

FCC RF Test Report

APPLICANT	:	Zhejiang Lingzhu Technology Co., Ltd.		
EQUIPMENT	:	Smart Control Panel L		
MODEL NAME	:	TPP05-Z(US)		
FCC ID	:	2BEWX-TPP05		
STANDARD	:	FCC Part 15 Subpart E §15.407		
CLASSIFICATION	:	(NII) Unlicensed National Information Infrastructure		
TEST DATE(S)	:	Jul. 27, 2023 ~ Aug. 25, 2023		

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

JasonJia

Approved by: Jason Jia



Sporton International Inc. (Kunshan) No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR372501-02D	Rev. 01	Initial issue of report	Jul. 23, 2024



SUMMARY OF TEST RESULT

Report Section	FCC Rule	Rule Description		Result	Remark
3.1	15.403(i)	6dB, 26dB and 99% Occupied Bandwidth	> 500kHz	Pass	-
3.2	15.407(a)	Maximum Conducted Output Power	≤ 30 dBm	Pass	-
3.3	15.407(a)	Power Spectral Density	≤ 30 dBm/500kHz	Pass	-
3.4	15.407(b) Unwanted Emissions		15.407(b)(4)(i) &15.209(a)	Pass	Under limit 2.18 dB at 11570.00 MHz
3.5	15.207 AC Conducted Emission		15.207(a)	Pass	Under limit 9.05 dB at 0.476 MHz
3.6	15.203 & 15.407(a) Antenna Requirement		15.203 & 15.407(a)	Pass	-

Note: This is a change FCC ID report. Since no changes have been made to this device, therefore, all test

cases were leveraged from original report (FCC ID: 2A789-TPP05, report number FR372501D)

Conformity Assessment Condition:

 The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.

2. The measurement uncertainty please refer to each test result in the section "Measurement Uncertainty"

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.



1 General Description

1.1 Applicant

Zhejiang Lingzhu Technology Co., Ltd. Room 302,No 1 Building Huace Center,Xihu District, Hangzhou City, Zhejiang Province,China

1.2 Manufacturer

Zhejiang Lingzhu Technology Co., Ltd. Room 302,No 1 Building Huace Center,Xihu District, Hangzhou City, Zhejiang Province,China

1.3 Product Feature of Equipment Under Test

Product Feature				
Equipment Smart Control Panel L				
Model Name	TPP05-Z(US)			
FCC ID	2BEWX-TPP05			
SN Code	Conducted/Radiation: NSZEE18MK00008 Conduction: NSZEE18MK0005A			

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification					
Tx/Rx Channel Frequency Range5745 MHz ~ 5825 MHz					
Maximum Output Power	<5745 MHz ~ 5825 MHz> 802.11a : 19.80 dBm / 0.0955 W 802.11n HT20 : 20.64 dBm / 0.1159 W 802.11n HT40 : 22.31 dBm / 0.1702 W				
99% Occupied Bandwidth	802.11a : 23.58 MHz 802.11n HT20 : 26.22 MHz 802.11n HT40 : 48.85 MHz				
Type of Modulation	802.11a/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)				
Antenna Type / Gain	IPEX with gain 1.75 dBi				

1.5 Modification of EUT

No modifications are made to the EUT during all test items.



1.6 Testing Location

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International Inc. (Kunshan)					
	No. 1098, Pengxi North	n Road, Kunshan Econom	ic Development Zone			
Test Site Location	Jiangsu Province 215300 People's Republic of China					
	TEL : +86-512-57900158					
	Sporton Site No.	FCC Designation No.	FCC Test Firm			
Test Site No.	Sporton Site No.	FCC Designation No.	Registration No.			
Test Sile NO.	CO01-KS 03CH03-KS TH01-KS	CN1257	314309			

1.7 Test Software

ltem	Site	Manufacturer	Name	Version
1.	TH01-KS	SPORTON	FCC 15C-15E Test Tools Ver10.0_210607	10.0
2.	03CH03-KS	AUDIX	E3	210616
3.	CO01-KS	AUDIX	E3	6.2009-8-24

1.8 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part 15 Subpart E
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- ANSI C63.10-2013

Remark:

- 1. All test items were verified and recorded according to the standards and without any deviation during the test.
- 2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.



2 Test Configuration of Equipment Under Test

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Z plane) were recorded in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
	149	5745	157	5785
5745-5825 MHz	151*	5755	159*	5795
U-NII-3	153	5765	161	5805
	-	-	165	5825

Note: The above Frequency and Channel in "*" were 802.11n HT40.

2.2 Test Mode

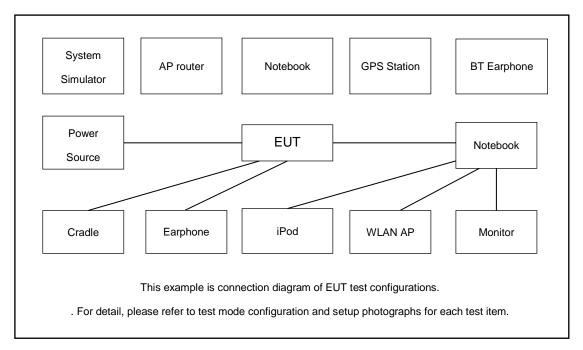
Final test modes are considering the modulation and worse data rates as below table.

	Modulation	Data Rate		
	802.11a	6 Mbps		
	802.11n HT20	MCS0		
	802.11n HT40	MCS0		
AC Conducted Emission Mode 1 : Zigbee Link + WLAN 5G Link + L1/L2 light link + RS485 Link + AC Pov				

	Ch. #	U-NII-3:5745-5825 MHz			
		802.11a	802.11n HT20	802.11n HT40	
L	Low	149	149	151	
М	Middle	157	157	-	
Н	High	165	165	159	



2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

ltem	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Bluetooth Earphone	Lenovo	thinkplus-BH3	N/A	N/A	N/A
2.	WLAN AP	D-link	DIR-655	KA21R655B1	N/A	Unshielded,1.8m
3.	Light	NA	NA	NA	NA	NA
4.	Notebook	Lenovo	G480	QDS-BRCM1050I	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m

2.5 EUT Operation Test Setup

For WLAN RF test items, an engineering test program was provided and enabled to make EUT continuous transmit.

For AC power line conducted emissions, the EUT was set to connect with the WLAN AP under large package sizes transmission.



2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 7.0 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 7.0 + 10 = 17.0 (dB)



3 Test Result

3.1 6dB and 26dB and 99% Occupied Bandwidth Measurement

3.1.1 Description of 6dB and 26dB and 99% Occupied Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz. 26dB and 99% Occupied bandwidth are reporting only.

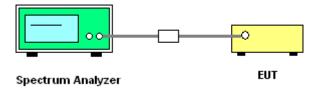
3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

- The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section C) Emission bandwidth for the band 5.725-5.85GHz
- For 6dB BW, Set RBW = 100kHz.
 For 26dB BW, Set RBW = approximately 1% of the emission bandwidth.
 For 99% OBW, Set RBW = 1% to 5% of the OBW.
- 3. For 26dB BW, Set the VBW > RBW. For 6dB BW & 99% OBW, Set the VBW \ge 3 x RBW.
- 4. Detector = Peak.
- 5. Trace mode = max hold
- 6. Measure the maximum width of the emission that is 6 dB down from the peak of the emission.
- 7. Measure and record the results in the test report.

3.1.4 Test Setup

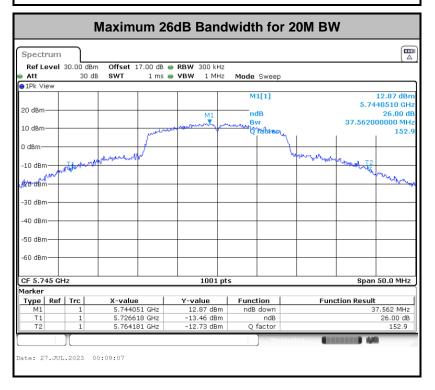


3.1.5 Test Result of 6dB Bandwidth

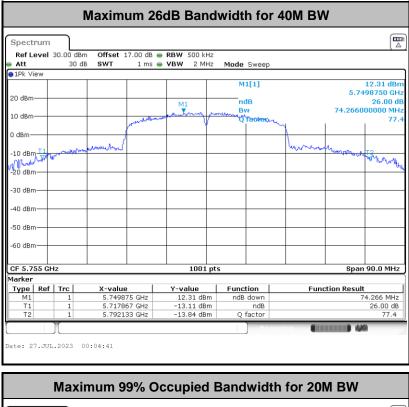
Please refer to Appendix A.

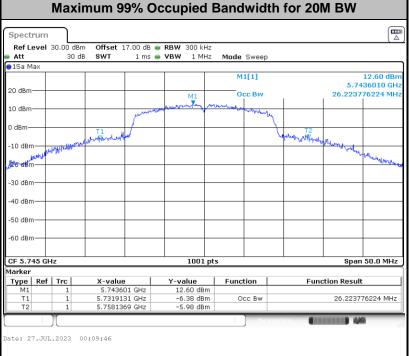


	1 30.00 dBm	Offset	17.00 dB 😑						
Att 1Pk Max	30 de	SWT	1.1 ms 👄	VBW 300 k	Hz Mode	Sweep			
1Pk Max					м	1[1]			5.11 dB
						411		5.77	93500 GF
20 dBm					D	2[1]			0.09 0
								13	3.1500 MF
10 dBm	D1 10.800	dBm	M1		-				
	D2 4.8	00 dBm	M1	hundre	and himplestander	D2			
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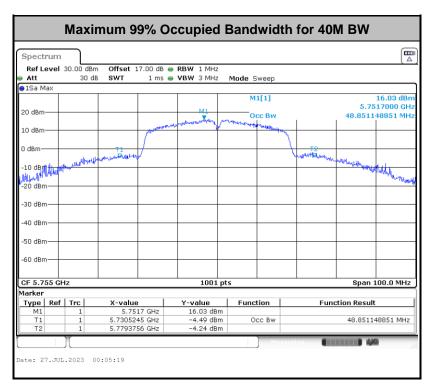












Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

3.2 Maximum Conducted Output Power Measurement

3.2.1 Limit of Maximum Conducted Output Power

For the band 5.725–5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

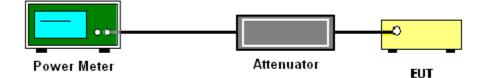
3.2.3 Test Procedures

The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

Method PM (Measurement using an RF average power meter):

- 1. Measurement is performed using a wideband RF power meter.
- 2. The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.
- 3. Measure the average power of the transmitter, and the average power is corrected with duty factor, $10 \log(1/x)$, where x is the duty cycle.

3.2.4 Test Setup



3.2.5 Test Result of Maximum Conducted Output Power

Please refer to Appendix A.



3.3 **Power Spectral Density Measurement**

3.3.1 Limit of Power Spectral Density

For the band 5.725–5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.3.3 Test Procedures

The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

Section F) Maximum power spectral density.

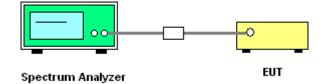
Method SA-2

(trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction).

- Measure the duty cycle.
- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- Set RBW = 500KHz (or 300 kHz if the SA can't set RBW=500KHz).
- Set VBW ≥ 1 MHz.
- Number of points in sweep \geq 2 Span / RBW.
- Sweep time = auto.
- Detector = RMS
- Trace average at least 100 traces in power averaging mode.
- If the SA can't set RBW=500KHz, then add 10 log(500kHz/RBW) to the test result
- Add 10 log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times. For example, add 10 log(1/0.25) = 6 dB if the duty cycle is 25 percent.
- 1. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
- 2. Each plot has already offset with cable loss, and attenuator loss. Measure the PPSD and record it.

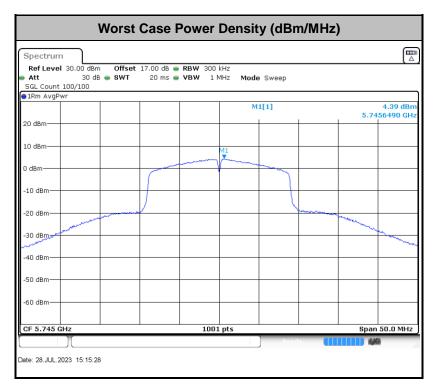


3.3.4 Test Setup

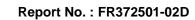


3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.



Note: Average Power Density (dB) = Measured value+ Duty Factor + RBW Factor





3.4 Unwanted Emissions Measurement

This section is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement.

3.4.1 Limit of Unwanted Emissions

(1) For transmitters operating in the 5.725-5.85 GHz band:

15.407(b)(4)(i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

(2) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table,

Frequency	Field Strength	Measurement Distance
(MHz)	(microvolts/meter)	(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



EIRP (dBm)	Field Strength at 3m (dBµV/m)			
- 27	68.2			

Note: The following formula is used to convert the EIRP to field strength.

 $EIRP = E_{Meas} + 20log (d_{Meas}) - 104.7$

where

EIRP is the equivalent isotropically radiated power, in dBm

 $E_{\mbox{\tiny Meas}}$ is the field strength of the emission at the measurement distance, in $dB\mu V/m$

d_{Meas} is the measurement distance, in m

(3) ANSI C63.10-2013 clause 12.7.3 note 97

As specified by regulatory requirements, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit. However, an out-of-band emission that complies with both the average and peak general regulatory limits is not required to satisfy the peak emission limit.

3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.



3.4.3 Test Procedures

- The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section G) Unwanted emissions measurement.
 - (1) Procedure for Unwanted Emissions Measurements Below 1000MHz
 - RBW = 120 kHz
 - VBW = 300 kHz
 - Detector = Peak
 - Trace mode = max hold

(2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz

- RBW = 1 MHz
- VBW ≥ 3 MHz
- Detector = Peak
- Sweep time = auto
- Trace mode = max hold

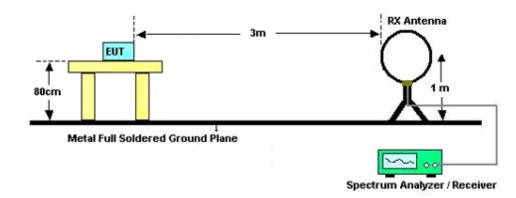
(3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

- RBW = 1 MHz
- VBW = 10 Hz, when duty cycle is no less than 98 percent.
- VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
- 2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
- 3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
- 4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
- 5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
- 6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
- 7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than peak limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

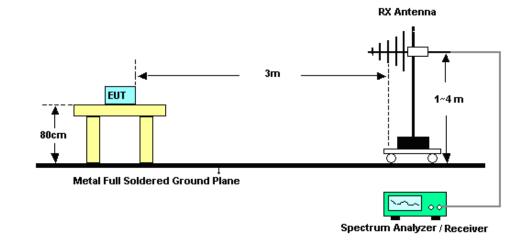


3.4.4 Test Setup

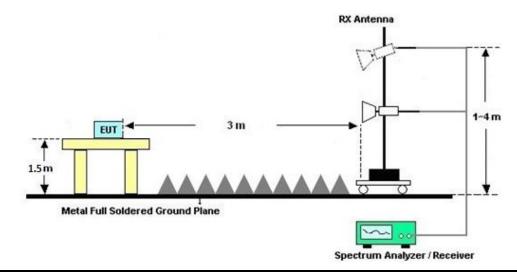
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



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3.4.5 Test Results of Radiated Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.4.6 Test Result of Radiated Band Edges

Please refer to Appendix C.

3.4.7 Duty Cycle

Please refer to Appendix D.

3.4.8 Test Result of Unwanted Radiated Emission (30MHz ~ 10th Harmonic or 40GHz, whichever is lower)

Please refer to Appendix C.



3.5 AC Conducted Emission Measurement

3.5.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBµV)				
Frequency of emission (MHZ)	Quasi-peak	Average			
0.15-0.5	66 to 56*	56 to 46*			
0.5-5	56	46			
5-30	60	50			

*Decreases with the logarithm of the frequency.

3.5.2 Measuring Instruments

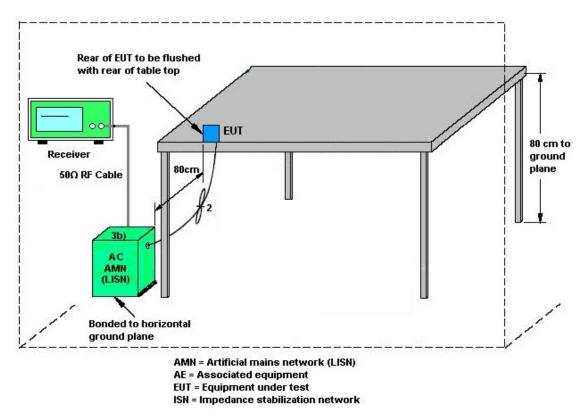
The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

- 1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- 2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- 3. All the support units are connecting to the other LISN.
- 4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- 5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
- 6. Both sides of AC line were checked for maximum conducted interference.
- 7. The frequency range from 150 kHz to 30 MHz was searched.
- 8. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.



3.5.4 Test Setup



3.5.5 Test Result of AC Conducted Emission

Please refer to Appendix B.



3.6 Antenna Requirements

3.6.1 Standard Applicable

If transmitting antenna directional gain is greater than 6 dBi, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.6.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.6.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	Oct. 12, 2022	Jul. 27, 2023~ Jul. 28, 2023	Oct. 11, 2023	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 05, 2023	Jul. 27, 2023~ Jul. 28, 2023	Jan. 04, 2024	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 05, 2023	Jul. 27, 2023~ Jul. 28, 2023	Jan. 04, 2024	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY56400004	3Hz~8.5GHz;Ma x 30dBm	Oct. 13, 2022	Aug. 25, 2023	Oct. 12, 2023	Radiation (03CH03-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150244	10Hz-44GHz	May 15, 2023	Aug. 25, 2023	May 14, 2024	Radiation (03CH03-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 16, 2022	Aug. 25, 2023	Oct. 15, 2023	Radiation (03CH03-KS)
Bilog Antenna	TeseQ	CBL6112D	23182	30MHz-1GHz	Dec. 23, 2022	Aug. 25, 2023	Dec. 22, 2023	Radiation (03CH03-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	75957	1GHz~18GHz	Nov. 15, 2022	Aug. 25, 2023	Nov. 14, 2023	Radiation (03CH03-KS)
SHF-EHF Horn	com-power	AH-840	101116	18GHz~40GHz	Oct. 17, 2022	Aug. 25, 2023	Oct. 16, 2023	Radiation (03CH03-KS)
Amplifier	SONOMA	310N	413740	30MHz ~1000MHz	Jan. 05, 2023	Aug. 25, 2023	Jan. 04, 2024	Radiation (03CH03-KS)
Amplifier	EM	EM18G40GA	060851	18~40GHz	Jan. 05, 2023	Aug. 25, 2023	Jan. 04, 2024	Radiation (03CH03-KS)
high gain Amplifier	MITEQ	AMF-7D-0010 1800-30-10P	2082394	1Ghz-18Ghz	Jan. 05, 2023	Aug. 25, 2023	Jan. 04, 2024	Radiation (03CH03-KS)
Amplifier	Keysight	83017A	MY53270319	1GHz~26.5GHz	Oct. 12, 2022	Aug. 25, 2023	Oct. 11, 2023	Radiation (03CH03-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Aug. 25, 2023	NCR	Radiation (03CH03-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Aug. 25, 2023	NCR	Radiation (03CH03-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Aug. 25, 2023	NCR	Radiation (03CH03-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	May 16, 2023	Aug. 11, 2023	May 15, 2024	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 13, 2022	Aug. 11, 2023	Oct. 12, 2023	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	May 16, 2023	Aug. 11, 2023	May 15, 2024	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP0000008 11	AC 0V~300V, 45Hz~1000Hz	Oct. 12, 2022	Aug. 11, 2023	Oct. 11, 2023	Conduction (CO01-KS)

NCR: No Calibration Required



5 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Conducted Measurement

Test Item	Uncertainty		
Conducted Power	±0.46 dB		
Conducted Emissions	±2.26 dB		
Occupied Channel Bandwidth	±0.1 %		
Conducted Power Spectral Density	±0.88 dB		

Uncertainty of Conducted Emission Measurement (150kHz ~ 30MHz)

Measuring Uncertainty for a Level of Confidence	0 70 JD
of 95% (U = 2Uc(y))	2.78dB

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence	4.0.15
of 95% (U = 2Uc(y))	4.0dB

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence	5.0dB	
of 95% (U = 2Uc(y))	5.VQB	

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence	5.0dB		
of 95% (U = 2Uc(y))	5.00B		

----- THE END ------



Appendix A. Conducted Test Results

Report Number : FR372501-02D

Test Engineer:	akun	Temperature:	21~25	°C
Test Date:	2023/7/27~2023/7/28	Relative Humidity:	51~54	%

TEST RESULTS DATA 6dB and 26dB EBW and 99% OBW

	U-NII-3 single antenna																					
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Bandwi dth (MHz)	26dB Bandwi dth (MHz)	6 dB Bandwi dth (MHz)	6 dB Bandwidth Min. Limit (MHz)	Pass/Fail													
																		Ant 1	Ant 1	Ant 1] ()	
11a	6Mbps	1	149	5745	16.58	20.33	14.95	0.5	Pass													
11a	6Mbps	1	157	5785	23.58	35.32	13.15	0.5	Pass													
11a	6Mbps	1	165	5825	16.43	19.78	13.85	0.5	Pass													
HT20	MCS0	1	149	5745	26.22	37.56	15.00	0.5	Pass													
HT20	MCS0	1	157	5785	22.88	35.27	13.80	0.5	Pass													
HT20	MCS0	1	165	5825	17.53	20.63	13.85	0.5	Pass													
HT40	MCS0	1	151	5755	48.85	74.27	31.32	0.5	Pass													
HT40	MCS0	1	159	5795	46.95	71.66	31.32	0.5	Pass													

FR372501-02D

<u>TEST RESULTS DATA</u> <u>Average Power Table</u>

U-NII-3 single antenna										
Mod.	Data Rate NTX CH. Freq. (MHz) Average Duty Conducted Factor Power (dB) with duty factor (dBm)		FCC Condu cted Power Limit	lu DG d (dBi) Pass/Fa t						
					Ant 1	Ant 1	SUM	Ant 1	Ant 1	
11a	6Mbps	1	149	5745	0.27	17.31		30.00	1.75	Pass
11a	6Mbps	1	157	5785	0.27	19.80		30.00	1.75	Pass
11a	6Mbps	1	165	5825	0.27	16.96		30.00	1.75	Pass
HT20	MCS0	1	149	5745	0.41	20.64		30.00	1.75	Pass
HT20	MCS0	1	157	5785	0.41	20.33	20.33		1.75	Pass
HT20	MCS0	1	165	5825	0.41	17.47		30.00	1.75	Pass
HT40	MCS0	1	151	5755	0.79	22.31		30.00	1.75	Pass
HT40	MCS0	1	159	5795	0.79	21.83		30.00	1.75	Pass

FR372501-02D

TEST RESULTS DATA Power Spectral Density

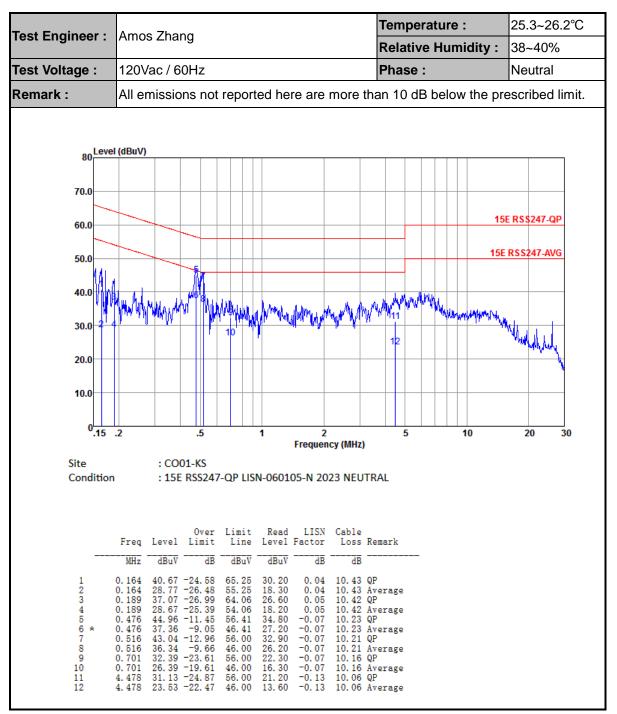
	U-NII-3 single antenna										
Mod.	Data Rate	Ntx	CH.	Freq. (MHz)	Duty Factor (dB)	10log (500kH z /RBW) Factor	KH Power Density with Duty W) Factor		Average PSD Limit (dBm/50 0kHz)	DG (dBi)	Pass /Fail
					Ant 1	Ant 1	Ant 1	SUM	Ant 1	Ant 1	
11a	6Mbps	1	149	5745	0.27	2.22	3.99		30.00	1.75	Pass
11a	6Mbps	1	157	5785	0.27	2.22	6.22		30.00	1.75	Pass
11a	6Mbps	1	165	5825	0.27	2.22	3.66		30.00	1.75	Pass
HT20	MCS0	1	149	5745	0.41	2.22	7.02		30.00	1.75	Pass
HT20	MCS0	1	157	5785	0.41	2.22	6.67		30.00	1.75	Pass
HT20	MCS0	1	165	5825	0.41	2.22	4.53		30.00	1.75	Pass
HT40	MCS0	1	151	5755	0.79	2.22	5.66		30.00	1.75	Pass
HT40	MCS0	1	159	5795	0.79	2.22	5.59		30.00	1.75	Pass



Appendix B. AC Conducted Emission Test Results

Toot Engineer	Amon Zhong		Temperature :	25.3~26.2°C
Test Engineer :	Amos Zhang		Relative Humidity	': 38~40%
Fest Voltage :	120Vac / 60Hz		Phase :	Line
Remark :	All emissions not	reported here are m	ore than 10 dB below the	prescribed limit.
80 Leve	l (dBuV)			
70.0				
60.0				15E RS\$247-QP
50.0				15E RSS247-AVG
40.0	WM ALAL MAN	Marchart with Hallow where a some	AL MUMANA WANTA	
30.0		a an Alla a marked way		March March Lin March
20.0			12	
10.0				
10.0				
0 <mark>.15</mark>	.2 .5	1 2 Frequency	5 10 (MHz)	20 30
Site	: CO01-KS	requency	(1112)	
Condition	: 15E RSS247	-QP LISN-060105-L 2023	LINE	
	Over Freq Level Limit	Limit Read LISN (Line Level Factor	able Loss Remark	
	MHz dBuV dB	dBuV dBuV dB	dB	
1 2 3	0.165 41.97 -23.24 0.165 29.37 -25.84 0.476 44.81 -11.60		0.43 QP 0.43 Average 0.23 QP	
4	0.476 37.11 -9.30	46.41 26.90 -0.02 1 56.00 33.30 -0.03 1 46.00 26.60 -0.03 1	0.23 Average	
7 8	1.077 32.20 -23.80 1.077 25.10 -20.90	56.00 22.20 -0.10 1 46.00 15.10 -0.10 1	0.10 QP 0.10 Average	
9 10	3. 436 32. 16 -23. 84 3. 436 23. 56 -22. 44	56.00 22.20 -0.10 1 46.00 13.60 -0.10 1 56.00 22.19 -0.12 1	0.06 QP 0.06 Average	
	4. 384 22. 53 -23. 47	46.00 12.59 -0.12 1	0.06 Average	





Note:

1. Level(dB μ V) = Read Level(dB μ V) + LISN Factor(dB) + Cable Loss(dB)

2. Over Limit(dB) = Level(dB μ V) – Limit Line(dB μ V)





Appendix C. Radiated Spurious Emission

Test Engineer :	Chris Chen	Relative Humidity :	41 ~ 42 %
		Temperature :	22 ~ 23 ℃

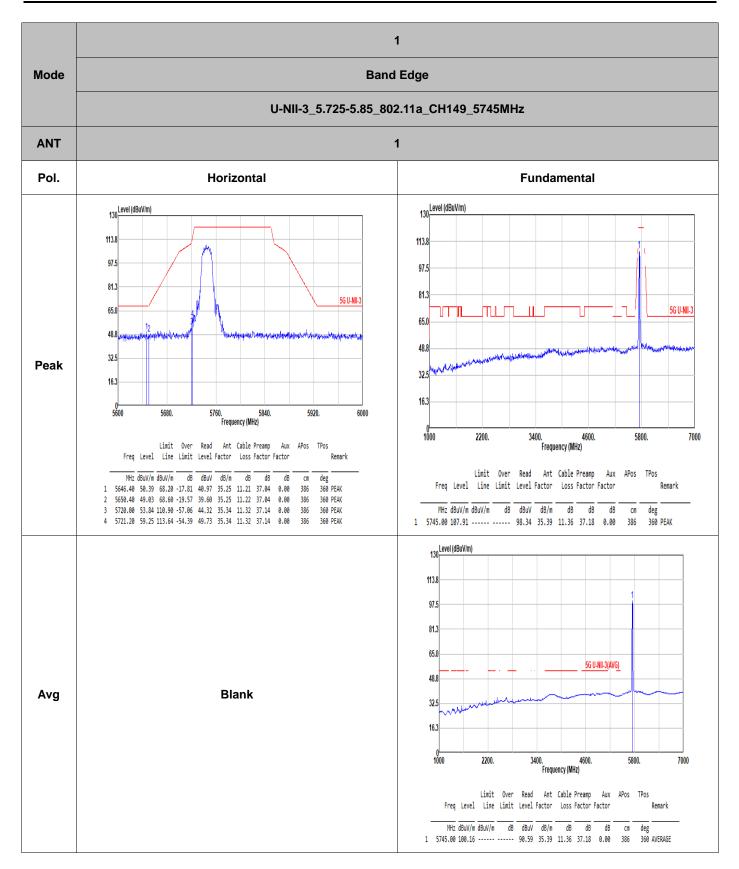
Radiated Spurious Emission Test Modes

Mode	Band	Band (GHz)	Antenna	Modulation	Channel	Frequency	Data Rate	Remark
Mode 1	U-NII-3	5.725-5.85	1	802.11a	149	5745	6Mbps	-
Mode 2	U-NII-3	5.725-5.85	1	802.11a	157	5785	6Mbps	-
Mode 3	U-NII-3	5.725-5.85	1	802.11a	165	5825	6Mbps	
Mode 4	U-NII-3	5.725-5.85	1	802.11n HT20	149	5745	MCS0	-
Mode 5	U-NII-3	5.725-5.85	1	802.11n HT20	157	5785	MCS0	-
Mode 6	U-NII-3	5.725-5.85	1	802.11n HT20	165	5825	MCS0	-
Mode 7	U-NII-3	5.725-5.85	1	802.11n HT40	151	5755	MCS0	-
Mode 8	U-NII-3	5.725-5.85	1	802.11n HT40	159	5795	MCS0	-

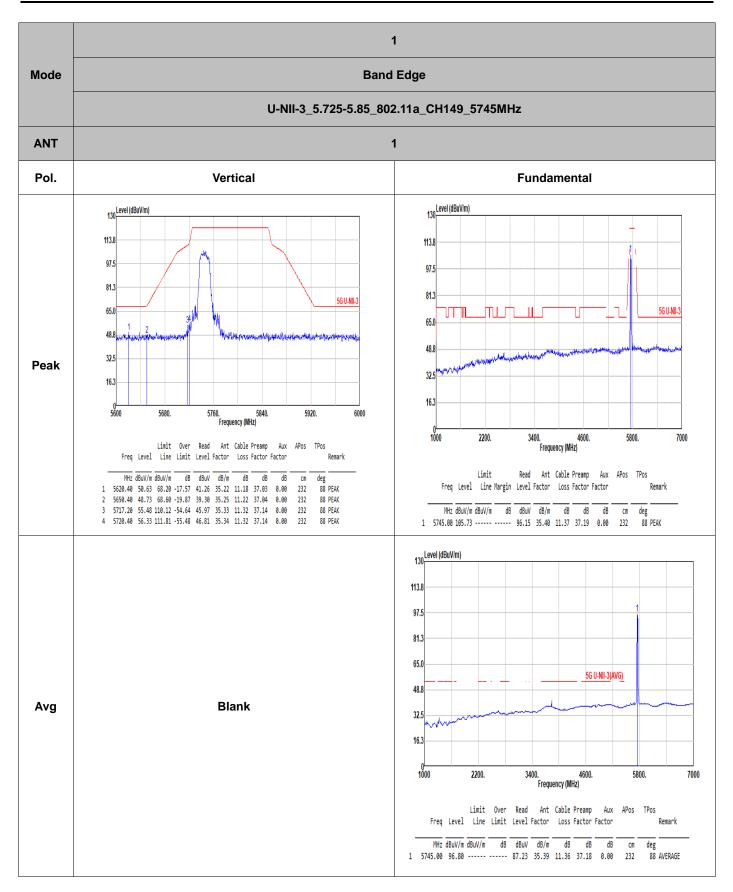
Summary of each worse mode

Mode	Modulation	Ch.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pol.	Peak Avg.	Result	Remark
1	802.11a	149	5646.40	50.66	68.20	-17.54	V	PEAK	Pass	Band Edge
	802.11a	149	17235.00	65.55	68.20	-2.65	V	PEAK	Pass	Harmonic
	802.11a	157	-	-	-	-	-	-	-	Band Edge
2	802.11a	157	11570.00	51.82	54.00	-2.18	Н	AVERAGE	Pass	Harmonic
	802.11a	157	585.81	43.81	46	-2.19	Н	QP	Pass	LF
2	802.11a	165	5979.60	52.03	68.20	-16.17	Н	PEAK	Pass	Band Edge
3	802.11a	165	17475.00	65.04	68.20	-3.16	V	PEAK	Pass	Harmonic
	802.11n HT20	149	5636.40	50.07	68.20	-18.23	Н	PEAK	Pass	Band Edge
4	802.11n HT20	149	17237.33	65.39	68.20	-2.81	V	Peak	Pass	Harmonic
5	802.11n HT20	157	-	-	-	-	-	-	-	Band Edge
Э	802.11n HT20	157	17365.67	65.17	68.20	-3.03	V	Peak	Pass	Harmonic
6	802.11n HT20	165	5966.80	50.61	68.20	-17.59	Н	Peak	Pass	Band Edge
6	802.11n HT20	165	17480.07	65.15	68.20	-3.05	Н	Peak	Pass	Harmonic
7	802.11n HT40	151	5929.14	50.59	68.20	-17.61	Н	PEAK	Pass	Band Edge
	802.11n HT40	151	17261.53	61.61	68.20	-6.59	Н	Peak	Pass	Harmonic
8	802.11n HT40	159	5941.20	50.18	68.20	-18.02	V	PEAK	Pass	Band Edge
0	802.11n HT40	159	17382.53	60.96	68.20	-7.24	Н	PEAK	Pass	Harmonic

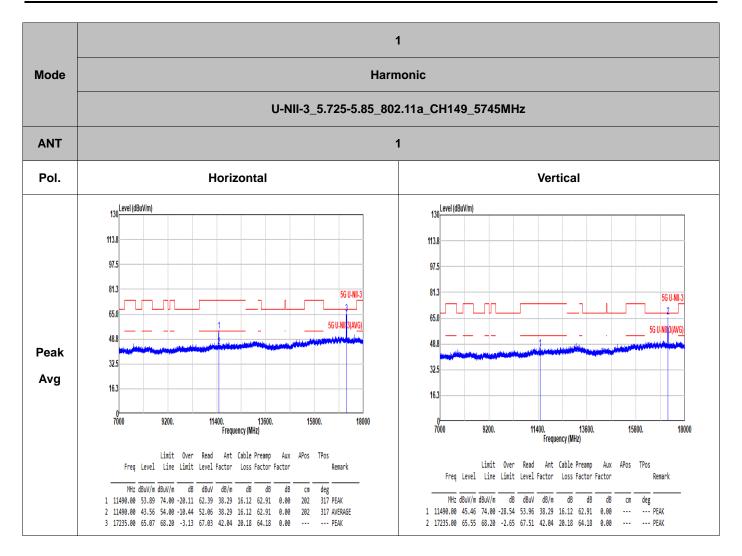




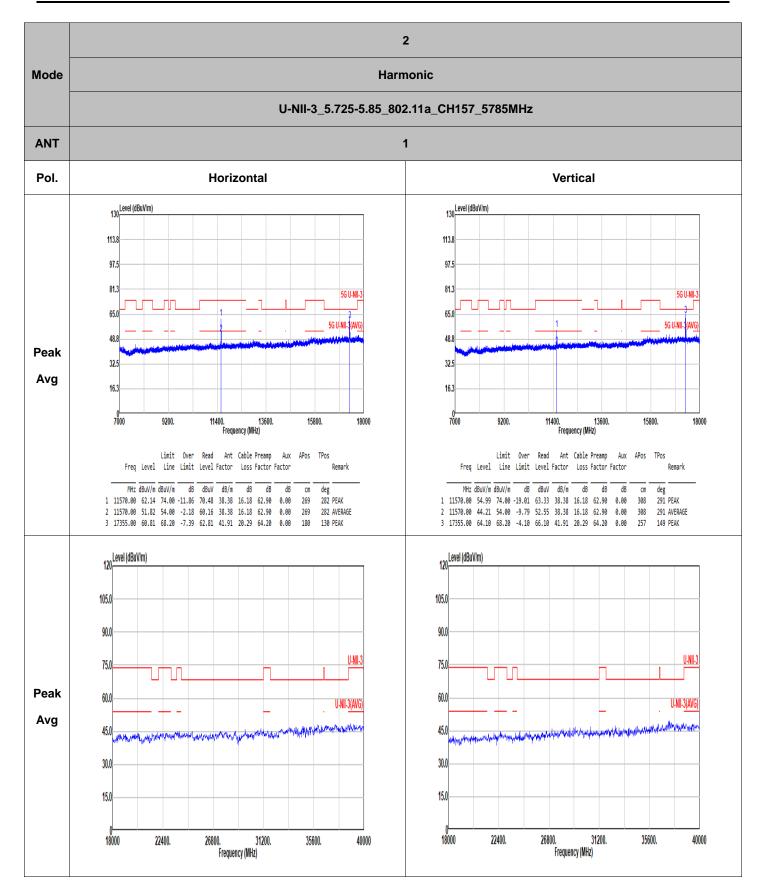




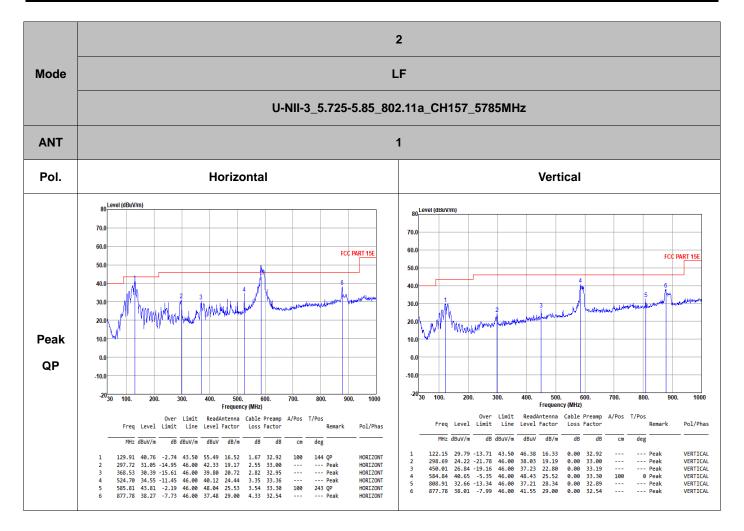




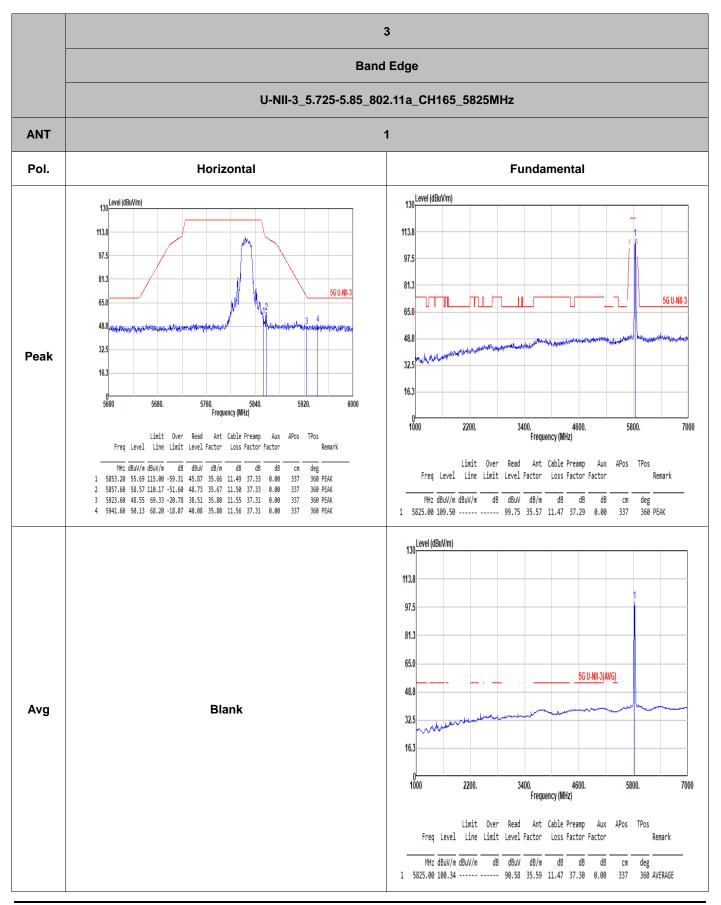






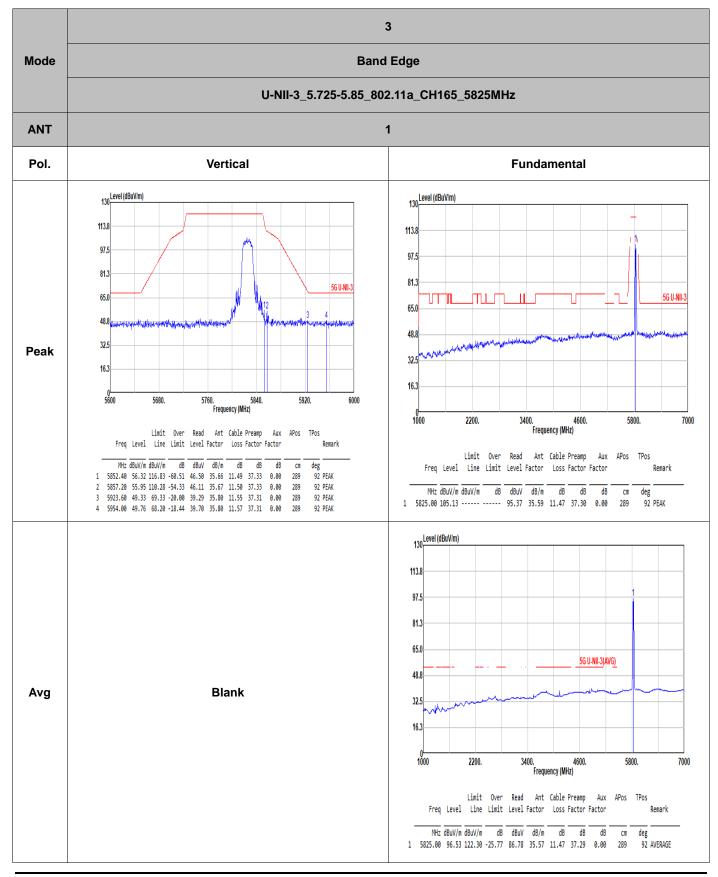






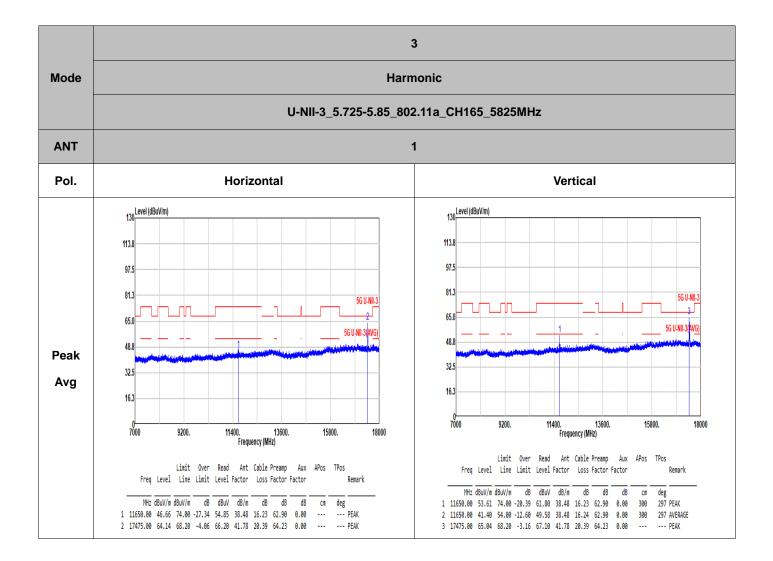
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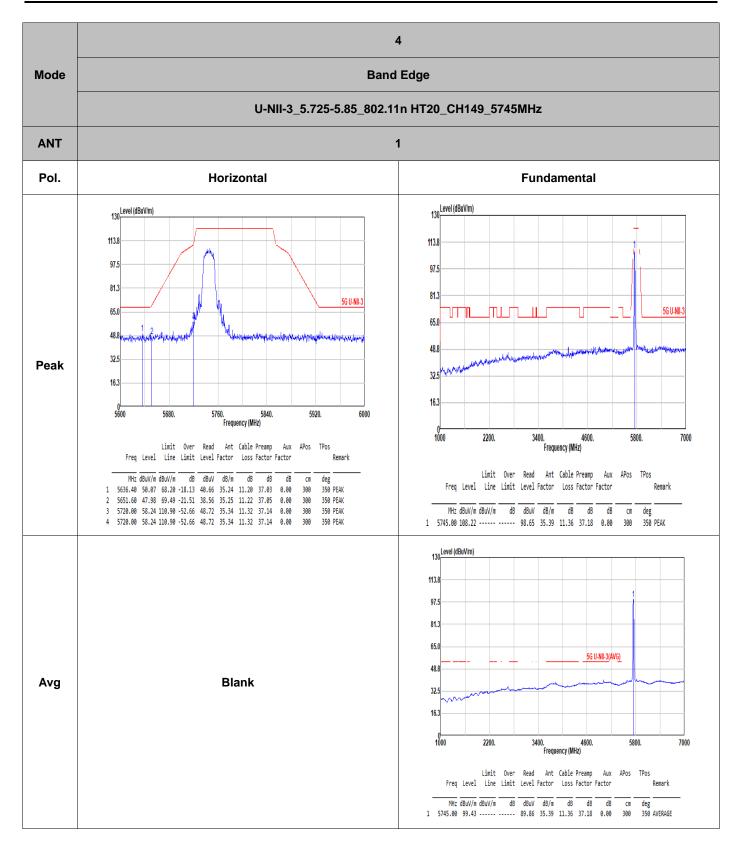


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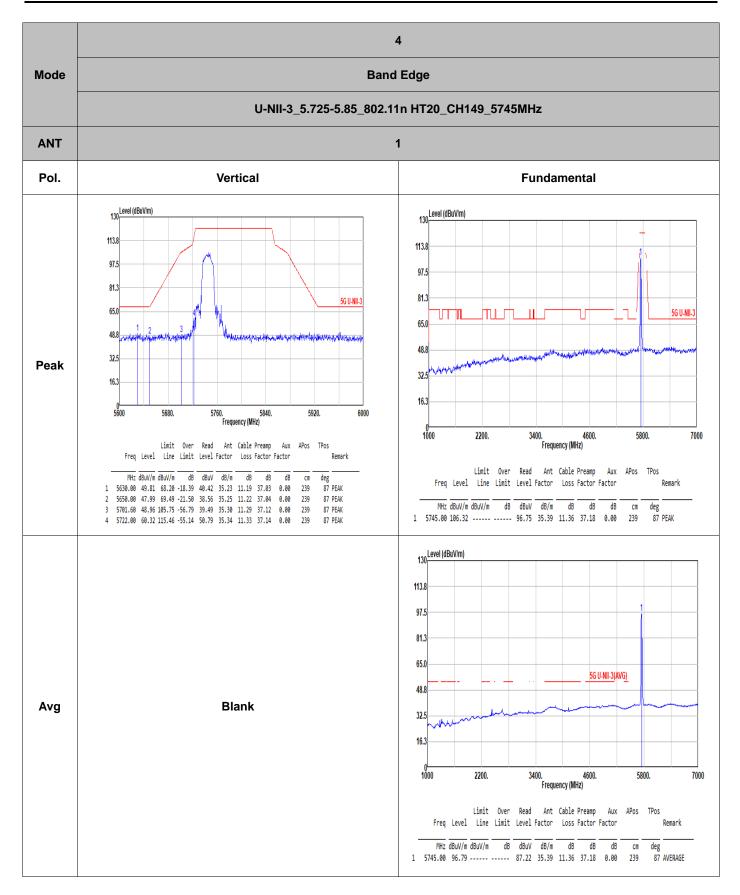




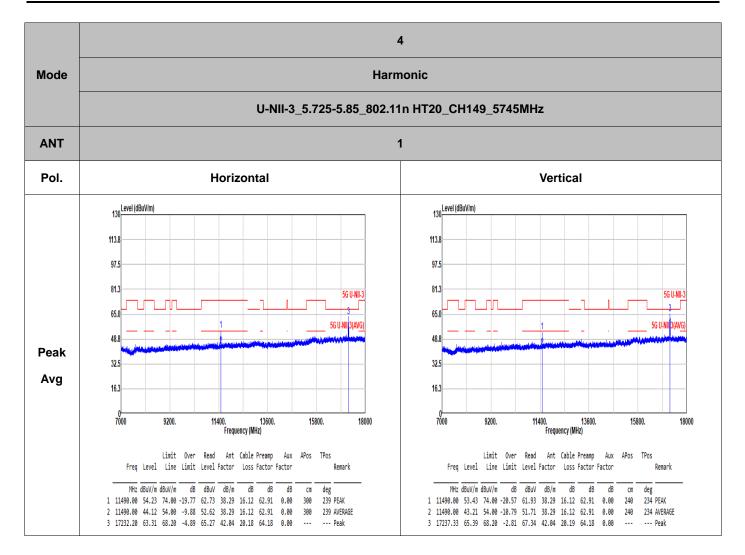




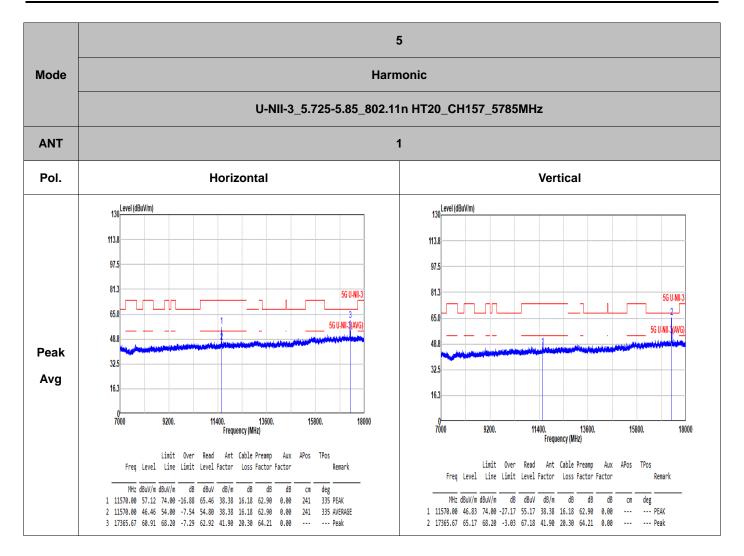




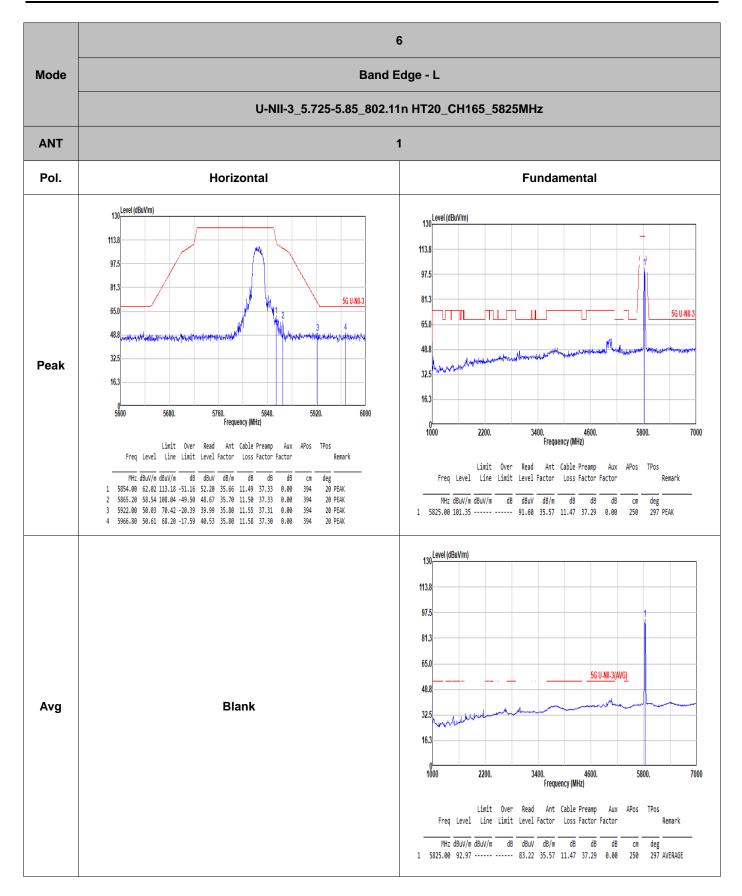




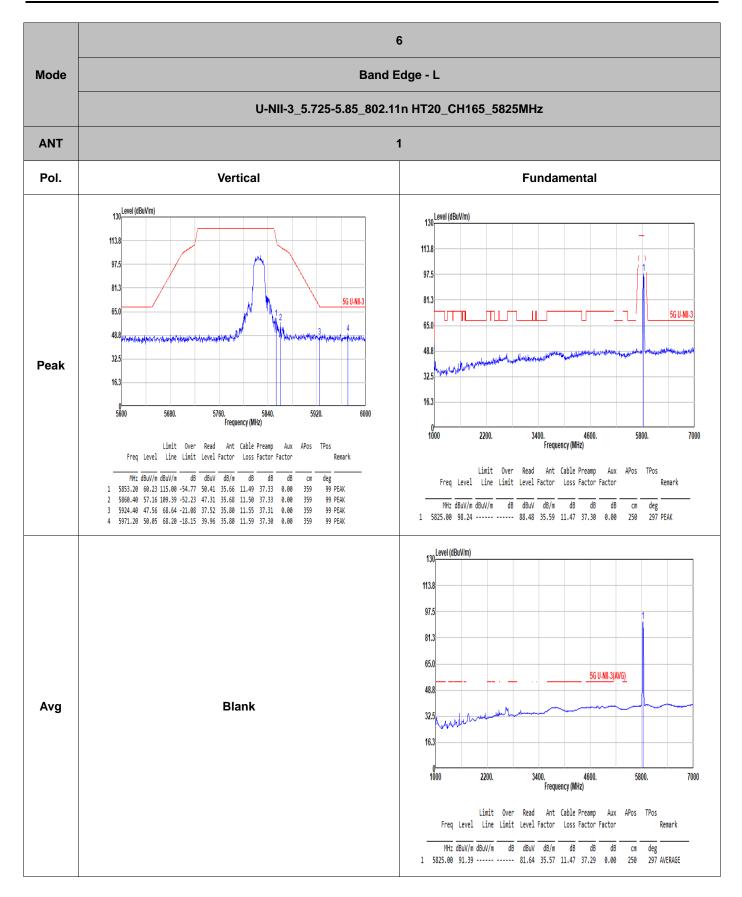




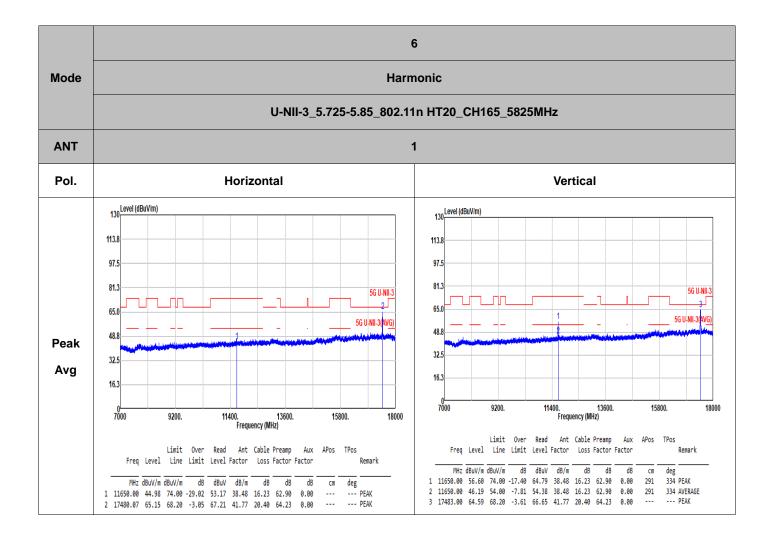




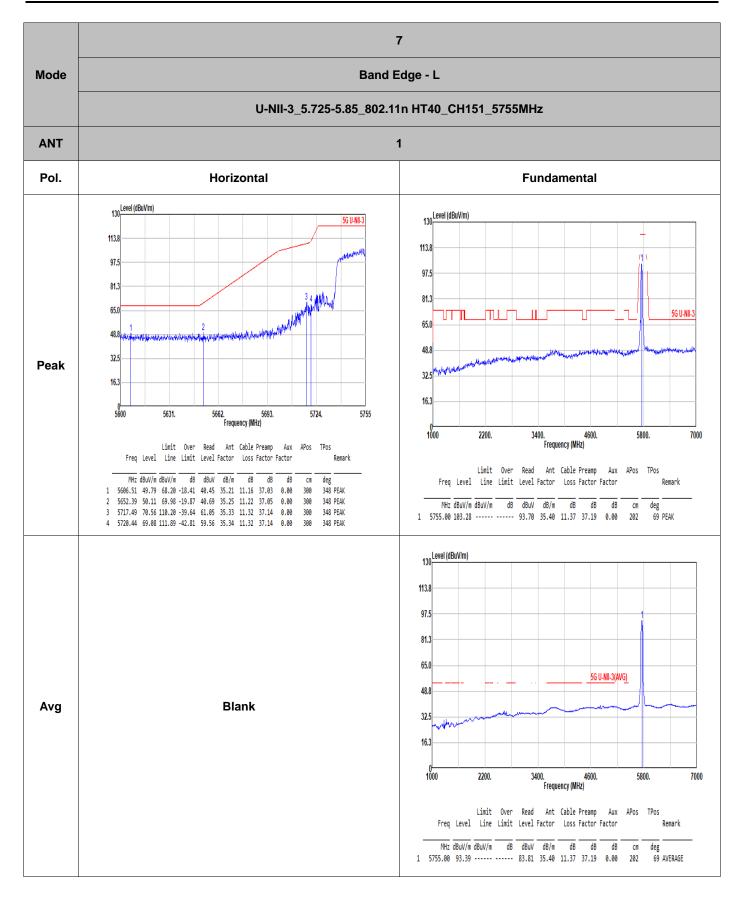




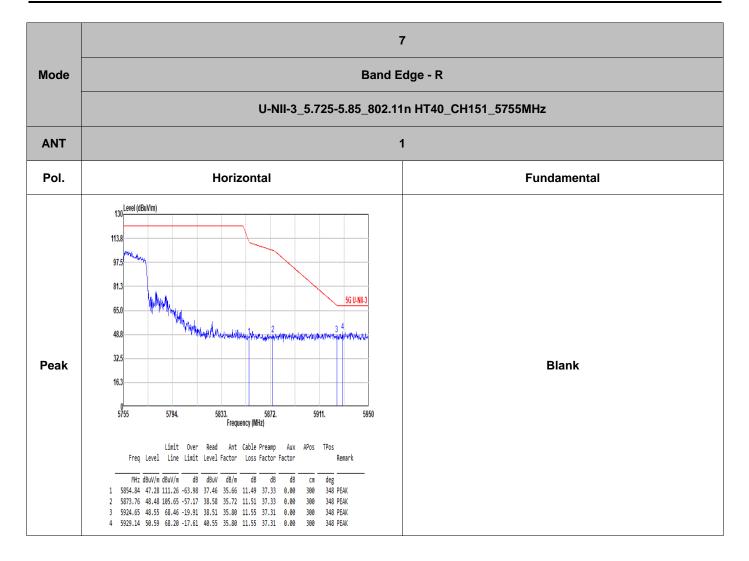




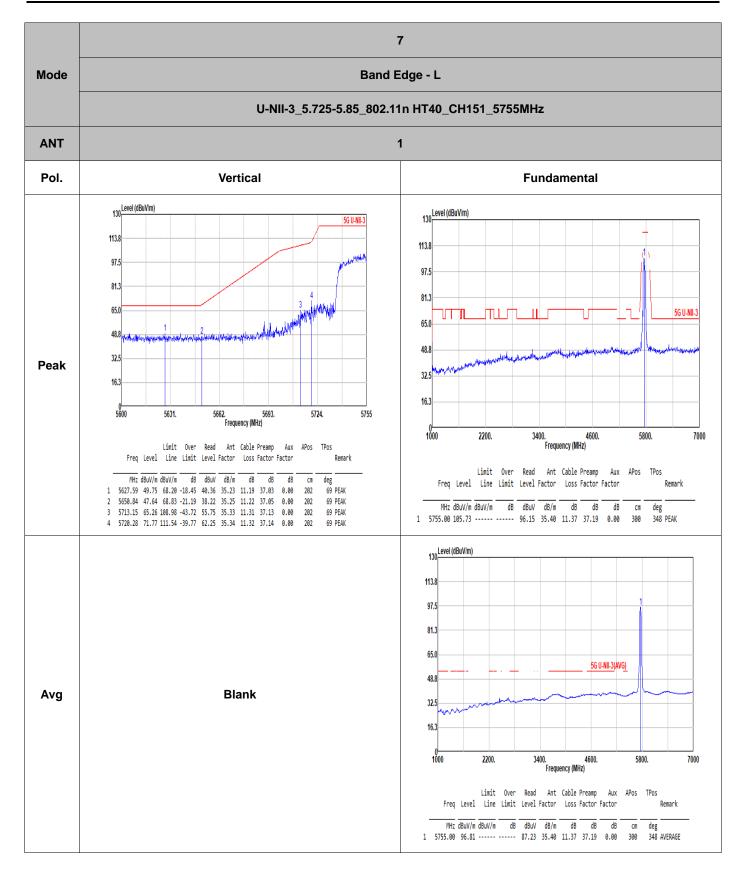




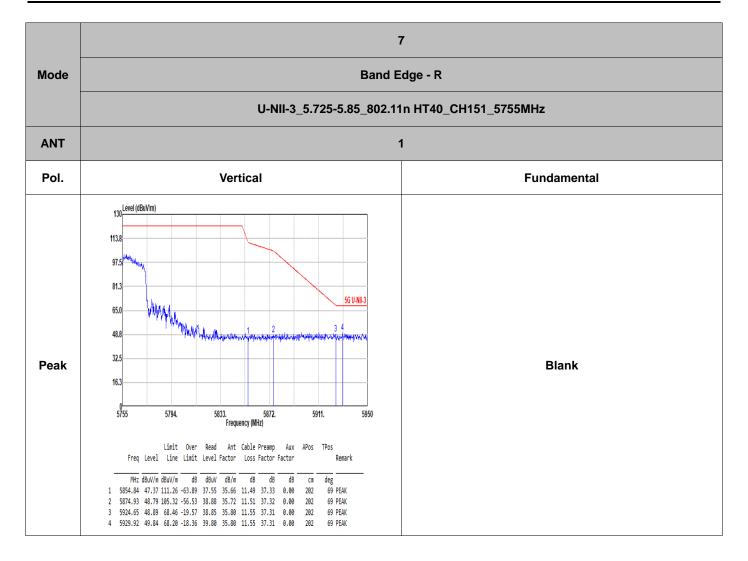




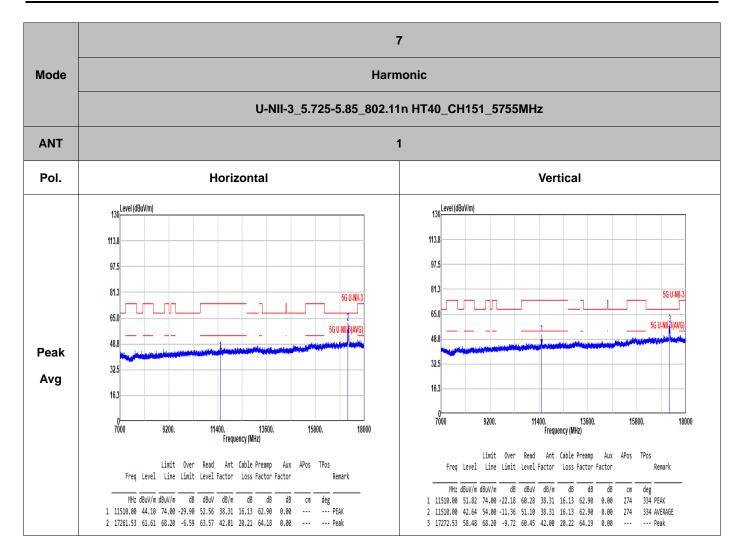




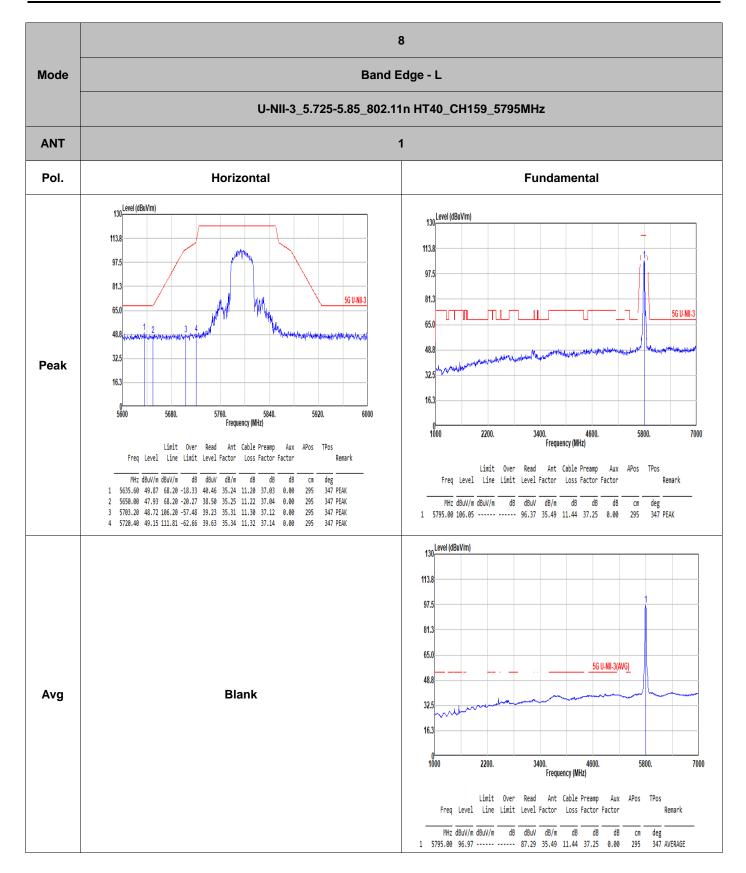




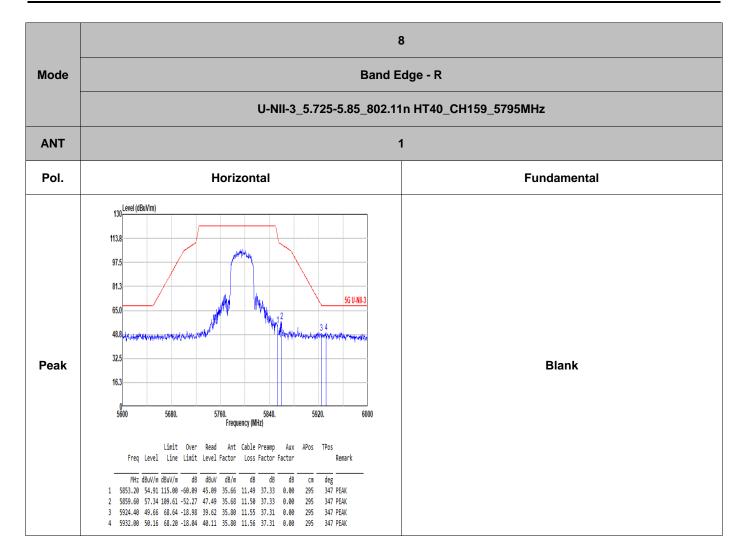




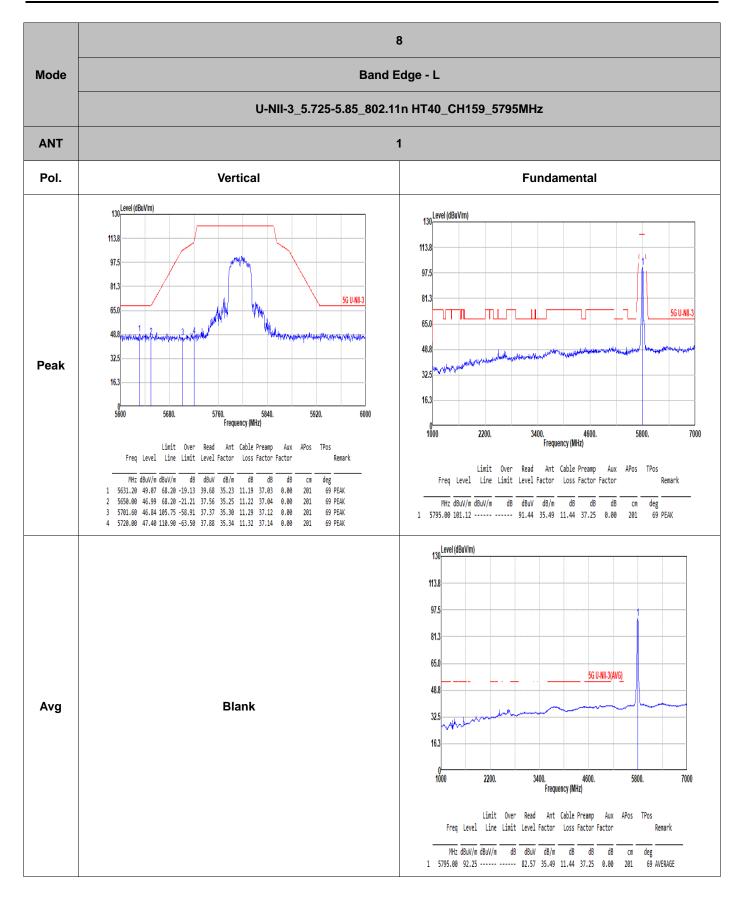




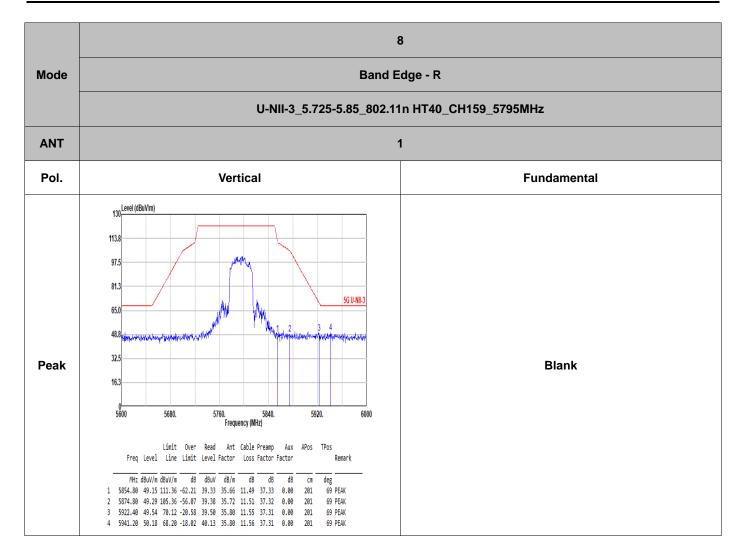




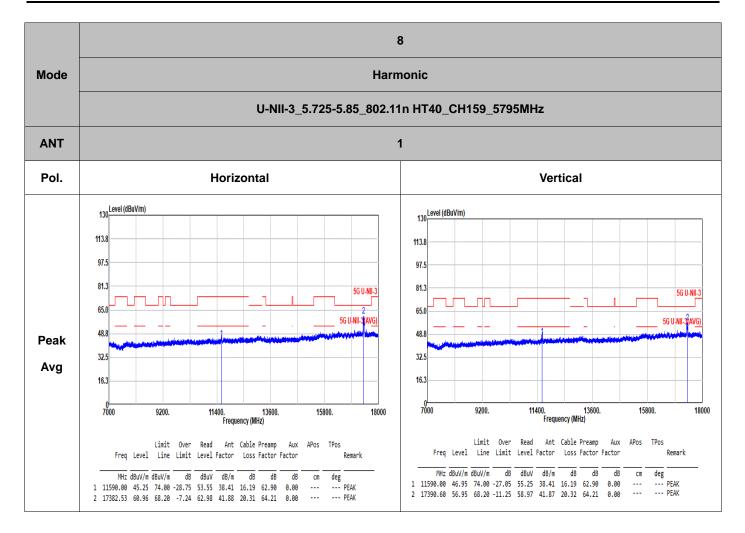














Appendix D. Duty Cycle Plots

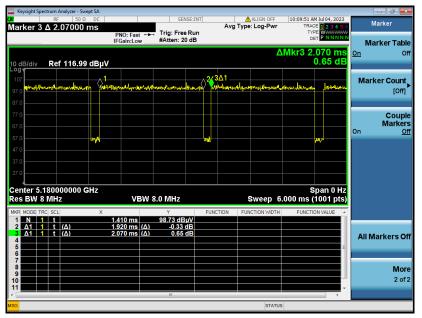
Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
802.11a	92.19	2.065	0.484	0.51KHz
802.11n HT20	92.75	1.92	0.521	0.56KHz
802.11n HT40	84.86	0.942	1.062	1.1KHz

802.11a

Keysight Spectrum Analyzer - Swept SA				
× 50 Ω DC Marker 3 Δ 2.24000 ms	PNO: Fast	Avg Type: Log-Pwr	05:52:43 AM Jul 04, 2023 TRACE 1 2 3 4 5 6 TYPE WWWWWW DET P NNNNN	Marker
10 dB/div Ref 106.99 dBµV	IFGain:Low Atten: 10 dB	ΔΙ		Marker Table On Off
97.0 yeared Content of the set of	$243\Delta 1$	allerhennetheldense van de Hjaldelfer	Adacord Sharphoton for	Marker Count
77.0				Couple Markers On Off
47.0 47.0 37.0 27.0			(Mary)	
17.0 Center 5.180000000 GHz Res BW 8 MHz	VBW 8.0 MHz	Sweep 5.	Span 0 Hz 000 ms (1001 pts)	
IKR MODE TRC SCL X		TION FUNCTION WIDTH	FUNCTION VALUE	
$\begin{array}{c} 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ \end{array}$	2.240 ms (Δ) -0.44 dB		E	All Markers Of
7 8 9				More 2 of 2
11 				2 0.1



802.11n HT20



802.11n HT40

