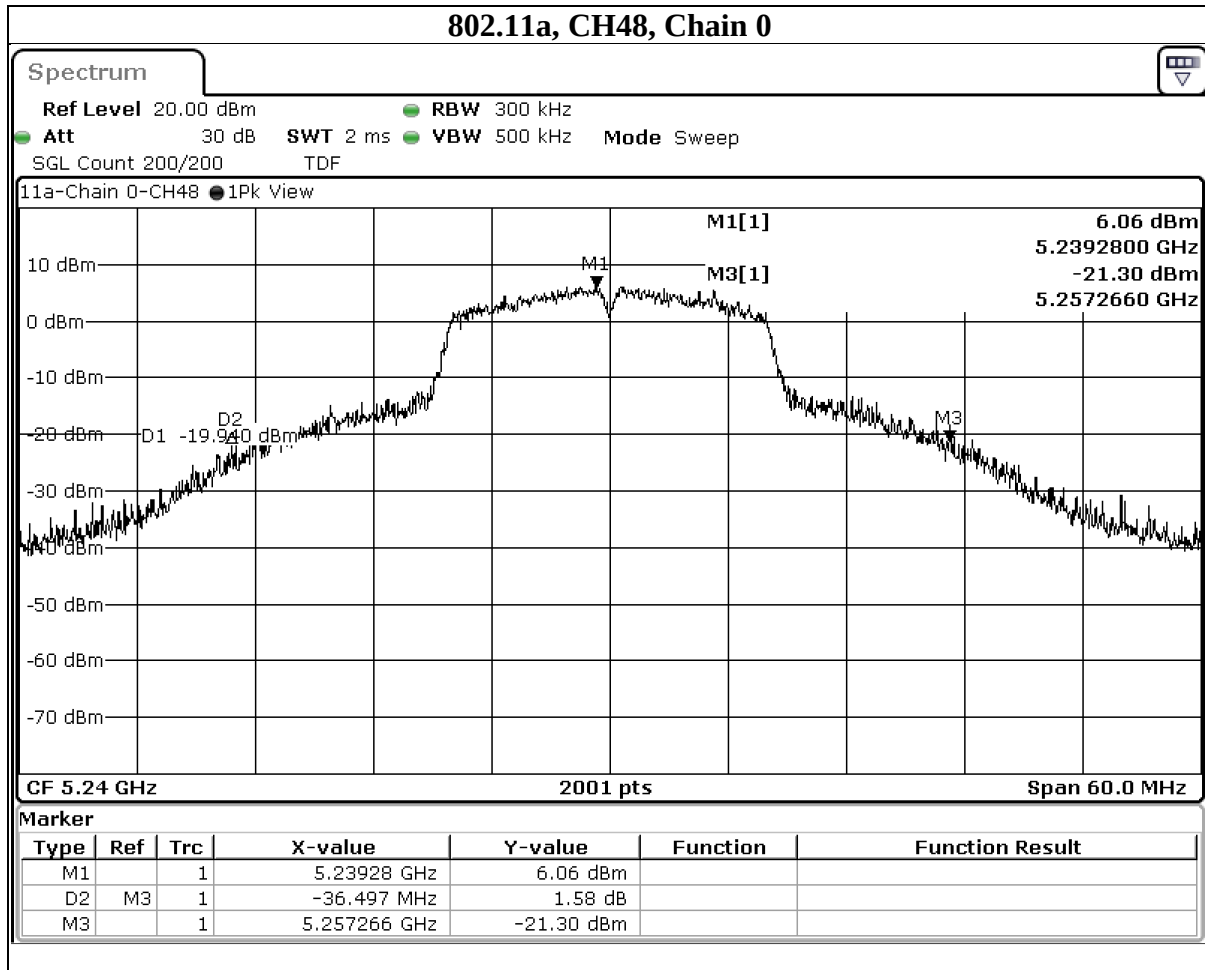
Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

Test Data

Mode	CH	Freq (MHz)	26dB BW (MHz)	Limit (MHz)	Result
			Chain 0		
802.11a	36	5180	36.304	N/A	PASS
	44	5220	33.825	N/A	PASS
	48	5240	36.497	N/A	PASS



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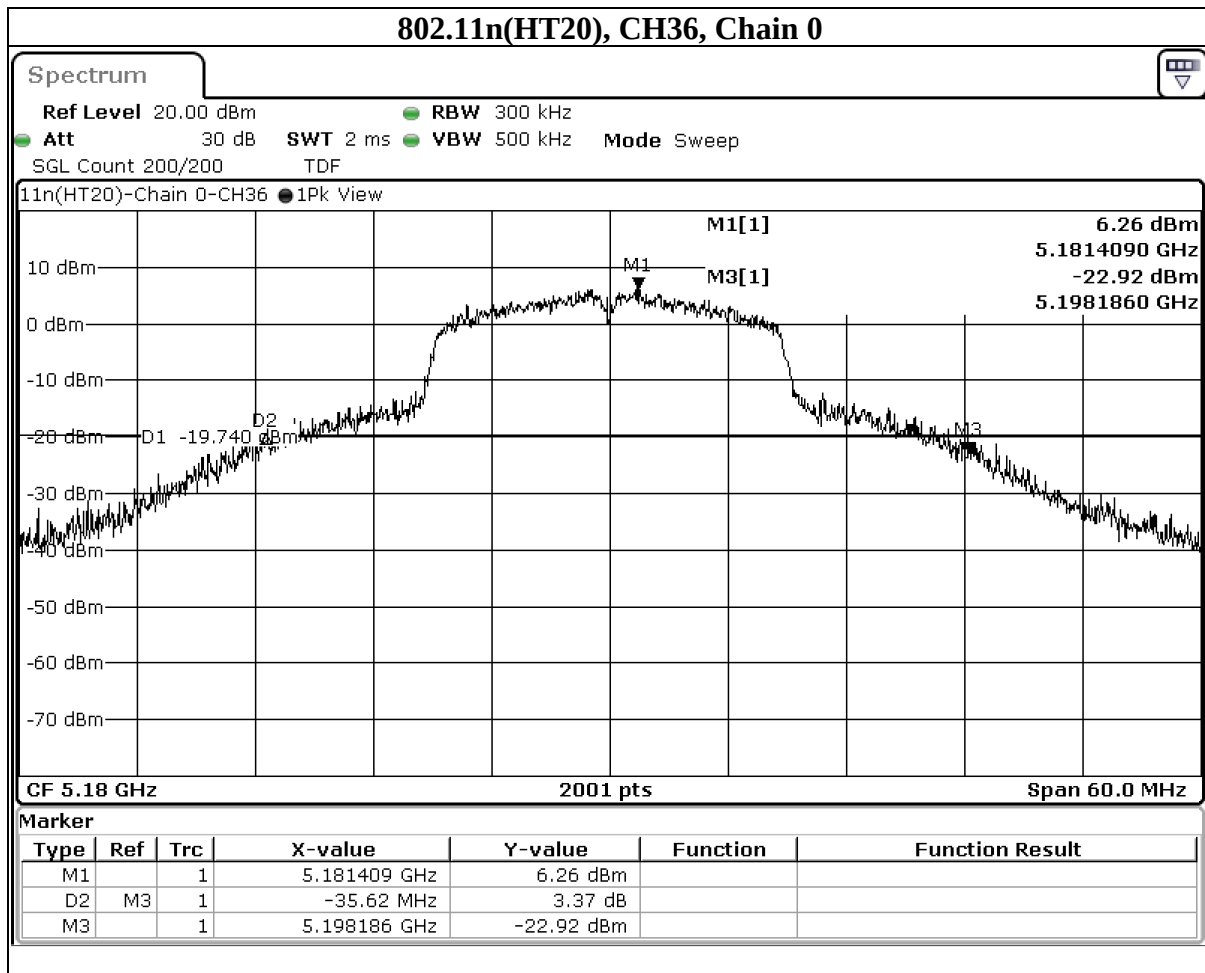
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Mode	CH	Freq (MHz)	26dB BW (MHz)	Limit (MHz)	Result
			Chain 0		
802.11n(HT20)	36	5180	35.62	N/A	PASS
	44	5220	35.474	N/A	PASS
	48	5240	34.744	N/A	PASS

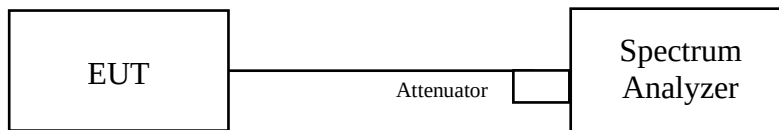


9.3. Occupied Bandwidth

Test procedure

- Set center frequency to the nominal EUT channel center frequency.
- Set span = 1.5 times to 5.0 times the OBW.
- Set RBW = 1% to 5% of the OBW
- Set VBW $\geq 3 \times$ RBW
- Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
- Use the 99% power bandwidth function of the instrument (if available).
- If the instrument does not have a 99% power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.
- The plot of the test result only shows the worst case of channels as a representative.

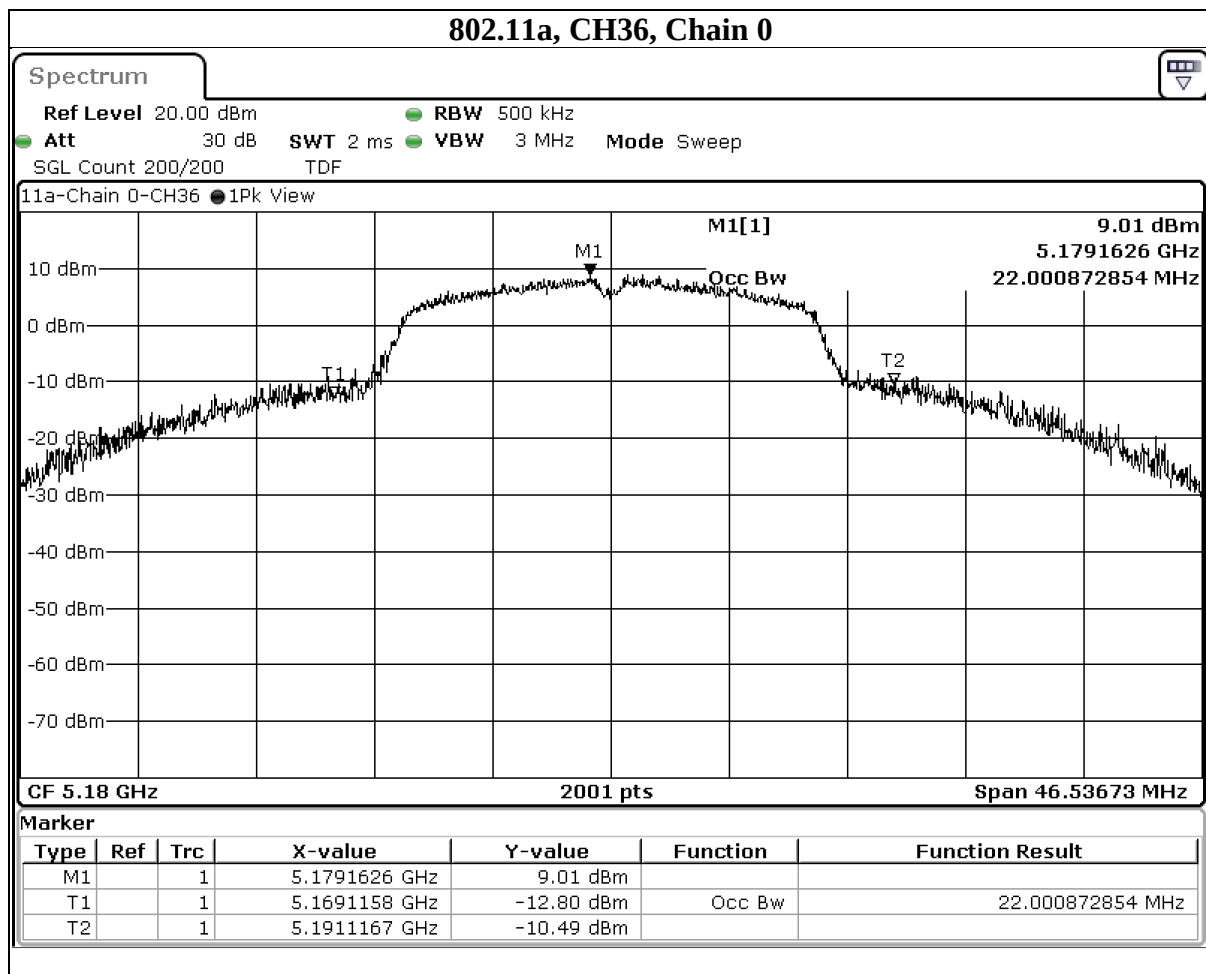
Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

Test Data

Mode	CH	Freq (MHz)	OBW (MHz)	Limit (MHz)	Result
			Chain 0		
802.11a	36	5180	22.001	N/A	PASS
	44	5220	20.167	N/A	PASS
	48	5240	19.062	N/A	PASS
	149	5745	17.036	N/A	PASS
	157	5785	16.954	N/A	PASS
	165	5825	17.257	N/A	PASS



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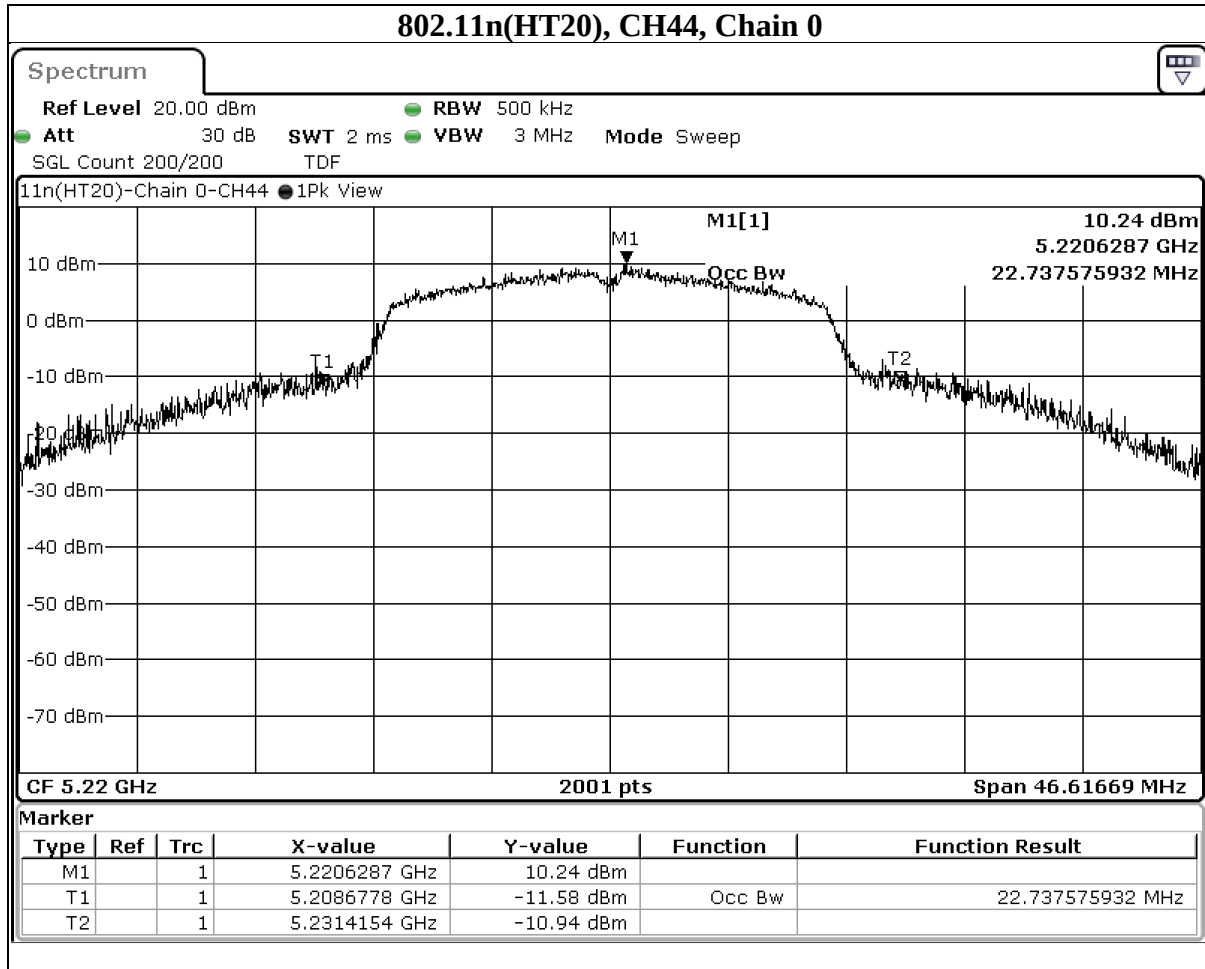
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Mode	CH	Freq (MHz)	OBW (MHz)	Limit (MHz)	Result
			Chain 0		
802.11n(HT20)	36	5180	19.663	N/A	PASS
	44	5220	22.738	N/A	PASS
	48	5240	19.485	N/A	PASS
	149	5745	17.963	N/A	PASS
	157	5785	17.998	N/A	PASS
	165	5825	18.15	N/A	PASS



9.4. Conducted output power

Requirements

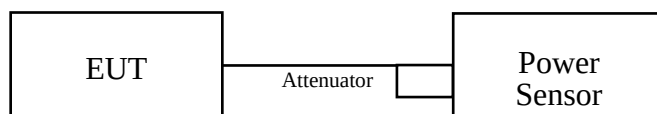
Operation Band	EUT Category		Limit
U-NII-1		Outdoor Access Point	1 Watt (30 dBm) Max. e.i.r.p $\leq 125\text{mW}$ (21 dBm) at any elevation angle above 30 degrees as measured from the horizon If $G_{\text{TX}} > 6 \text{ dBi}$, then $P_{\text{Out}} = 30 - (G_{\text{TX}} - 6)$
		Fixed point-to-point Access Point	1 Watt (30 dBm) If $G_{\text{TX}} > 23 \text{ dBi}$, then $P_{\text{Out}} = 30 - (G_{\text{TX}} - 23)$
	√	Indoor Access Point	1 Watt (30 dBm) If $G_{\text{TX}} > 6 \text{ dBi}$, then $P_{\text{Out}} = 30 - (G_{\text{TX}} - 6)$
		Client device	250mW (24 dBm) If $G_{\text{TX}} > 6 \text{ dBi}$, then $P_{\text{Out}} = 23.98 - (G_{\text{TX}} - 6)$
U-NII-2A	---		250mW (24 dBm) or 11 dBm+10 log B* If $G_{\text{TX}} > 6 \text{ dBi}$, then $P_{\text{Out}} = 23.98 - (G_{\text{TX}} - 6)$
U-NII-2C	---		250mW (24 dBm) or 11 dBm+10 log B* If $G_{\text{TX}} > 6 \text{ dBi}$, then $P_{\text{Out}} = 23.98 - (G_{\text{TX}} - 6)$
U-NII-3	---		For Point-to-multipoint systems (P2M): 1 Watt (30 dBm). If $G_{\text{TX}} > 6 \text{ dBi}$, then $P_{\text{Out}} = 30 - (G_{\text{TX}} - 6)$ For Point-to-point systems (P2P): 1 Watt (30 dBm)
U-NII-4	√	Indoor Access Point	Maximum e.i.r.p. 4 W
		Subordinate Device	Maximum e.i.r.p. 4 W
		Client Device	Maximum e.i.r.p. 1 W

Note:

1. P_{Out} = maximum conducted output power in dBm, G_{TX} = the maximum transmitting antenna directional gain in dBi, B is the 26 dB emission bandwidth in megahertz
2. If EUT with Multiple Transmitter Output:
 - a. Directional Gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{Gn/20})^2 / N_{\text{ant}}]$ dBi.
Nant: Number of Transmit Antennas
G1, G2,..., Gn: Gain of Individual Antennas
Example: two antenna and gain 5 dBi / 3dBi, so if it was used for TxBF power measurement
Directional Gain = $10 \log[(105/20 + 103/20)^2 / 2]$ dBi = 7.07 dBi
 - b. Per KDB 662911 Method of conducted output power measurement on IEEE 802.11 devices, CDD
Array Gain = 0 dB (i.e., no array gain) for $N_{\text{ANT}} \leq 4$;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT} ;
Array Gain = $5 \log(N_{\text{ANT}}/N_{\text{SS}})$ dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{\text{ANT}} \geq 5$.
Example: Maximum antenna gain = 5 dBi and $N_{\text{ANT}} \leq 4$, so if it was used for CDD power measurement
Directional Gain = 5 dBi + Array Gain = 5 dBi + 0 dB = 5 dBi
 - c. For power measurement of KDB 662911 is used with multiple transmitter output. Total conducted power is the sum of the conducted power levels measured at the various output ports.

Test Procedure**For Average Power Measurement****Test method PM**

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 and set the detector to AVERAGE. Duty factor is not added to measured value.

Test Setup**For Average Power Measurement**

The loss between RF output port of the EUT and the input port of the Power Meter has been taken into consideration.

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Test Data

802.11a

Channel	Channel Frequency (MHz)	Maximum Conducted Power (mW)	Maximum Conducted Power (dBm)	Power Limit (dBm)	Pass/Fail
36	5180	41.21	16.15	30	PASS
44	5220	45.604	16.59	30	PASS
48	5240	44.463	16.48	30	PASS
149	5745	61.802	17.91	30	PASS
157	5785	58.884	17.70	30	PASS
165	5825	58.076	17.64	30	PASS

802.11n (HT20)

Channel	Channel Frequency (MHz)	Maximum Conducted Power (mW)	Maximum Conducted Power (dBm)	Power Limit (dBm)	Pass/Fail
36	5180	38.548	15.86	30	PASS
44	5220	43.752	16.41	30	PASS
48	5240	44.157	16.45	30	PASS
149	5745	60.395	17.81	30	PASS
157	5785	58.479	17.67	30	PASS
165	5825	56.494	17.52	30	PASS

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9.5. Power Spectral Density

Requirements

Operation Band	EUT Category		Limit
U-NII-1		Outdoor Access Point	17dBm/ MHz If $G_{TX} > 6$ dBi, then $PSD = 17 - (G_{TX} - 6)$
		Fixed point-to-point Access Point	17dBm/ MHz If $G_{TX} > 23$ dBi, then $PSD = 17 - (G_{TX} - 23)$
	√	Indoor Access Point	17dBm/ MHz If $G_{TX} > 6$ dBi, then $PSD = 17 - (G_{TX} - 6)$
		Client device	11dBm/ MHz If $G_{TX} > 6$ dBi, then $PSD = 11 - (G_{TX} - 6)$
U-NII-2A	---		11dBm/ MHz If $G_{TX} > 6$ dBi, then $PSD = 11 - (G_{TX} - 6)$
U-NII-2C	---		11dBm/ MHz If $G_{TX} > 6$ dBi, then $PSD = 11 - (G_{TX} - 6)$
U-NII-3	---		For Point-to-multipoint systems (P2M): 30dBm/ 500kHz. If $G_{TX} > 6$ dBi, then $PSD = 30 - (G_{TX} - 6)$ For Point-to-point systems (P2P): 30dBm/ 500kHz
U-NII-4	√	Indoor Access Point	Maximum e.i.r.p. PSD 20 dBm/MHz
		Subordinate Device	Maximum e.i.r.p. PSD 20 dBm/MHz
		Client Device	Maximum e.i.r.p. PSD 14 dBm/MHz

Note:

1. PSD = power spectral density that the same method as used to determine the conducted output power shall be used to determine the power spectral density. And power spectral density in dBm/MHz
2. G_{TX} = the maximum transmitting antenna directional gain in dBi.
3. If EUT with Multiple Transmitter Output:
 - a. Directional Gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{Gn/20})^2 / Nant]$ dBi.
Nant: Number of Transmit Antennas
G1, G2,..., Gn: Gain of Individual Antennas
Example: two antenna and gain 5 dBi / 3dBi, so if it was used for power density measurement
Directional Gain = $10 \log[(10^{5/20} + 10^{3/20})^2 / 2]$ dBi = 7.07 dBi
 - b. "PSD per chain" of the report shown is maximum value for each chain, at the "Total PSD" is summing entire spectra across corresponding frequency bins on the various outputs by computer, refer KDB 662911 Method a) for calculating total power density.
 - c. Method a) of power density measurement of KDB 662911 is used for calculating total power density with multiple transmitter output. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
4. Refer to section 6.6 for duty cycle spectrum plot. (If duty cycle<98%)

Test procedure

For U-NII-1 band:

Using method as below:

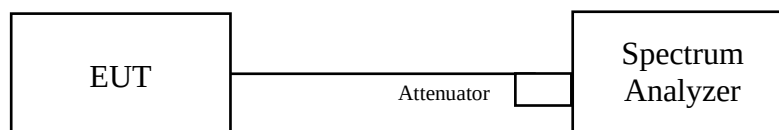
- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- Set RBW = 1 MHz, Set VBW $\geq$ 3 RBW, Detector = RMS
- Sweep time = auto, trigger set to “free run”.
- Trace average at least 100 traces in power averaging mode.
- Record the max value. (if Duty cycle $< 98\%$, add $10 \log (1/\text{duty cycle})$)
- The plot of the test result only shows the worst case of channels as a representative.

For U-NII-3 band:

Using method as below:

- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- Set RBW = 300 kHz, Set VBW $\geq$ 1 MHz, Detector = RMS
- Use the peak marker function to determine the maximum power level in any 300 kHz band segment within the fundamental EBW.
- 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 $\text{BWCF} = 10 \log (500 \text{ kHz}/300 \text{ kHz})$
- Sweep time = auto, trigger set to “free run”.
- Trace average at least 100 traces in power averaging mode.
- Record the max value. (if Duty cycle $< 98\%$, add $10 \log (1/\text{duty cycle})$)
- The plot of the test result only shows the worst case of channels as a representative.

Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

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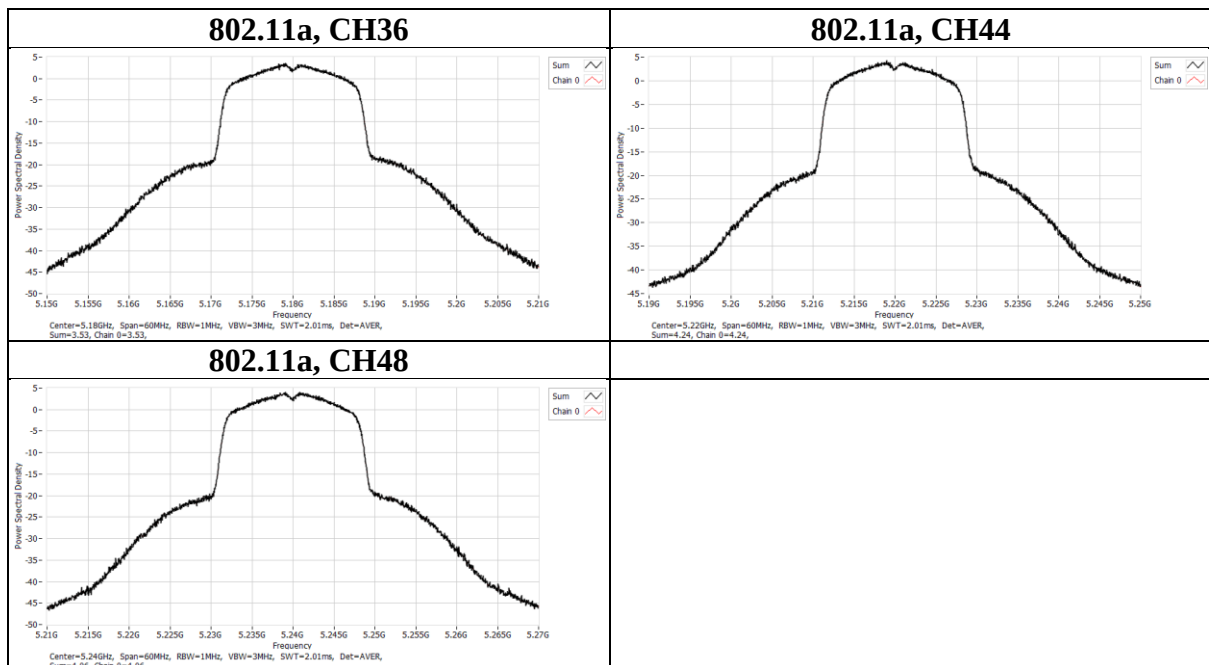
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Test Data

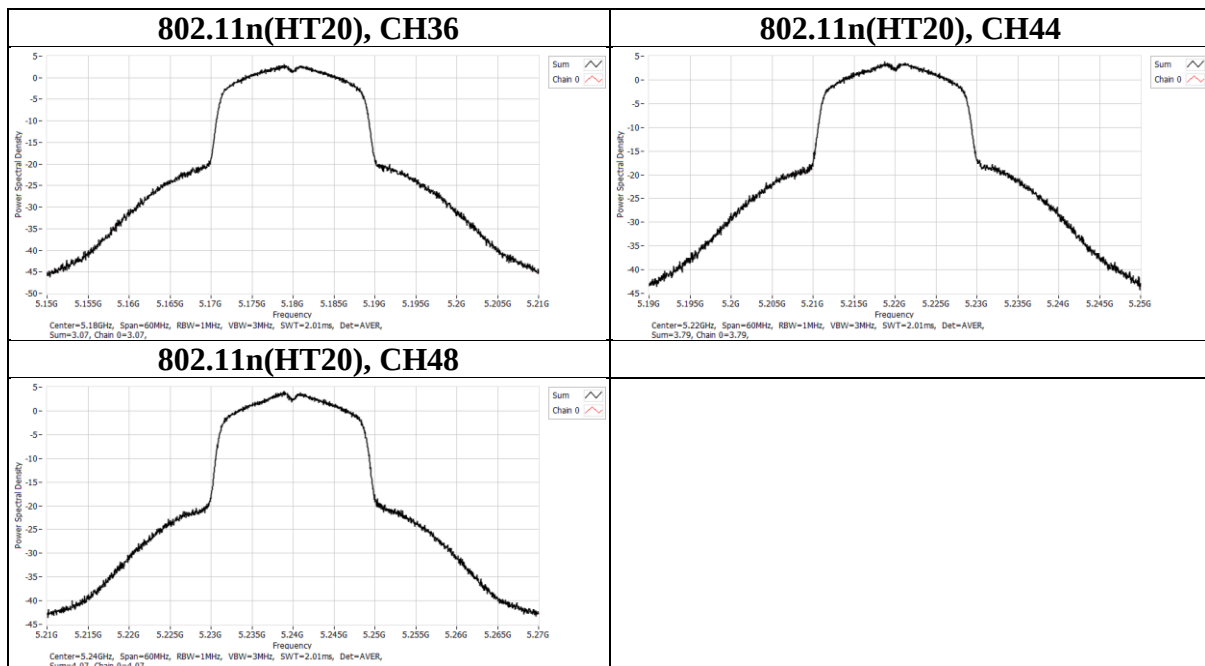
Mode (U-NII-1)	CH	Freq (MHz)	Directional Gain (dBi)	Total PSD (dBm/MHz)	Limit (dBm/MHz)	Result
802.11a	36	5180	1.76	3.53	17	PASS
	44	5220	1.76	4.24	17	PASS
	48	5240	1.76	4.06	17	PASS

Mode (U-NII-1)	CH	Freq (MHz)	PSD per Chain (dBm/MHz)
			Chain 0
802.11a	36	5180	3.53
	44	5220	4.24
	48	5240	4.06



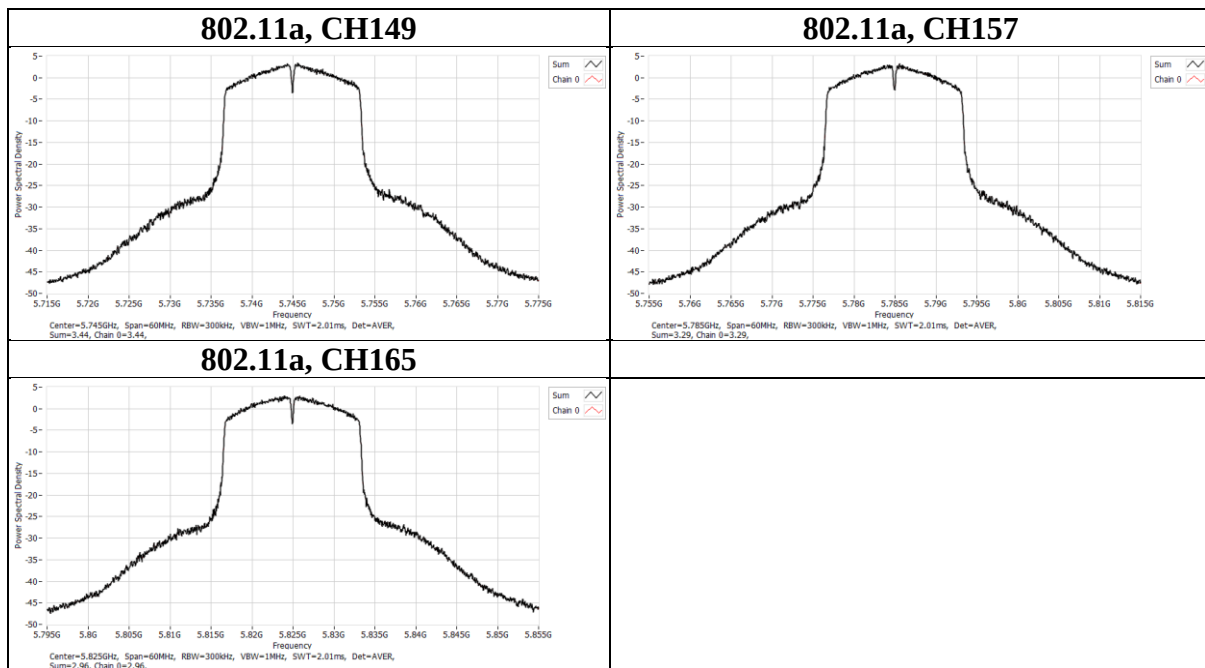
Mode (U-NII-1)	CH	Freq (MHz)	Directional Gain (dBi)	Total PSD (dBm/MHz)	Limit (dBm/MHz)	Result
802.11n(HT20)	36	5180	1.76	3.07	17	PASS
	44	5220	1.76	3.79	17	PASS
	48	5240	1.76	4.07	17	PASS

Mode (U-NII-1)	CH	Freq (MHz)	PSD per Chain (dBm/MHz)
			Chain 0
802.11n(HT20)	36	5180	3.07
	44	5220	3.79
	48	5240	4.07



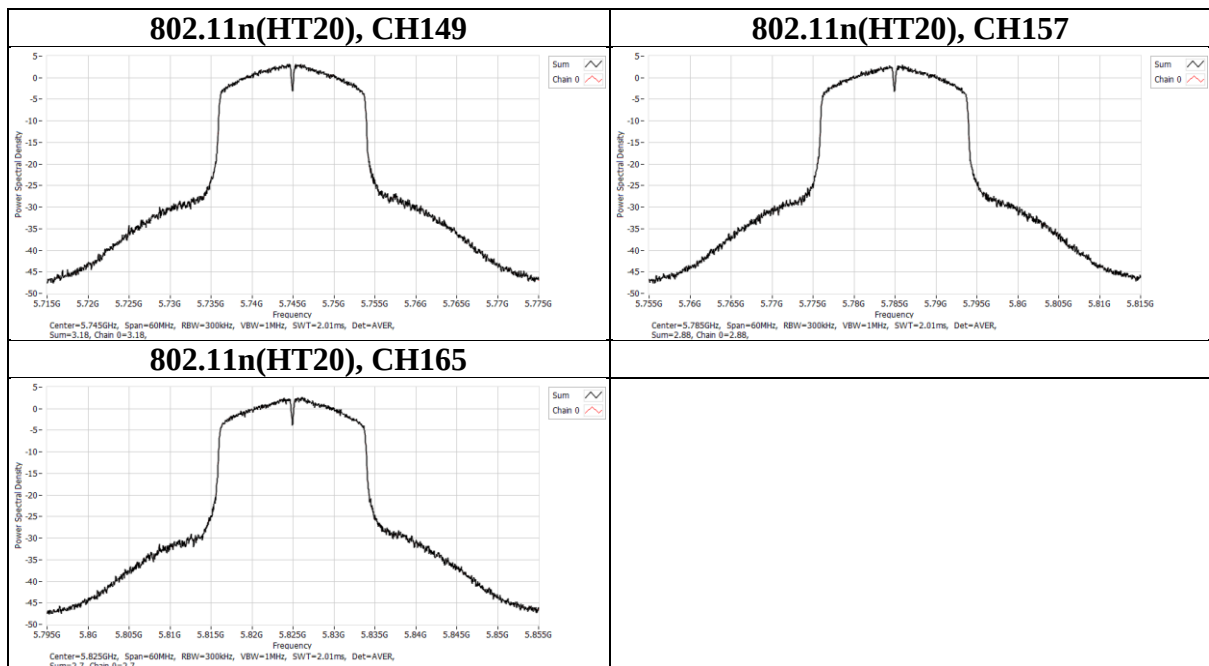
Mode (U-NII-3)	CH	Freq (MHz)	BWCF	Directional Gain (dBi)	Total PSD (dBm/500kHz)	Limit (dBm/500kHz)	Result
802.11a	149	5745	2.22	2.03	5.66	30	PASS
	157	5785	2.22	2.03	5.51	30	PASS
	165	5825	2.22	2.03	5.18	30	PASS

Mode (U-NII-3)	CH	Freq (MHz)	PSD per Chain (dBm/500kHz)
			Chain 0
802.11a	149	5745	3.44
	157	5785	3.29
	165	5825	2.96



Mode (U-NII-3)	CH	Freq (MHz)	BWCF	Directional Gain (dBi)	Total PSD (dBm/500kHz)	Limit (dBm/500kHz)	Result
802.11n(HT20)	149	5745	2.22	2.03	5.4	30	PASS
	157	5785	2.22	2.03	5.1	30	PASS
	165	5825	2.22	2.03	4.92	30	PASS

Mode (U-NII-3)	CH	Freq (MHz)	PSD per Chain (dBm/500kHz)
			Chain 0
802.11n(HT20)	149	5745	3.18
	157	5785	2.88
	165	5825	2.7



9.6. Frequency Stability

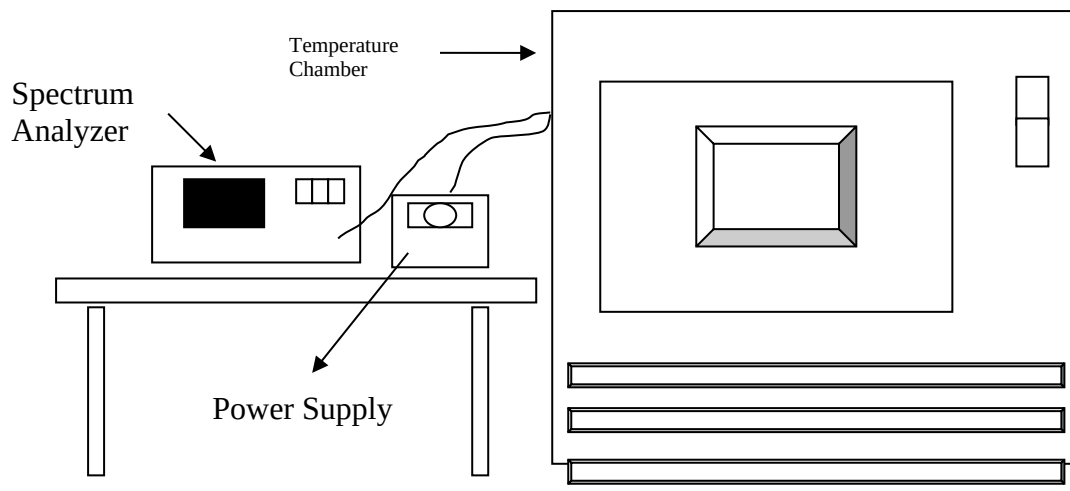
Requirements

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

Test procedure

- The EUT was placed inside the environmental test chamber and powered by nominal 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 2 and 3 with the temperature chamber set to the lowest temperature.
- 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.

Test Setup



Test Data

Frequency Stability Versus Temp.									
Operating Frequency: 5180 MHz									
TEMP. (°C)	Power Supply (Vdc)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)
50	5	5180.0144	2.78	5180.0123	2.37	5180.011	2.12	5180.0107	2.07
40	5	5180.0167	3.22	5180.0194	3.75	5180.0164	3.17	5180.0164	3.17
30	5	5180.018	3.47	5180.0164	3.17	5180.0192	3.71	5180.0187	3.61
20	5	5180.0198	3.82	5180.0226	4.36	5180.0189	3.65	5180.0199	3.84
10	5	5179.9987	-0.25	5179.9971	-0.56	5179.9969	-0.60	5179.9965	-0.68
0	5	5180.024	4.63	5180.0231	4.46	5180.0268	5.17	5180.0238	4.59
-10	5	5180.016	3.09	5180.0153	2.95	5180.0168	3.24	5180.0164	3.17
-20	5	5179.9885	-2.22	5179.9889	-2.14	5179.9886	-2.20	5179.9906	-1.81
-30	5	5180.0147	2.84	5180.0138	2.66	5180.0112	2.16	5180.0138	2.66
TEMP. (°C)	Power Supply (Vdc)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)
20	5.75	5180.0198	3.82	5180.0227	4.38	5180.0186	3.59	5180.0202	3.90
20	4.25	5180.0191	3.69	5180.0219	4.23	5180.0185	3.57	5180.0189	3.65

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9.7. Radiated Spurious Emission

Requirements

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table.

Frequency(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.

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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}
	^{*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.		
5850~5895 MHz	RSS-247 clause 6.2.5.3	5725 MHz and below: PK:27 (dBm/MHz) ^{*1} PK:15.6 (dBm/MHz) ^{*2} PK:10 (dBm/MHz) ^{*3} PK:-27 (dBm/MHz) ^{*4} 5895 MHz and above: AV:-27 (dBm/MHz) ^{*a} AV:15&-7 (dBm/MHz) ^{*b} AV:-5&-27 (dBm/MHz) ^{*c}	5725 MHz and below: PK:122.2 (dBμV/m) ^{*1} PK:110.8 (dBμV/m) ^{*2} PK:105.2 (dBμV/m) ^{*3} PK:68.2 (dBμV/m) ^{*4} 5895 MHz and above: AV: 68.2 (dBμV/m) ^{*a} AV:110.2&88.2 (dBμV/m) ^{*b} AV:90.2&68.2 (dBμV/m) ^{*c}
		^{*1} 5 MHz below the 5725 MHz band edge. ^{*2} 5 MHz below the 5725 MHz band edge decreasing linearly to 10 dBm/MHz at 25 MHz below ^{*3} 25 MHz below the 5725 MHz band edge decreasing linearly to -27 dBm/MHz at 75 MHz below ^{*4} More than 75 MHz below the 5725 MHz band edge. ^{*a} Fixed outdoor access points and fixed outdoor client devices shall not exceed -27 dBm/MHz e.i.r.p. spectral density at or above the 5895 MHz band edge. ^{*b} Indoor access points or indoor subordinate devices shall not exceed 15 dBm/MHz e.i.r.p. spectral density at the 5895 MHz band edge and shall decrease linearly to not exceed -7 dBm/MHz e.i.r.p. spectral density at or above 5925 MHz. ^{*c} Client devices shall not exceed -5 dBm/MHz e.i.r.p. spectral density at the 5895 MHz band edge and shall decrease linearly to not exceed -27 dBm/MHz e.i.r.p. spectral density at or above 5925 MHz.	

Note:

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

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

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Test Procedures

[For 9 kHz ~ 30 MHz]

- 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. For measurement below 30MHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

[For above 30 MHz]

- 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. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
- 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.

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Note:

- a. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
- b. 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.
- c. 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.

Peak

Frequency	RBW	VBW
9 kHz~150 kHz	200 Hz	600 Hz
150 kHz~30 MHz	10 kHz	30 kHz
30 MHz~1 GHz	120 kHz	360 kHz
Above 1GHz	1 MHz	3 MHz

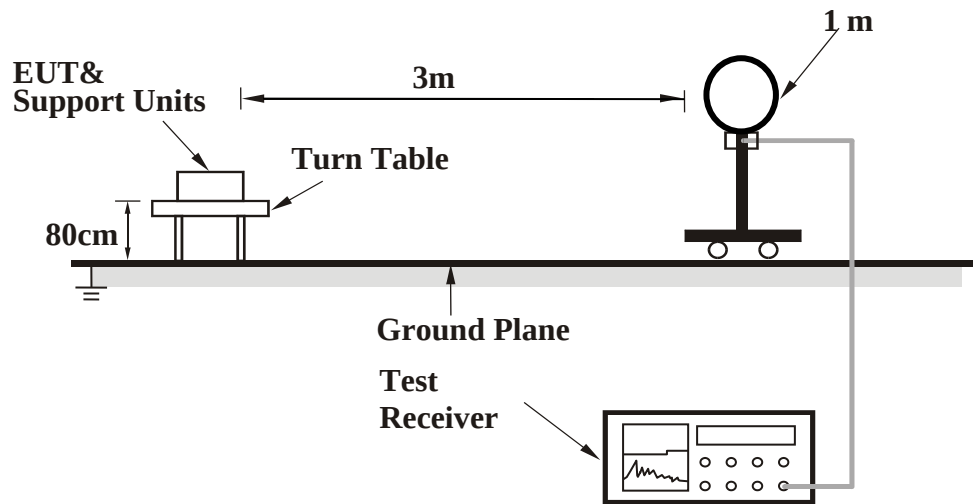
Average for above 1GHz

RBW	VBW
1MHz	Refer to section 6.6 for duty cycle.

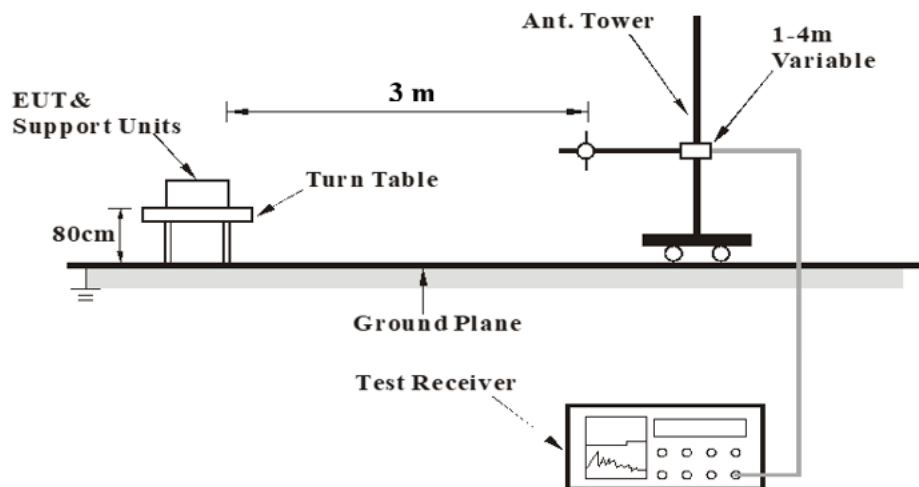
- d. All modes of operation were investigated (includes all external accessories) and the worst-case emissions are reported, the other emission levels were low against the limit.
- e. Test data of Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
- f. Test data of Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
- g. Test data of Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
- h. Test data of Notation "@" = Fundamental Frequency
- i. Test data of Notation "*" = Only required peak limit or the peak result under 20 dB above and complies with AVG limit, AVG result is deemed to comply with AVG limit.

Test Setup

<Frequency Range 9 kHz ~ 30 MHz>



<Frequency Range 30 MHz ~ 1 GHz >

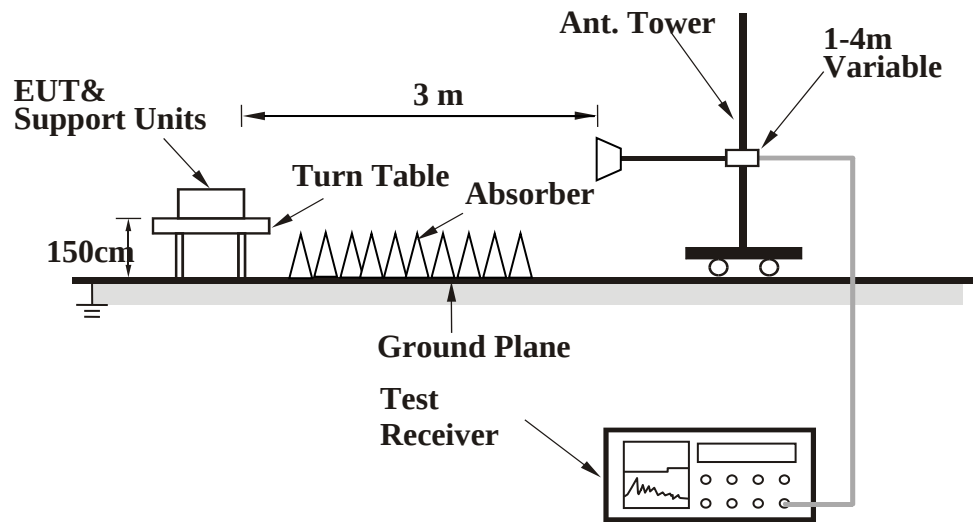


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Doc No: Form-ULID-004739 (DCS:17-EM-F0878) / 6.1

<Frequency Range above 1 GHz>



For the actual test configuration, please refer to the Setup Configurations.

Test Data**Above 1 GHz**

Mode	802.11a	Channel	36
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Polarization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
		(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Horizontal		5066.15	43.19	19.76	62.95	74	-11.05	PK
		5116.55	32.29	20.02	52.31	54	-1.69	AVG
	@	5180	85.36	19.97	105.33	N/A	N/A	PK
	@	5180	76.44	19.97	96.41	N/A	N/A	AVG
	*	10360	34.7	18.22	52.92	68.2	-15.28	PK
Vertical		5148.75	33.61	20.06	53.67	54	-0.33	AVG
		5149.1	47.87	20.06	67.93	74	-6.07	PK
	@	5180	94.94	19.97	114.91	N/A	N/A	PK
	@	5180	84.99	19.97	104.96	N/A	N/A	AVG
	*	10360	39.23	18.22	57.45	68.2	-10.75	PK

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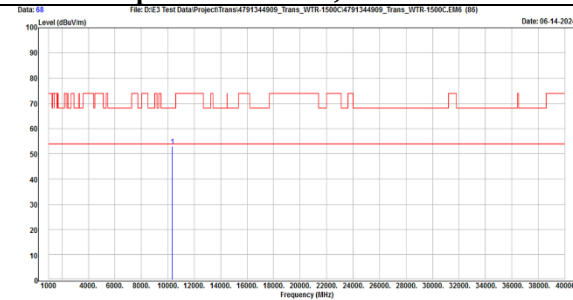
Building A, B and E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

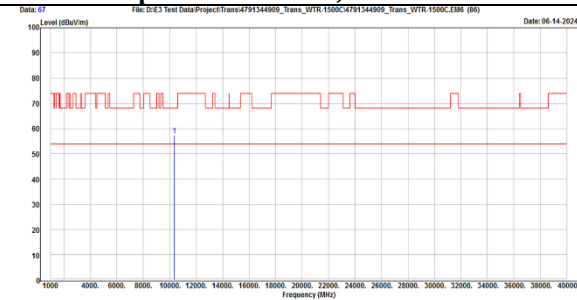
Facsimile (FAX) : +886-3-583-7948

Doc No: Form-ULID-004739 (DCS:17-EM-F0878) / 6.1

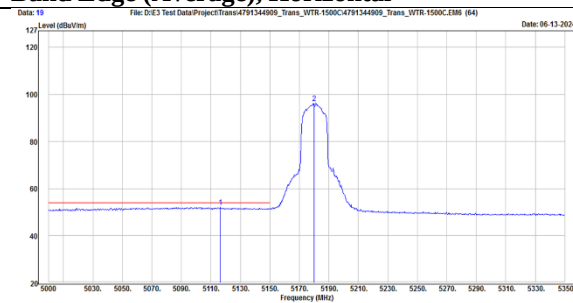
TX, 802.11a (Ch 36)
Radiated Spurious Emission, Horizontal



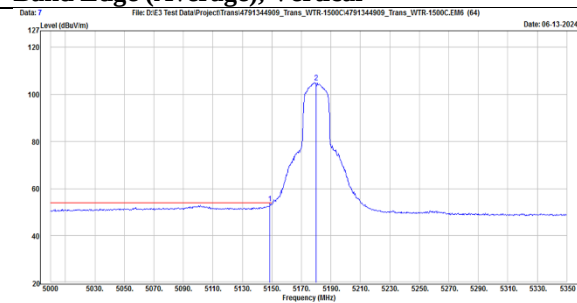
TX, 802.11a (Ch 36)
Radiated Spurious Emission, Vertical



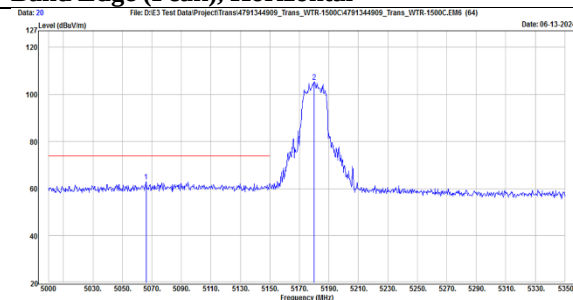
TX, 802.11a (Ch 36)
Band Edge (Average), Horizontal



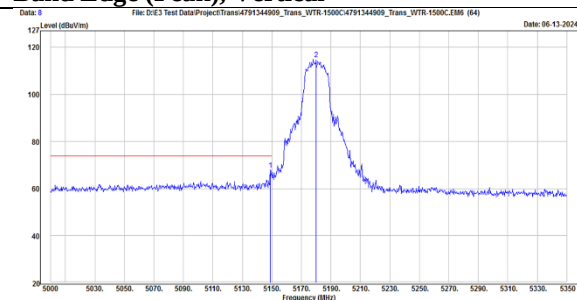
TX, 802.11a (Ch 36)
Band Edge (Average), Vertical



TX, 802.11a (Ch 36)
Band Edge (Peak), Horizontal



TX, 802.11a (Ch 36)
Band Edge (Peak), Vertical



Mode	802.11a	Channel	44
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Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal		5096.95	43.5	19.98	63.48	74	-10.52	PK
		5130.2	31.92	20.04	51.96	54	-2.04	AVG
	@	5220	86.17	19.9	106.07	N/A	N/A	PK
	@	5220	76.66	19.9	96.56	N/A	N/A	AVG
	*	10440	36.2	18.52	54.72	68.2	-13.48	PK
Vertical		5139.3	43.13	20.04	63.17	74	-10.83	PK
		5139.65	32.93	20.04	52.97	54	-1.03	AVG
	@	5220	95.12	19.9	115.02	N/A	N/A	PK
	@	5220	85.01	19.9	104.91	N/A	N/A	AVG
	*	10440	39.84	18.52	58.36	68.2	-9.84	PK

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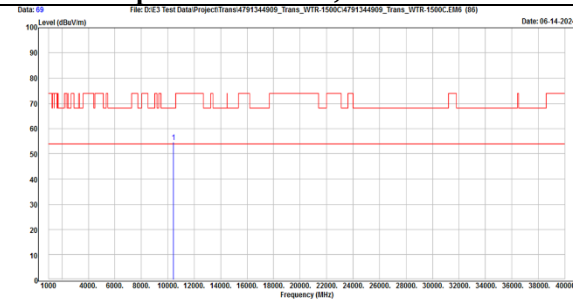
Building A, B and E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

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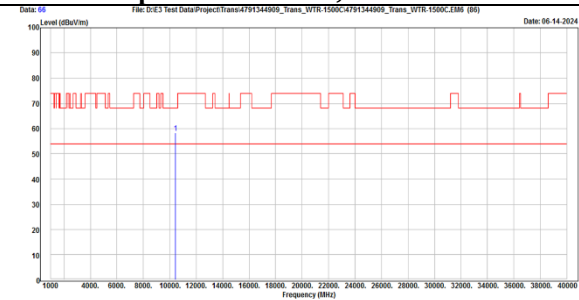
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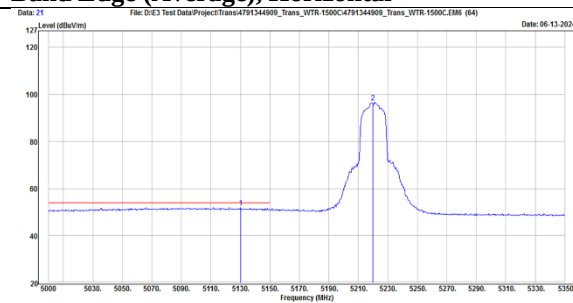
TX, 802.11a (Ch 44)
Radiated Spurious Emission, Horizontal



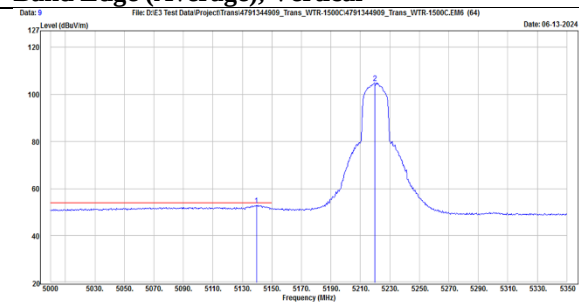
TX, 802.11a (Ch 44)
Radiated Spurious Emission, Vertical



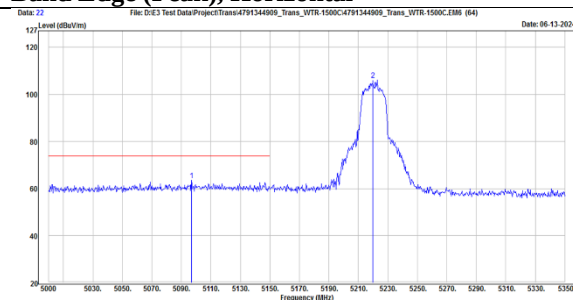
TX, 802.11a (Ch 44)
Band Edge (Average), Horizontal



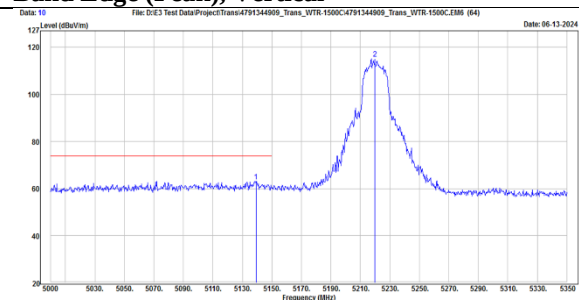
TX, 802.11a (Ch 44)
Band Edge (Average), Vertical



TX, 802.11a (Ch 44)
Band Edge (Peak), Horizontal



TX, 802.11a (Ch 44)
Band Edge (Peak), Vertical



Mode	802.11a	Channel	48
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Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal		5094.15	43.47	19.95	63.42	74	-10.58	PK
		5133.7	32.08	20.03	52.11	54	-1.89	AVG
	@	5240	86.16	19.88	106.04	N/A	N/A	PK
	@	5240	76.98	19.88	96.86	N/A	N/A	AVG
	*	10480	38.5	18.66	57.16	68.2	-11.04	PK
Vertical		5087.5	32.23	19.9	52.13	54	-1.87	AVG
		5092.05	42.38	19.94	62.32	74	-11.68	PK
	@	5240	95.21	19.88	115.09	N/A	N/A	PK
	@	5240	84.47	19.88	104.35	N/A	N/A	AVG
	*	10480	41.04	18.66	59.7	68.2	-8.5	PK

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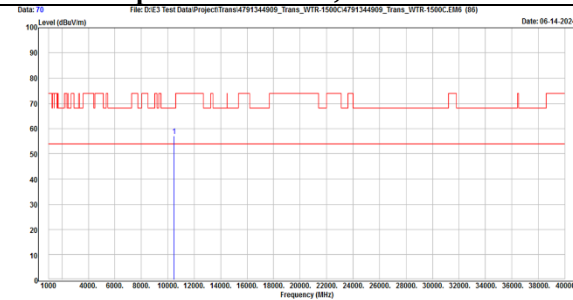
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Telephone : +886-2-7737-3000

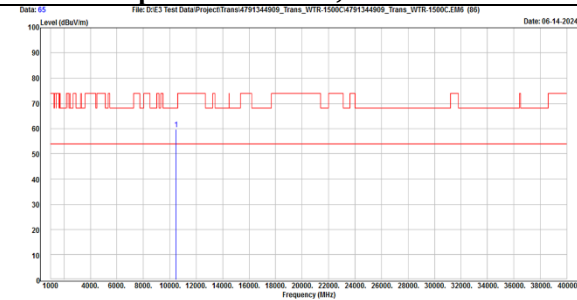
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Doc No: Form-ULID-004739 (DCS:17-EM-F0878) / 6.1

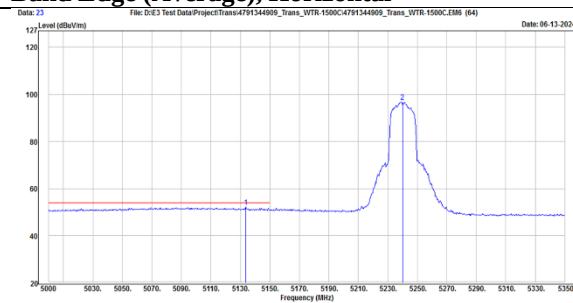
TX, 802.11a (Ch 48)
Radiated Spurious Emission, Horizontal



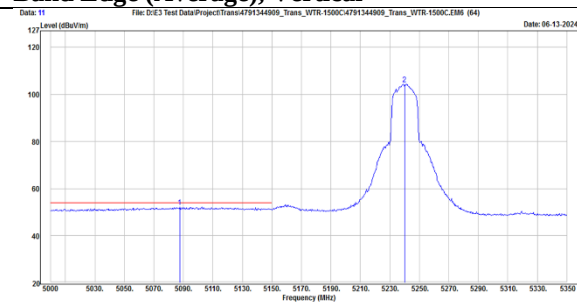
TX, 802.11a (Ch 48)
Radiated Spurious Emission, Vertical



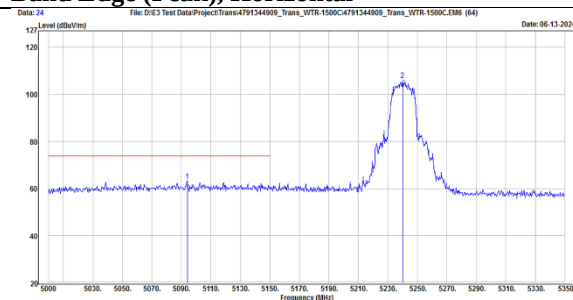
TX, 802.11a (Ch 48)
Band Edge (Average), Horizontal



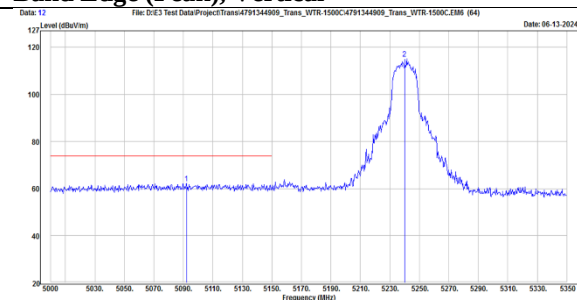
TX, 802.11a (Ch 48)
Band Edge (Average), Vertical



TX, 802.11a (Ch 48)
Band Edge (Peak), Horizontal



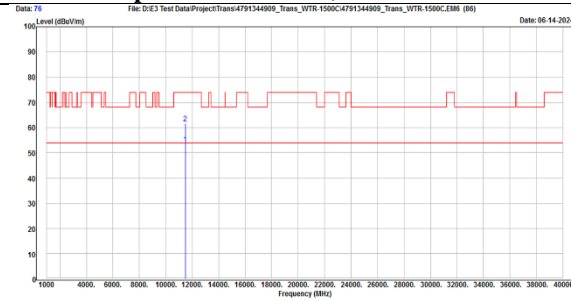
TX, 802.11a (Ch 48)
Band Edge (Peak), Vertical



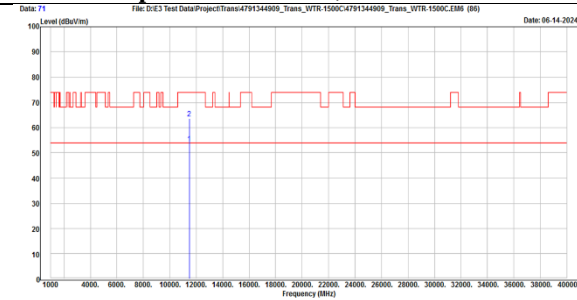
Mode	802.11a	Channel	149
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Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal	@	5623	41.32	20.51	61.83	68.2	-6.37	PK
		5667	40.84	20.38	61.22	80.82	-19.6	PK
		5745	83.95	20.62	104.57	N/A	N/A	PK
		11490	41.89	19.74	61.63	74	-12.37	PK
		11490	33.76	19.74	53.5	54	-0.5	AVG
Vertical	@	5558.5	41.82	20.6	62.42	68.2	-5.78	PK
		5671	41.84	20.38	62.22	83.78	-21.56	PK
		5745	90.15	20.62	110.77	N/A	N/A	PK
		11490	43.77	19.74	63.51	74	-10.49	PK
		11490	33.89	19.74	53.63	54	-0.37	AVG

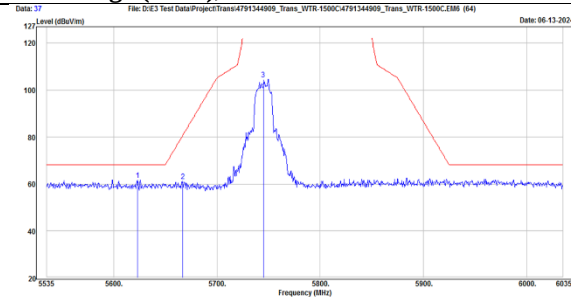
TX, 802.11a (Ch 149)
Radiated Spurious Emission, Horizontal



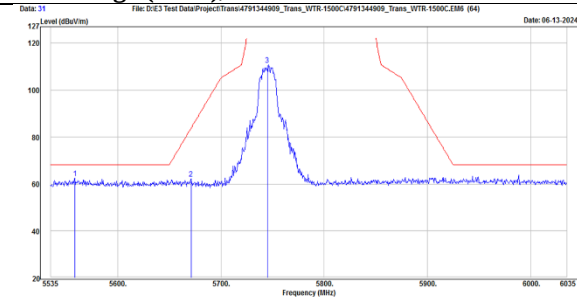
TX, 802.11a (Ch 149)
Radiated Spurious Emission, Vertical



TX, 802.11a (Ch 149)
Band Edge (Peak), Horizontal

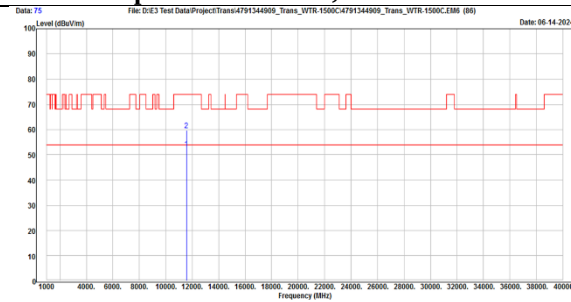
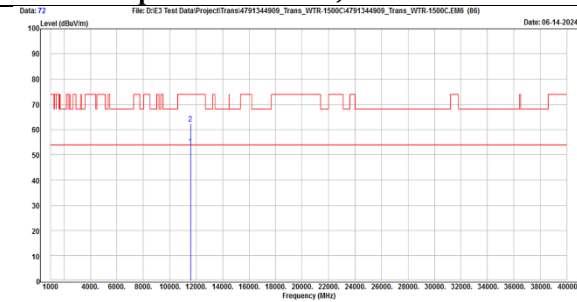
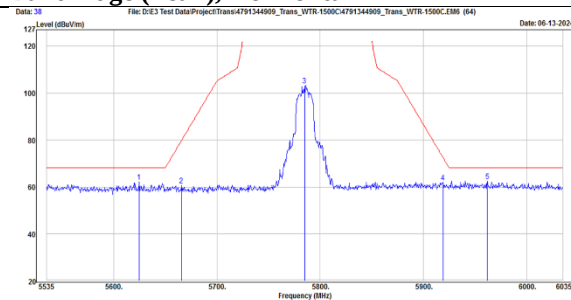
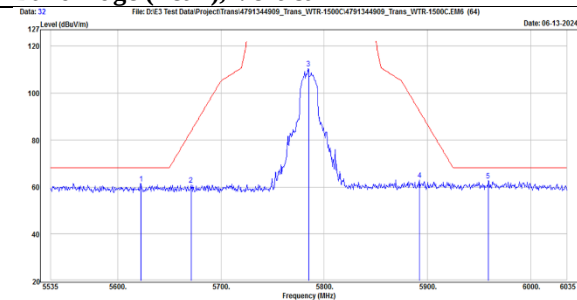


TX, 802.11a (Ch 149)
Band Edge (Peak), Vertical



Mode	802.11a	Channel	157
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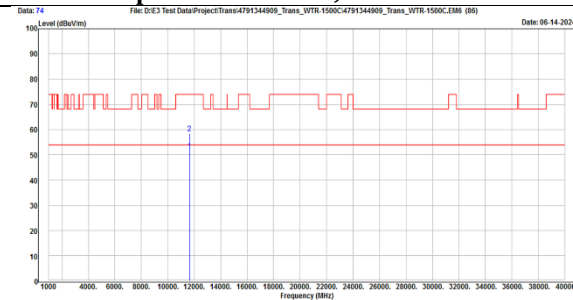
Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal		5624.5	41.69	20.5	62.19	68.2	-6.01	PK
		5665.5	40.42	20.39	60.81	79.7	-18.89	PK
	@	5785	82.44	20.9	103.34	N/A	N/A	PK
		5919	40.48	21.54	62.02	72.62	-10.6	PK
		5962	41.04	21.61	62.65	68.2	-5.55	PK
		11570	40.03	19.71	59.74	74	-14.26	PK
		11570	32.76	19.71	52.47	54	-1.53	AVG
Vertical		5622.5	41.12	20.51	61.63	68.2	-6.57	PK
		5671	40.74	20.38	61.12	83.78	-22.66	PK
	@	5785	89.53	20.9	110.43	N/A	N/A	PK
		5892.5	41.51	21.51	63.02	92.21	-29.19	PK
		5959	41.12	21.6	62.72	68.2	-5.48	PK
		11570	42.81	19.71	62.52	74	-11.48	PK
		11570	33.73	19.71	53.44	54	-0.56	AVG

TX, 802.11a (Ch 157)
Radiated Spurious Emission, Horizontal

TX, 802.11a (Ch 157)
Radiated Spurious Emission, Vertical

TX, 802.11a (Ch 157)
Band Edge (Peak), Horizontal

TX, 802.11a (Ch 157)
Band Edge (Peak), Vertical


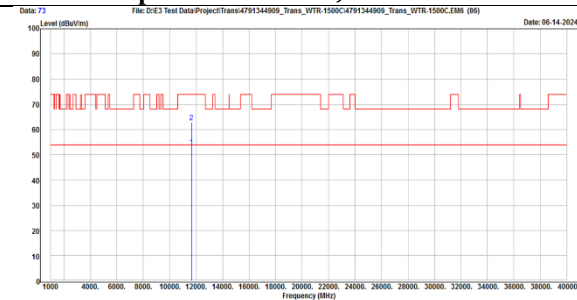
Mode	802.11a	Channel	165
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Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal	@	5825	80.7	21.24	101.94	N/A	N/A	PK
		5897	41.86	21.52	63.38	88.88	-25.5	PK
		5940.5	41.19	21.57	62.76	68.2	-5.44	PK
		11650	39.17	19.46	58.63	74	-15.37	PK
		11650	32.35	19.46	51.81	54	-2.19	AVG
Vertical	@	5825	87.31	21.24	108.55	N/A	N/A	PK
		5891.5	41.1	21.51	62.61	92.96	-30.35	PK
		5975.5	40.37	21.66	62.03	68.2	-6.17	PK
		11650	43.35	19.46	62.81	74	-11.19	PK
		11650	33.73	19.46	53.19	54	-0.81	AVG

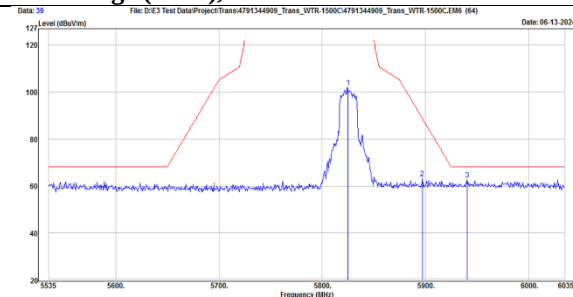
TX, 802.11a (Ch 165)
Radiated Spurious Emission, Horizontal



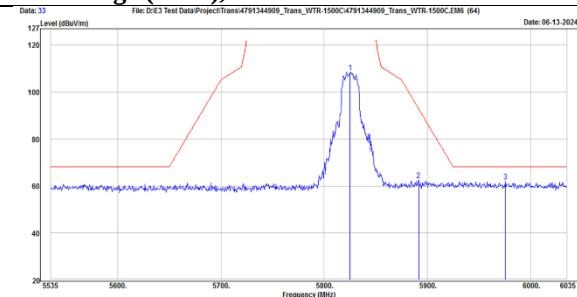
TX, 802.11a (Ch 165)
Radiated Spurious Emission, Vertical



TX, 802.11a (Ch 165)
Band Edge (Peak), Horizontal



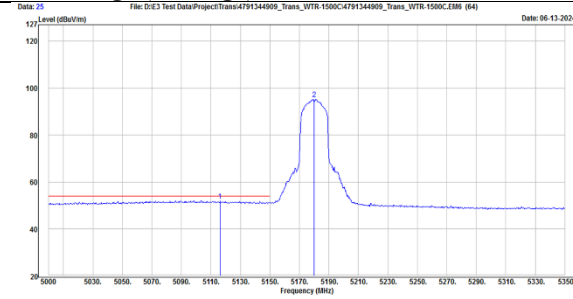
TX, 802.11a (Ch 165)
Band Edge (Peak), Vertical



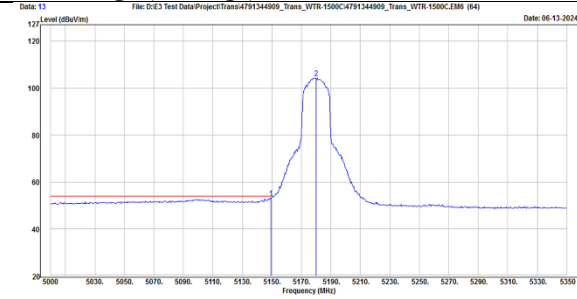
Mode	802.11n(HT20)	Channel	36
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Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal		5048.3	42.98	19.63	62.61	74	-11.39	PK
		5116.2	31.99	20.02	52.01	54	-1.99	AVG
	@	5180	84.72	19.97	104.69	N/A	N/A	PK
	@	5180	75.42	19.97	95.39	N/A	N/A	AVG
Vertical		5148.75	45.74	20.06	65.8	74	-8.2	PK
		5149.45	33.25	20.06	53.31	54	-0.69	AVG
	@	5180	93.39	19.97	113.36	N/A	N/A	PK
	@	5180	84.44	19.97	104.41	N/A	N/A	AVG

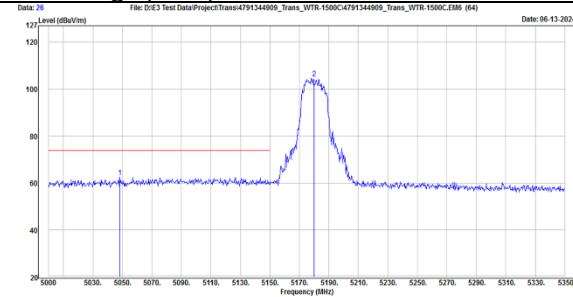
TX, 802.11n(HT20) (Ch 36)
Band Edge (Average), Horizontal



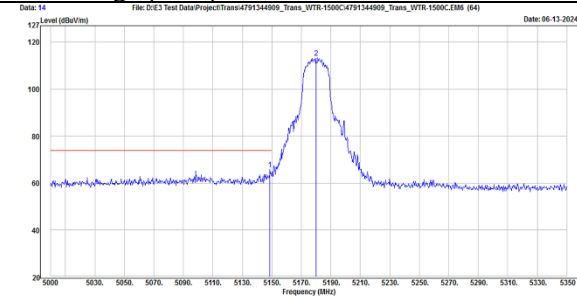
TX, 802.11n(HT20) (Ch 36)
Band Edge (Average), Vertical



TX, 802.11n(HT20) (Ch 36)
Band Edge (Peak), Horizontal



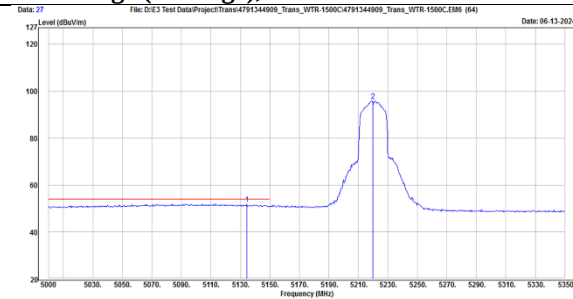
TX, 802.11n(HT20) (Ch 36)
Band Edge (Peak), Vertical



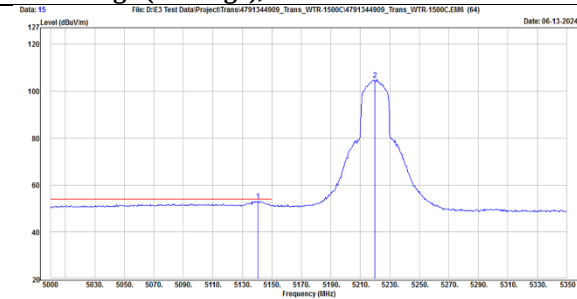
Mode	802.11n(HT20)	Channel	44
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Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal		5038.15	43.13	19.61	62.74	74	-11.26	PK
		5134.4	32.03	20.04	52.07	54	-1.93	AVG
	@	5220	85.79	19.9	105.69	N/A	N/A	PK
	@	5220	76	19.9	95.9	N/A	N/A	AVG
Vertical		5140.7	33.2	20.05	53.25	54	-0.75	AVG
		5143.5	43.89	20.05	63.94	74	-10.06	PK
	@	5220	94.58	19.9	114.48	N/A	N/A	PK
	@	5220	84.91	19.9	104.81	N/A	N/A	AVG

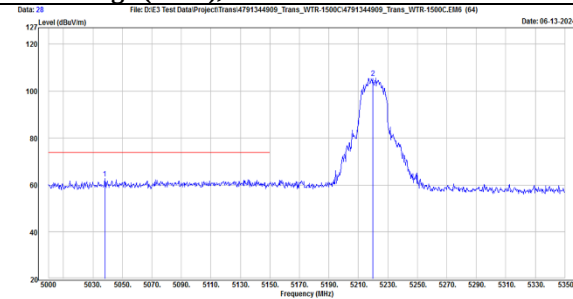
TX, 802.11n(HT20) (Ch 44)
Band Edge (Average), Horizontal



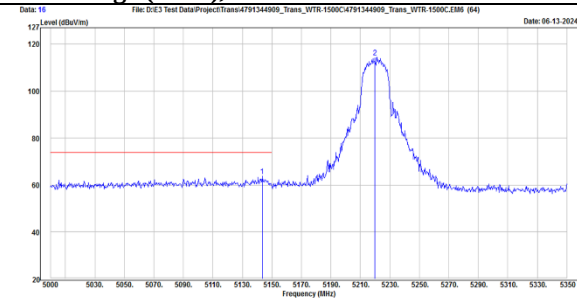
TX, 802.11n(HT20) (Ch 44)
Band Edge (Average), Vertical



TX, 802.11n(HT20) (Ch 44)
Band Edge (Peak), Horizontal



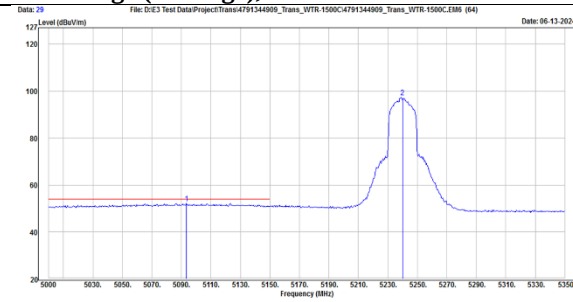
TX, 802.11n(HT20) (Ch 44)
Band Edge (Peak), Vertical



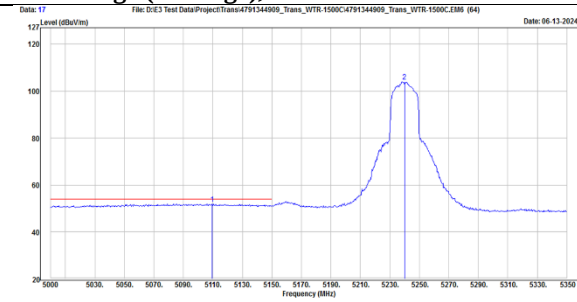
Mode	802.11n(HT20)	Channel	48
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Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal		5089.25	43.65	19.93	63.58	74	-10.42	PK
		5093.45	32.21	19.95	52.16	54	-1.84	AVG
	@	5240	85.92	19.88	105.8	N/A	N/A	PK
	@	5240	77.5	19.88	97.38	N/A	N/A	AVG
Vertical		5109.55	31.96	20.01	51.97	54	-2.03	AVG
		5140	43.1	20.04	63.14	74	-10.86	PK
	@	5240	93.81	19.88	113.69	N/A	N/A	PK
	@	5240	84.11	19.88	103.99	N/A	N/A	AVG

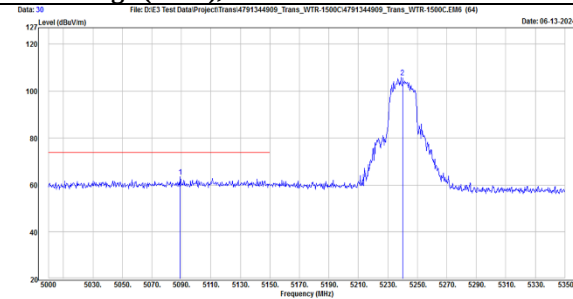
TX, 802.11n(HT20) (Ch 48)
Band Edge (Average), Horizontal



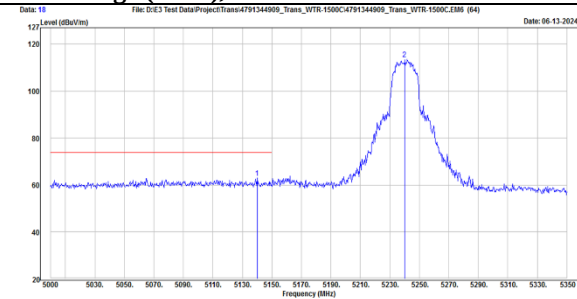
TX, 802.11n(HT20) (Ch 48)
Band Edge (Average), Vertical



TX, 802.11n(HT20) (Ch 48)
Band Edge (Peak), Horizontal

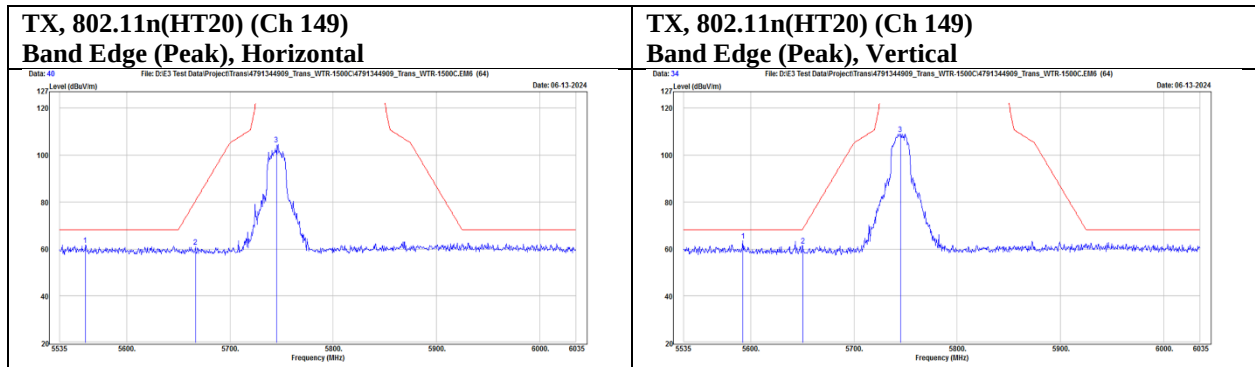


TX, 802.11n(HT20) (Ch 48)
Band Edge (Peak), Vertical



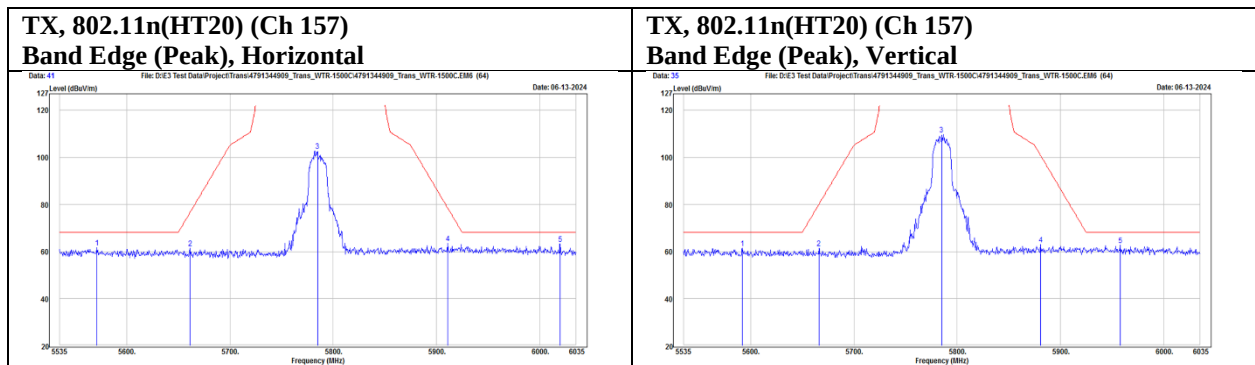
Mode	802.11n(HT20)	Channel	149
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Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal		5560	41.2	20.6	61.8	68.2	-6.4	PK
		5666.5	40.72	20.38	61.1	80.45	-19.35	PK
	@	5745	84.02	20.62	104.64	N/A	N/A	PK
Vertical		5592.5	42.87	20.58	63.45	68.2	-4.75	PK
		5650.5	41.19	20.43	61.62	68.57	-6.95	PK
	@	5745	88.34	20.62	108.96	N/A	N/A	PK



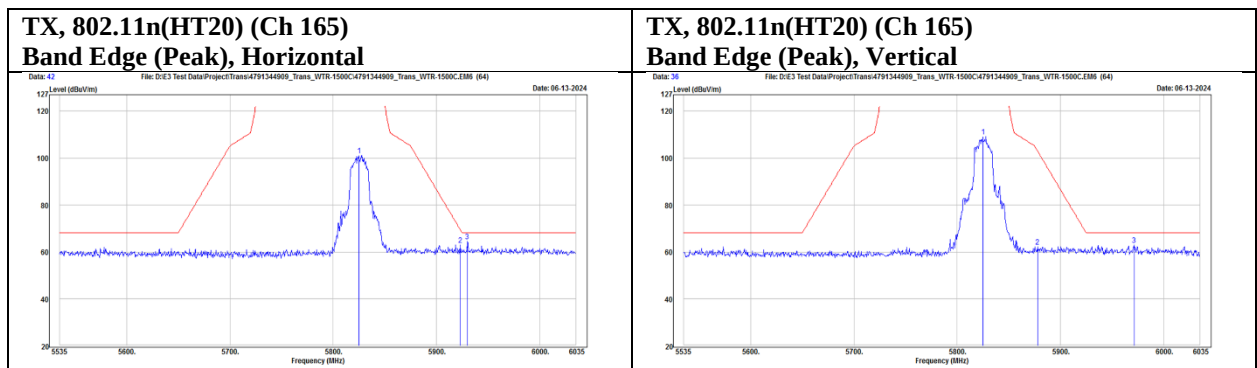
Mode	802.11n(HT20)	Channel	157
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Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal		5571	41.22	20.59	61.81	68.2	-6.39	PK
		5661.5	41.11	20.4	61.51	76.74	-15.23	PK
	@	5785	81.93	20.9	102.83	N/A	N/A	PK
		5911	42.08	21.53	63.61	78.53	-14.92	PK
		6020	41.55	21.83	63.38	68.2	-4.82	PK
Vertical		5592	40.8	20.59	61.39	68.2	-6.81	PK
		5666	41.01	20.39	61.4	80.08	-18.68	PK
	@	5785	88.79	20.9	109.69	N/A	N/A	PK
		5881	41.5	21.5	63	100.74	-37.74	PK
		5958	41.16	21.6	62.76	68.2	-5.44	PK



Mode	802.11n(HT20)	Channel	165
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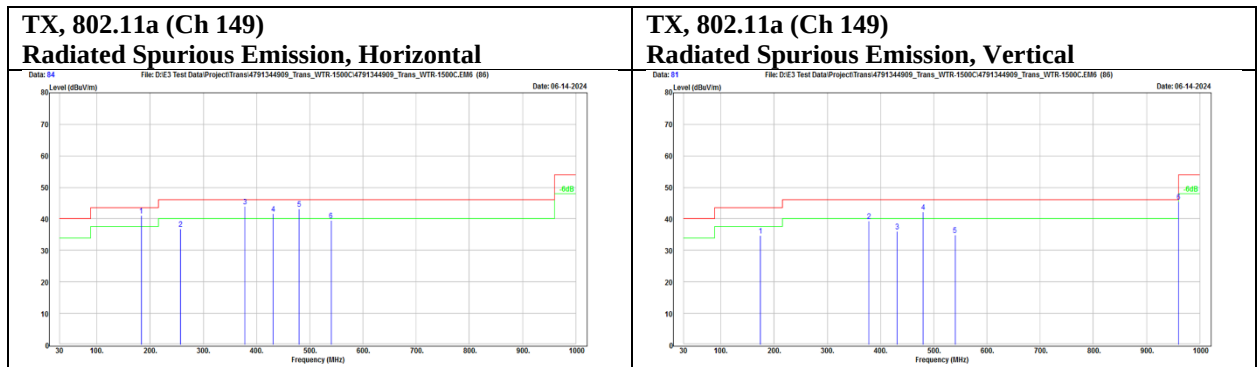
Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal	@	5825	79.87	21.24	101.11	N/A	N/A	PK
		5923	41.56	21.54	63.1	69.67	-6.57	PK
		5930	43.04	21.55	64.59	68.2	-3.61	PK
Vertical	@	5825	87.92	21.24	109.16	N/A	N/A	PK
		5878	40.87	21.49	62.36	102.97	-40.61	PK
		5971.5	41.43	21.64	63.07	68.2	-5.13	PK



Below 1 GHz

Mode	802.11a	Channel	149
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Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal		183.26	54.38	-13.26	41.12	43.5	-2.38	PK
		256.98	49.06	-12.15	36.91	46	-9.09	PK
		378.23	52.14	-8.14	44	46	-2	PK
		431.58	48.22	-6.58	41.64	46	-4.36	PK
		480.08	48.73	-5.47	43.26	46	-2.74	PK
		540.22	43.8	-4.23	39.57	46	-6.43	PK
Vertical		174.53	46.93	-12.22	34.71	43.5	-8.79	PK
		378.23	47.44	-8.14	39.3	46	-6.7	PK
		431.58	42.66	-6.58	36.08	46	-9.92	PK
		480.08	47.71	-5.47	42.24	46	-3.76	PK
		540.22	39.12	-4.23	34.89	46	-11.11	PK
		960.23	41.92	3.65	45.57	54	-8.43	PK



9 kHz ~ 30 MHz Data:

For 9 kHz to 30 MHz radiated emission have performed all modes of operation were investigated. The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

No non-compliance noted:

KDB 414788 D01 OATS and Chamber Correlation Justification

- Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

- OATs and chamber correlation testing had been performed and chamber measured test results is the worst case test result.

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30m open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

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Doc No: Form-ULID-004739 (DCS:17-EM-F0878) / 6.1

9.8. AC Power Line Conducted Emission

Requirements

Frequency (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	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.

Test Procedures

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

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.
2. All modes of operation were investigated (includes all external accessories) and the worst-case emissions are reported, the other emission levels were low against the limit.
3. Test data of Result value (dBuV) = Reading value (dBuV) + Correction Factor (dB).
4. Test data of Margin(dB) = Result value (dBuV) - Limit value (dBuV).
5. Test data of Correction Factor (dB) = Insertion loss(dB) + Cable loss(dB).

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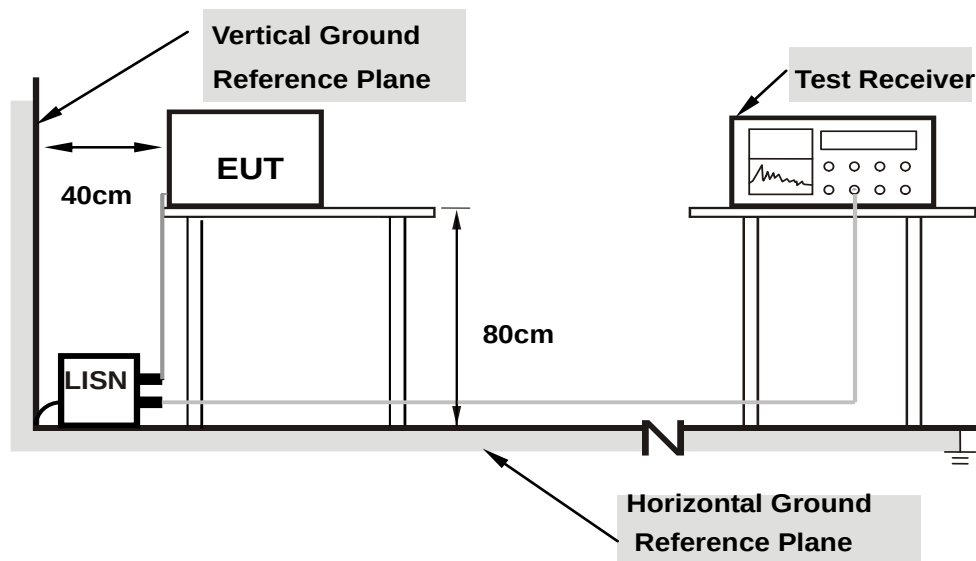
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Test Setup

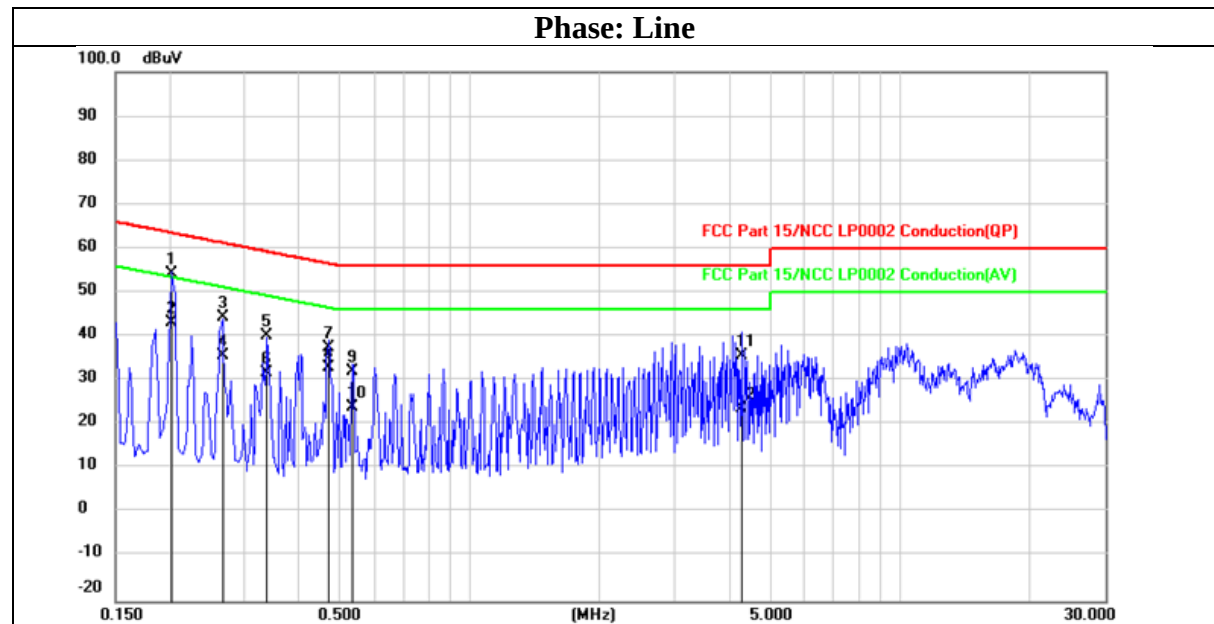


Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the Setup Configurations.

Test Data

Mode	A_TX5745	Channel	149
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.2020	44.17	9.95	54.12	63.53	-9.41	QP
2	0.2020	33.32	9.95	43.27	53.53	-10.26	AVG
3	0.2660	34.51	9.95	44.46	61.24	-16.78	QP
4	0.2660	25.79	9.95	35.74	51.24	-15.50	AVG
5	0.3379	30.15	9.95	40.10	59.25	-19.15	QP
6	0.3379	21.69	9.95	31.64	49.25	-17.61	AVG
7	0.4700	27.55	9.95	37.50	56.51	-19.01	QP
8	0.4700	22.99	9.95	32.94	46.51	-13.57	AVG
9	0.5340	22.23	9.95	32.18	56.00	-23.82	QP
10	0.5340	13.86	9.95	23.81	46.00	-22.19	AVG
11	4.2860	25.70	10.10	35.80	56.00	-20.20	QP
12	4.2860	13.52	10.10	23.62	46.00	-22.38	AVG

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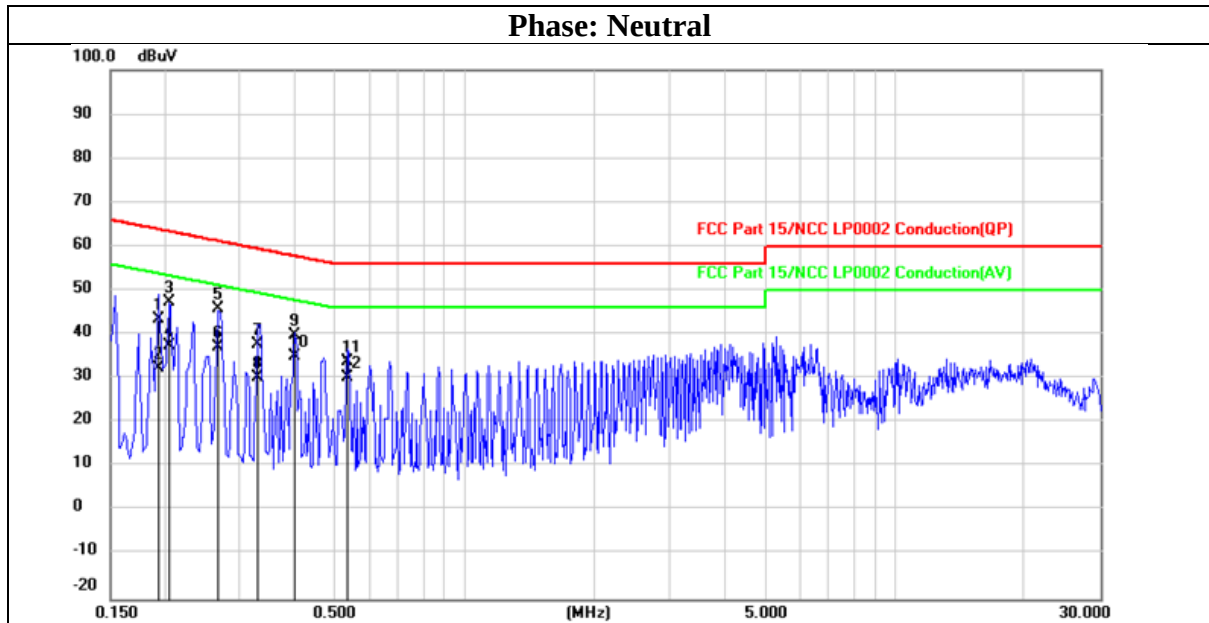
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Mode	A_TX5745	Channel	149
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1940	33.54	9.94	43.48	63.86	-20.38	QP
2	0.1940	22.40	9.94	32.34	53.86	-21.52	AVG
3	0.2060	37.31	9.94	47.25	63.37	-16.12	QP
4	0.2060	27.61	9.94	37.55	53.37	-15.82	AVG
5	0.2660	35.77	9.94	45.71	61.24	-15.53	QP
6	0.2660	27.32	9.94	37.26	51.24	-13.98	AVG
7	0.3300	27.83	9.95	37.78	59.45	-21.67	QP
8	0.3300	20.32	9.95	30.27	49.45	-19.18	AVG
9	0.4020	29.79	9.95	39.74	57.81	-18.07	QP
10	0.4020	24.97	9.95	34.92	47.81	-12.89	AVG
11	0.5340	23.78	9.95	33.73	56.00	-22.27	QP
12	0.5340	20.19	9.95	30.14	46.00	-15.86	AVG

END OF REPORT

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