

# CFR 47 FCC PART 15 SUBPART E CERTIFICATION TEST REPORT

For

**Amcrest 4MP Video Doorbell Camera** 

**MODEL NUMBER: AD410** 

PROJECT NUMBER: 4790425401-2.1

REPORT NUMBER: 4790425401-2.1-2

FCC ID: ZZ2-AD410

**ISSUE DATE: Jun 30, 2022** 

Prepared for

**Amcrest Technologies LLC.** 

Prepared by

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# **Revision History**

Rev.	Issue Date	Revisions	Revised By
V0	06/30/2022	Initial Issue	



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#### 1. ATTESTATION OF TEST RESULTS

**Applicant Information** 

Company Name: Amcrest Technologies LLC.

Address: 16727 Park Row Dr, Houston, TX 77084, United States Of America

**Manufacturer Information** 

Company Name: Amcrest Technologies LLC.

Address: 16727 Park Row Dr, Houston, TX 77084, United States Of America

**EUT Description** 

Product Name: Amcrest 4MP Video Doorbell Camera

Model Number: AD410
Model Difference N/A
Sample Number: 4991737
Data of Receipt Sample: May 31,2022

Date Tested: May 31, 2022– Jun. 30, 2022

APPLICABLE STANDARDS			
STANDARD TEST RESULTS			
CFR 47 FCC PART 15 SUBPART E	PASS		



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Summary of Test Results						
Clause	Test Items	FCC Rules	Test Results			
1	6dB/26dB Bandwidth	FCC 15.407 (a)&(e)	PASS			
2	Conducted Output Power	FCC 15.407 (a)	PASS			
3	Power Spectral Density	FCC 15.407 (a)	PASS			
4	Radiated Bandedge and Spurious Emission	FCC 15.407 (b) FCC 15.209 FCC 15.205	PASS			
5	Conducted Emission Test for AC Power Port	FCC 15.207	PASS			
6	Frequency Stability	FCC 15.407 (g)	PASS			
7	Dynamic Frequency Selection	FCC 15.407 (h)	PASS			
8	Antenna Requirement	FCC 15.203	PASS			

#### Remark:

Laboratory Leader

Prepared By:	Checked By:	
Tom Tang	Leon Wu	
Tom Tang Project Engineer	Leon Wu Senior Project Engineer	
Approved By:		
Chris Zhong		
Chris Zhong		

<sup>1)</sup> The measurement result for the sample received is <Pass> according to < ANSI C63.10-2013, CFR 47 FCC Part 2, CFR 47 FCC Part 15 E> when <Accuracy Method>

<sup>2)</sup> It is a slave device without radar detection.



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#### 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, CFR 47 FCC Part 2, CFR 47 FCC Part 15, KDB 789033 D02 v02r01, KDB414788 D01 Radiated Test Site v01r01, KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02 and 905462 Client Without DFS New Rules v01r02.

#### 3. FACILITIES AND ACCREDITATIO

Test Location	UL-CCIC Company Limited, EMC&RF Lab
Address	No. 2, Chengwan Road, Suzhou Industrial Park, Suzhou 215122, China
Accreditation Certificate	A2LA (Certificate No.: 4829.01)  UL-CCIC COMPANY LIMITED has been assessed and proved to be in compliance with A2LA.  FCC (FCC Designation No.: CN1247)  UL-CCIC COMPANY LIMITED has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules.  IC (IC Designation No.: 25056 CAB No.: CN0073)  UL-CCIC COMPANY LIMITED has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules.

Remark 1: All tests measurement facilities use to collect the measurement data are located at No. 2, Chengwan Road, Suzhou Industrial Park, Suzhou 215122, People's Republic of China

Remark 2: For below 30MHz, lab had performed measurements at test anechoic chamber and comparing to measurements obtained on an open field site. These measurements below 30MHz had been correlated to measurements performed on an OFS based on KDB 414788.

Remark 3: The test anechoic chamber in UL-CCIC COMPANY LIMITED had been calibrated and compared to the open field sites and the test anechoic chamber is shown to be equivalent to or worst case from the open field site.



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#### 4. CALIBRATION AND UNCERTAINTY

#### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations and is traceable to recognize national standards.

#### 4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Item	Uncertainty			
Uncertainty for Conduction emission test	3.1dB			
Uncertainty for Radiation Emission test (include Fundamental emission) (9KHz-30MHz)	3.4dB			
Uncertainty for Radiation Emission test (include Fundamental emission) (30MHz-1GHz)	3.4dB			
Uncertainty for Radiation Emission test (1GHz to 40GHz) (include Fundamental	3.7dB (1GHz-18Gz)			
emission)	4.0dB (18GHz-26.5Gz)			
,	4.8dB (26.5GHz-40Gz)			
Remark: This uncertainty represents an expanded uncertainty expressed at				

Remark: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.



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# 5. EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF EUT

Product Name:	Amcrest 4MP Video Doorbell Camera				
Model No.:	AD410				
Operating Frequency:	IEEE 802.11b/g/n(HT20): 2412MHz to 2462MHz IEEE 802.11n(HT40): 2422MHz to 2452MHz IEEE 802.11a/n/ac 20MHz:5180MHz to 5240MHz, 5260MHz to 5320MHz, 5500MHz to 5720MHz, 5745MHz to 5825MHz IEEE 802.11n/ac 40MHz: 5190MHz to 5230MHz, 5270MHz to 5310MHz, 5510MHz to 5710MHz, 5755MHz-5795MHz IEEE 802.11ac 80MHz: 5210MHz, 5290MHz, 5530MHz to 5690MHz, 5775MHz				
	This report just i	ncluding 5G WIFI part.			
Type of Modulation:	IEEE for 802.11a/n: OFDM (BPSK, QPSK,16QAM, 64QAM) IEEE for 802.11ac: OFDM (BPSK, QPSK,16QAM, 64QAM, 256QAM)				
Channels Step:	Channels with 5MHz step				
Test software of EUT:	SecureCRT (ma	nufacturer declare)			
Antenna Type:	PCB Integral antenna				
Antenna Gain:	UNII-1 BAND	Antenna1: 1.31 dBi			
	OMII-T BAND	Antenna2: 2.63 dBi			
	UNII-2A BAND	Antenna1: 1.92 dBi			
	ONII-ZA BAND	Antenna2: 2.83 dBi			
	UNII-2C BAND	Antenna1: 2.99 dBi			
	ONII 20 BAND	Antenna2: 2.33 dBi			
	UNII-3 BAND Antenna1: 1.91 dBi				
	Antenna2: -1.41 dBi				
	Remark: This data is provided by customer and our lab isn't responsible for this data				
Test Voltage	AC120V/ 60Hz				



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# **5.2. MAXIMUM OUTPUT POWER**

#### **UNII-1 BAND**

IEEE Std. 802.11	Frequency (MHz)	Maximum Average Conducted Power (dBm)			Max Average EIRP (dBm)		
	, , ,	Ant 1	Ant 2	Total	Ant 1	Ant 2	Total
а	5150 ~ 5250	15.06	/	/	16.37	/	/
ac VHT20		13.53	3.77	13.88	14.84	6.40	18.88
ac VHT40		14.28	4.76	14.74	15.59	7.39	19.74
ac VHT80		13.66	4.17	14.12	14.97	6.80	19.12

## **UNII-2A BAND**

IEEE Std. 802.11	Frequency	Maximum Average Conducted Power (dBm)			
	(MHz)	Ant 1 Ant 2		Total	
a	5250 ~ 5350	14.85	/	/	
ac VHT20		13.83	0.53	14.03	
ac VHT40		14.64	2.09	14.87	
ac VHT80		13.57	1.14	13.81	

#### **UNII-2C BAND**

IEEE Std. 802.11	Frequency	Max Power (dBm)				
	(MHz)	Ant 1	Ant 1 Ant 2 Total			
а	5470 ~ 5725 -	16.05	/	/		
ac VHT20		15.22	-1.00	15.32		
ac VHT40		15.85	0.21	15.97		
ac VHT80		14.84	-0.88	14.62		

#### **UNII-3 BAND**

IEEE Std. 802.11	Frequency	Max Power (dBm)		
	(MHz)	Ant 1 Ant 2 T		Total
а	5725 ~ 5850 -	14.65	/	/
ac VHT20		13.86	-3.73	13.90
ac VHT40		14.28	-2.65	14.34
ac VHT80		13.17	-4.14	13.25

Remark: Only the antenna1 can transmit at the 11a mode.



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# **5.3. CHANNEL LIST**

UNII-1		UNII-1		UNII-1	
(For Bandwidth = 20 MHz)		(For Bandwidth = 40 MHz)		(For Bandwidth = 80 MHz)	
Channel	Channel Frequency (MHz)		Frequency (MHz)	Channel	Frequency (MHz)
36	5180	38	5190	42	5210
40	5200	46	5230		
44	5220				
48	5240				

UNII-2A		UNII-2A		UNII-2A	
(For Bandwidth = 20 MHz)		(For Bandwidth = 40 MHz)		(For Bandwidth = 80 MHz)	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
52	5260	54	5270	58	5290
56	5280	62	5310		
60	5300				
64	5320				

UNII-2C (For Bandwidth = 20 MHz)		UNII-2C (For Bandwidth = 40 MHz)		UNII-2C (For Bandwidth = 80 MHz)	
(For Bandwidt	$\ln = 20 \text{ MHz})$	(For Bandwid	itn = 40 MHz	(For Bandwid	th = 80 MHz
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
100	5500	102	5510	106	5530
104	5520	110	5550	122	5610
108	5540	118	5590	138	5690
112	5560	126	5630		
116	5580	134	5670		
120	5600	142	5710		
124	5620				
128	5640				
132	5660				
136	5680				
140	5700				
144	5720				

UNII-3 (For Bandwidth = 20 MHz)		UNII-3 (For Bandwidth = 40 MHz)		UNII-3 (For Bandwidth = 80 MHz)	
(For Bandwidi	$\ln = 20 \text{ N/Hz}$	(For Bandwid	I(I) = 40  MHz	(For Bandwid	I(I) = 80  IVIHZ
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
149	5745	151	5755	155	5775
153	5765	159	5795		
157	5785				
161	5805				
165	5825				



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# **5.4. TEST CHANNEL CONFIGURATION**

UNII-1 Test Channel Configuration						
IEEE Std.	Test Channel Number	Frequency				
802.11a	CH 36(Low Channel), CH 40(MID Channel), CH 48(High Channel)	5180 MHz, 5200 MHz, 5240 MHz				
802.11n HT20	CH 36(Low Channel), CH 40(MID Channel), CH 48(High Channel)	5180 MHz, 5200 MHz, 5240 MHz				
802.11n HT40	CH 38(Low Channel), CH 46(High Channel)	5190 MHz, 5230 MHz				
802.11ac VHT20 CH 36(Low Channel), CH 40(MID Channel), CH 48(High Channel)		5180 MHz, 5200 MHz, 5240 MHz				
802.11ac VHT40	CH 38(Low Channel), CH 46(High Channel)	5190 MHz, 5230 MHz				
802.11ac VHT80 CH 42(Low Channel)		5210 MHz				

UNII-2A Test Channel Configuration						
IEEE Std.	Test Channel Number	Frequency				
802.11a	CH 52(Low Channel), CH 56(MID Channel), CH 64(High Channel)	5260 MHz, 5280 MHz, 5320 MHz				
802.11n HT20	CH 52(Low Channel), CH 56(MID Channel), CH 64(High Channel)	5260 MHz, 5280 MHz, 5320 MHz				
802.11n HT40	CH 54(Low Channel), CH 62(High Channel)	5270 MHz, 5310 MHz				
802.11ac VHT20 CH 52(Low Channel), CH 56(MID Channel), CH 64(High Channel)		5260 MHz, 5280 MHz, 5320 MHz				
802.11ac VHT40	CH 54(Low Channel), CH 62(High Channel)	5270 MHz, 5310 MHz				
802.11ac VHT80 CH 58(Low Channel)		5290 MHz				

UNII-2C Test Channel Configuration						
IEEE Std.	Test Channel Number	Frequency				
802.11a	CH 100(Low Channel), CH 116(MID Channel), CH 140(MID Channel), CH 144(High Channel)	5500 MHz, 5580 MHz, 5700 MHz,5720 MHz				
802.11n HT20	CH 100(Low Channel), CH 116(MID Channel), CH 140(MID Channel), CH 144(High Channel)	5500 MHz, 5580 MHz, 5700 MHz,5720 MHz				
802.11n HT40	CH 102(Low Channel), CH 110(MID Channel), CH 134(MID Channel), CH 142(High Channel)	5510 MHz, 5550 MHz, 5670 MHz, 5710 MHz,				
802.11ac VHT20	CH 100(Low Channel), CH 116(MID Channel), CH 140(MID Channel), CH 144(High Channel)	5500 MHz, 5580 MHz, 5700 MHz,5720 MHz				
802.11ac VHT40	CH 102(Low Channel), CH 110(MID Channel), CH 134(MID Channel), CH 142(High Channel)	5510 MHz, 5550 MHz, 5670 MHz, 5710 MHz,				
802.11ac VHT80	CH 102(Low Channel), CH 122(MID Channel) CH 138(High Channel)	5530 MHz, 5610 MHz, 5690 MHz				



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UNII-3 Test Channel Configuration							
IEEE Std.	Test Channel Number	Frequency					
802.11a	CH 149(Low Channel), CH 157(MID Channel), CH 165(High Channel)	5745 MHz, 5785 MHz, 5825 MHz					
802.11n HT20	CH 149(Low Channel), CH 157(MID Channel), CH 165(High Channel)	5745 MHz, 5785 MHz, 5825 MHz					
802.11n HT40	CH 151(Low Channel), CH 159(High Channel)	5755MHz, 5795MHz					
802.11ac VHT20 CH 149(Low Channel), CH 157(MID Channel), CH 165(High Channel)		5745 MHz, 5785 MHz, 5825 MHz					
802.11ac VHT40	CH 151(Low Channel), CH 159(High Channel)	5755 MHz, 5795 MHz					
802.11ac VHT80 CH 155(Low Channel)		5775 MHz					



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## 5.5. DESCRIPTION OF AVAILABLE ANTENNAS

Antonno	Frequency	Antenna	Maximum Antenna Gain	Directional Gain (dBi)
Antenna	Antenna Band		(dBi)	MIMO Mode
1	UNII-1	Patch	1.31 dBi	5.00
2	UNII-1	Patch	2.63 dBi	5.00
1	UNII-2A	Patch	1.92 dBi	F 40
2	UNII-2A	Patch	2.83 dBi	5.40
1	UNII-2C	Patch	2.99 dBi	F 60
2	UNII-2C	Patch	2.33 dBi	5.68
1	UNII-3	Patch	1.91 dBi	2.44
2	UNII-3	Patch	-1.41 dBi	3.41

IEEE Std. 802.11	Transmit and Receive Mode	Description	
а	⊠1TX, 1RX	ANT 1 can be used as transmitting/receiving antenna.	
n HT20	⊠2TX, 2RX	ANT 1, 2 can be used as transmitting/receiving antenna.	
n HT40	⊠2TX, 2RX	ANT 1, 2 can be used as transmitting/receiving antenna.	
ac VHT20	⊠2TX, 2RX	ANT 1, 2 can be used as transmitting/receiving antenna.	
ac VHT40	⊠2TX, 2RX	ANT 1, 2 can be used as transmitting/receiving antenna.	
ac VHT80	⊠2TX, 2RX	ANT 1, 2 can be used as transmitting/receiving antenna.	

Remark: 1. Only 802.11n and 802.11ac modes can support for SISO and MIMO transmission, and for the modes of 11a only the antenna1 is working.

2. 2.4 GHz WLAN& 5 GHz WLAN can't transmit simultaneously. (Declared by customer.)

Remark: MIMO Mode Directional gain= 10 log [(10<sup>G1/20</sup> + 10<sup>G2/20</sup>)<sup>2</sup>/N<sub>ANT</sub>]

G<sub>ANT</sub>: Average of the Antenna Gain

N<sub>ANT</sub>: Antenna numbers



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# 5.6. THE WORSE CASE POWER SETTING PARAMETER

The Worse Case Power Setting Parameter				
Test Software	Secure CRT			

UNII-1

<u>UNII-1</u>						
Pato	Channel	Test Software Setting Value				
raic	Onamici	ANT 1	ANT 2			
	36	default	/			
6M	40	default	/			
	48	default	/			
MCS0	36	default	default			
	40	default	default			
	48	default	default			
MCS0	38	default	default			
	46	default	default			
MCS0	42	default	default			
	MCS0	Rate Channel  36 40 48 36 MCS0 40 48 36 MCS0 40 48 48 48	Rate         Channel         Test Software           ANT 1         36         default           6M         40         default           48         default           36         default           MCS0         40         default           48         default           48         default           48         default           46         default			

**UNII-2A** 

UNII-ZA							
IEEE Std. 802.11	Rate	Channel	Test Software Setting Value				
1EEE 3td. 802.11	Nate	Charmer	ANT 1	ANT 2			
		52	default	/			
а	6M	60	default	/			
		64	default	/			
	MCS0	52	default	default			
ac VHT20		60	default	default			
		64	default	default			
00 V/UT40	MCS0	54	default	default			
ac VHT40		62	default	default			
ac VHT80	MCS0	58	default	default			



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**UNII-2C** 

ONII-2C						
IEEE Std. 802.11	Rate	Channel	Test Softwar	e Setting Value		
ILLE Std. 802.11	Nate	Gridililei	ANT 1	ANT 2		
		100	default	/		
a	6M	116	default	/		
a	Olvi	140	default	/		
		144	default	/		
	MCS0	100	default	default		
ac VHT20		116	default	default		
ac viiizo		140	default	default		
		144	default	default		
	MCS0	102	default	default		
ac VHT40		118	default	default		
ac viii40	IVICOU	134	default	default		
		142	default	default		
		106	default	default		
ac VHT80	MCS0	122	default	default		
		138	default	default		

UNII-3

<u>Ottir v</u>							
IEEE Std. 902 11	Doto	Channal	Test Software Setting Value				
IEEE Std. 802.11	Rate	Channel	ANT 1	ANT 2			
		149	default	/			
а	6M	157	default	/			
		165	default	/			
	MCS0	149	default	default			
ac VHT20		157	default	default			
		165	default	default			
ac VHT40	MCS0	151	default	default			
ac vn 140	MCSU	159	default	default			
ac VHT80	MCS0	155	default	default			

Remark: Since 802.11ac VHT20/VHT40 modes are different from 802.11n HT20/HT40 only in control messages, so all the tests are performed on the worst case (802.11ac VHT20/802.11ac VHT40) mode between these 4 modes and only the worst data is recorded in this report.



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#### 5.7. DESCRIPTION OF TEST SETUP

#### **SUPPORT EQUIPMENT**

Item	Equipment	Brand Name	Model Name	Description
1	Laptop	ThinkPad	E590	N/A
2	SD Card	N/A	N/A	Supply by UL Lab
3	Fixed Frequency Board	N/A	N/A	Supply by Customer
4	Power Adapter	MASS POWER	ADS-12AM- 12 12012- EPCU	INPUT:100-240V~, 50/60Hz, 0.3A OUTPUT:5.0V1.0A

## **I/O PORT**

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
1	USB	USB to TTL	USB	100cm Length (Supply by UL Lab)	N/A

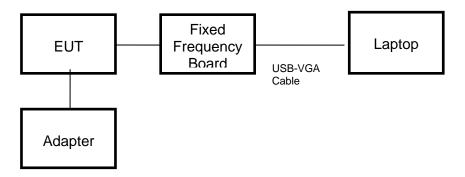
#### **ACCESSORY**

Item	Accessory	Brand Name	Model Name	Description
1	N/A	N/A	N/A	N/A

#### **TEST SETUP**

The EUT can work in an engineer mode with a software through a PC.

## **SETUP DIAGRAM FOR TESTS**



Remark: The EUT has been built one Micro SD card during the testing

Form-ULID-008536-8 V1.0



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# 5.8. MEASURING INSTRUMENT AND SOFTWARE USED

	Conducted Emissions (Instrument)							
Used	Equipment	Manufacturer	Model No.		Serial No.	Upper Last Cal.	Last Cal.	Next Cal.
V	EMI Test Receiver	R&S	ESR	13	126700	2020-12-05	2021-12-04	2022-12-03
V	Two-Line V- Network	R&S	ENV2	216	126701	2020-12-05	2021-12-04	2022-12-03
				Soft	ware			
Used	Des	cription		Ма	nufacturer	Name	Version	
$\checkmark$	Test Software for C	Conducted distu	ırbance		R&S	EMC32	Ver. 9.25	
		Ra	diated E	miss	ions (Instrum	nent <b>)</b>		
Used	Equipment	Manufacturer	Model	No.	Serial No.	Upper Last Cal.	Last Cal.	Next Cal.
$\overline{\checkmark}$	Spectrum Analyzer	Keysight	N901		155727	2021-05-09	2022-04-09	2023-04-08
$\overline{\square}$	EMI test receiver	R&S	ESR:	26	126703	2020-12-05	2021-12-04	2022-12-03
<b>V</b>	Receiver Antenna (9kHz-30MHz)	Schwarzbeck	FMZB <sup>2</sup>	1513	155456	2018-06-15	2021-06-03	2024-06-02
$\square$	Receiver Antenna (30MHz-1GHz)	SunAR RF Motion	JB1	1	177821	2019-01-28	2022-01-18	2025-01-17
V	Receiver Antenna (1GHz-18GHz)	R&S	HF90	07	126705	2018-01-29	2022-02-28	2025-02-27
V	Receiver Antenna (18GHz-26.5GHz)	ETS	3160-	-10	155565	2019-01-05	2021-07-15	2024-07-14
V	Pre-amplification (To 18GHz)	Compliance Direction System Inc.	PAP-10 50		177825	2021-03-18	2022-03-01	2023-02-28
V	Pre-amplification (To 26.5GHz)	R&S	SCU-2	26D	135391	2021-12-05	2022-12-04	2022-12-03
<b>V</b>	Band Reject Filter	Wainwright	WRCJ 2350-2 2483 2533.5-4	400- .5-	1	2021-05-09	2022-04-09	2023-04-08
	Highpass Filter	Wainwright	WHKX 2700-3 18000-4	000-	2	2021-05-09	2022-04-09	2023-04-08
				Soft	ware			
Used	Descr	•		anufac		Name	Version	
$\overline{\mathbf{V}}$	Test Software for R	adiated disturba		onsce		36-RSE	4.0.0.1	
			Oth	er ins	truments	Hpport oct		
Used	Equipment	Manufacturer	Model No.		Serial No.	Upper Last Cal.	Last Cal.	Next Cal.
$\overline{\square}$	Spectrum Analyzer	Keysight	N901	0B	155368	2021-05-09	2022-04-09	2023-04-08
V	Power Meter	Keysight	U2021	XA	155370	2021-05-09	2022-04-09	2023-04-08



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# 6. ANTENNA PORT TEST RESULTS

# **6.1. TEST ENVIRONMENT**

Environment Parameter	Selected Values During Tests
Relative Humidity	59.3%
Atmospheric Pressure:	102kPa
Temperature	24.6°C



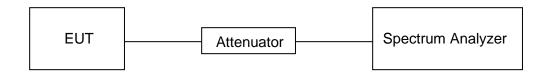
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#### 6.2. ON TIME AND DUTY CYCLE

## **LIMITS**

None; for reporting purposes only.

#### **TEST SETUP**



## **RESULTS**

#### **ANTENNA 1**

Mode	On Time (msec)	Period (msec)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/T Minimum VBW (KHz)	Final setting For VBW (KHz)
11a	2.06	2.19	0.941	94.1	0.26	0.49	1
11ac HT20	1.92	2.04	0.941	94.1	0.26	0.52	1
11ac HT40	0.95	1.04	0.913	91.3	0.40	1.05	2
11ac HT80	0.46	0.53	0.868	86.8	0.61	2.17	3

#### Remark:

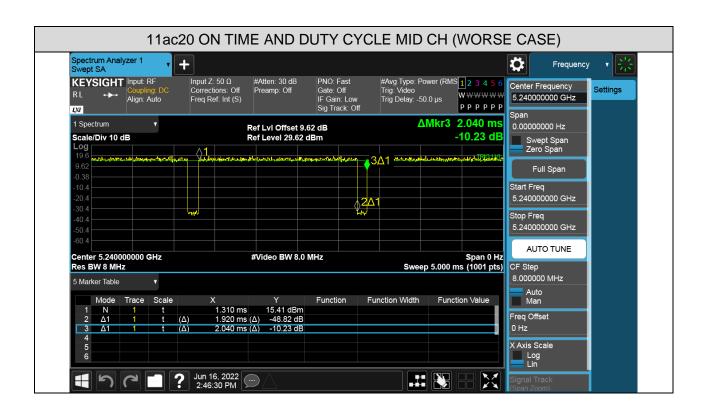
- 1. Duty Cycle Correction Factor=10log (1/x).
- 2. Where: x is Duty Cycle (Linear)
- 3. Where: T is On Time
- 4. If that calculated VBW is not available on the analyzer then the next higher value should be used.
- 5. Antenna 1 and Antenna 2 has the same duty cycle, only Antenna 1 data show here.

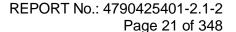


11a ON TIME AND DUTY CYCLE MID CH (WORSE CASE) Input Z: 50 Ω Corrections: Off Freq Ref: Int (S) #Atten: 30 dB Preamp: Off #Avg Type: Power (RMS 1 2 3 4 Trig: Video KEYSIGHT Input: RF PNO: Fast Gate: Off Center Frequency Settings  $\mathbf{w}_{wwww}$ 5.200000000 GHz IF Gain: Low Sig Track: Off Trig Delay: -50.0 µs Align: Auto PPPPPP LXI ΔMkr3 2.190 ms 1 Spectrum 0.00000000 Hz Ref LvI Offset 9.62 dB 0.31 dB Scale/Div 10 dB Ref Level 29.62 dBm Swept Span Zero Span Full Span Start Freq 5.200000000 GHz 5.200000000 GHz AUTO TUNE Center 5.200000000 GHz Res BW 8 MHz Span 0 Hz Sweep 6.000 ms (1001 pts) #Video BW 8.0 MHz CF Step 8.000000 MHz 5 Marker Table Auto Man Trace Scale Function Function Width Function Value 16.14 dBm 1.268 dB 1.100 ms 2.060 ms (Δ) Ν Δ1 Freq Offset (Δ) 2.190 ms (Δ) 0.3146 dB 0 Hz X Axis Scale Log Lin

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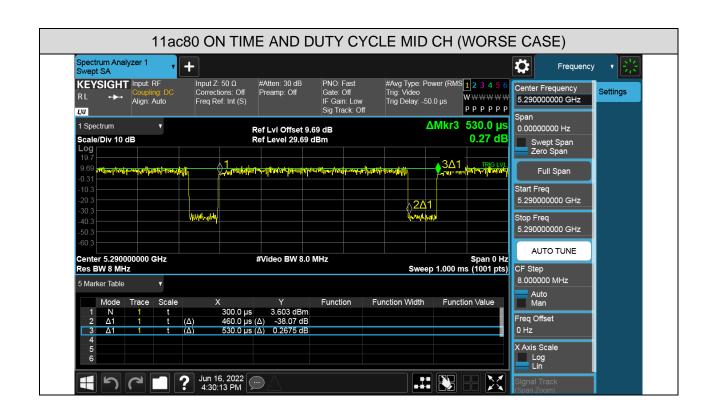




11ac40 ON TIME AND DUTY CYCLE MID CH (WORSE CASE) Spectrum Analyzer 1 Swept SA  $\Diamond$ + Frequency #Avg Type: Power (RMS 1 2 3 4 5 ( Input Z: 50 Ω Corrections: Off Freq Ref: Int (S) KEYSIGHT Input: RF #Atten: 30 dB PNO: Fast Center Frequency Gate: Off IF Gain: Low Sig Track: Off Preamp: Off Settings wwwwv Align: Auto 5.230000000 GHz Trig Delay: -50.0 µs PPPPPP LXI ΔMkr3 1.040 ms 1 Spectrum 0.00000000 Hz Ref LvI Offset 9.62 dB Ref Level 29.62 dBm -0.12 dB Scale/Div 10 dB Swept Span Zero Span <u>2Δ</u> 3Δ1 <u>πη</u>μείους Full Span Start Freq 5.230000000 GHz Stop Freq 5.230000000 GHz AUTO TUNE Center 5.230000000 GHz #Video BW 8.0 MHz Span 0 Hz Sweep 2.000 ms (1001 pts) Res BW 8 MHz CF Step 8.000000 MHz 5 Marker Table Auto Man Function Function Width Function Value Mode Trace Scale 7.824 dBm 1.752 dB 650.0 μs 950.0 μs (Δ) Freq Offset 1.040 ms (Δ) -0.1176 dB 0 Hz X Axis Scale Log

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## 6.3. 6dB/26dB BANDWIDTH

#### **LIMITS**

CFR 47 FCC Part15, Subpart E					
Test Item	Limit	Frequency Range (MHz)			
26 dB Emission Bandwidth	For reporting purposes only.	5150 ~ 5250			
26 dB Emission Bandwidth	For reporting purposes only.	5250 ~ 5350			
26 dB Emission Bandwidth	For reporting purposes only.	5470 ~ 5725			
6 dB Emission Bandwidth	The minimum 6 dB emission bandwidth shall be 500 kHz.	5725 ~ 5850			

#### **TEST PROCEDURE**

Refer to KDB 789033 D02 General U-NII Test Procedures New Rules v02r01 section II.C1. for 26 dB Emission Bandwidth; section II.C2. for 6 dB Emission Bandwidth; section II.D. for 99 % Occupied Bandwidth.

Connect the EUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	Peak
IRRW	For 6 dB Emission Bandwidth: RBW=100 kHz For 26 dB Emission bandwidth: approximately 1 % of the EBW.
IV/BW/	For 6 dB Bandwidth: ≥ 3*RBW For 26 dB Bandwidth: > RBW
Trace	Max hold
Sweep	Auto couple

- a) Use the 99 % power bandwidth function of the instrument, allow the trace to stabilize and report the measured bandwidth.
- b) Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6/26 dB relative to the maximum level measured in the fundamental emission.



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#### Calculation for 6dB Bandwidth of UNII-3 Straddle Channel:

For Example: Fundamental frequency: 5720 MHz

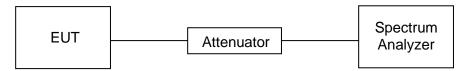
6 dB BW: 16.44 MHz

FL: 5711.76 MHz FH: 5728.2 MHz

Turning Frequency: 5725 MHz

6 dB Bandwidth of UNII-3 band Portion = 5728.2-5725=3.2 MHz

# **TEST SETUP**



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# **RESULTS TABLE ANTENNA 1 (WORST-CASE CONFIGURATION)**

## 1) 26 dB Emission Bandwidth Part:

1) 26 dB Emission Bandwidth Part:								
Test Mode	Antenna	Channel	26dB EBW [MHz]	FL[MHz]	FH[MHz]	Verdict		
		5180	20.640	5169.760	5190.400	PASS		
		5200	20.600	5189.600	5210.200	PASS		
		5240	20.640	5229.520	5250.160	PASS		
		5260	20.280	5249.960	5270.240	PASS		
		5280	21.000	5269.400	5290.400	PASS		
		5320	20.840	5309.480	5330.320	PASS		
		5500	23.760	5488.440	5512.200	PASS		
11A	Ant1	5580	21.800	5568.840	5590.640	PASS		
		5700	21.160	5689.160	5710.320	PASS		
		5720	20.720	5709.440	5730.160	PASS		
		5720_UNII-2C	15.560	5709.440	5725.000	PASS		
		5720_UNII-3	5.160	5725.000	5730.160	PASS		
		5745	20.560	5734.560	5755.120	PASS		
		5785	20.720	5774.600	5795.320	PASS		
		5825	20.560	5814.560	5835.120	PASS		
		5180	21.360	5169.200	5190.560	PASS		
		5200	21.520	5189.160	5210.680	PASS		
		5240	20.960	5229.520	5250.480	PASS		
		5260	20.920	5249.520	5270.440	PASS		
		5280	20.600	5269.680	5290.280	PASS		
		5320	21.000	5309.560	5330.560	PASS		
	Ant1	5500	21.440	5489.320	5510.760	PASS		
11AC20		5580	22.680	5569.080	5591.760	PASS		
MIMO		5700	20.840	5689.520	5710.360	PASS		
		5720	21.200	5709.240	5730.440	PASS		
		5720_UNII-2C	15.760	5709.240	5725.000	PASS		
		5720_UNII-3	5.440	5725.000	5730.440	PASS		
		5745	20.960	5734.600	5755.560	PASS		
		5785	21.320	5774.240	5795.560	PASS		
		5825	20.880	5814.480	5835.360	PASS		
		5190	42.960	5168.320	5211.280	PASS		
		5230	42.480	5208.480	5250.960	PASS		
		5270	42.560	5248.640	5291.200	PASS		
		5310	43.280	5288.160	5331.440	PASS		
		5510	56.880	5488.800	5545.680	PASS		
11AC40		5550	43.760	5528.640	5572.400	PASS		
MIMO	Ant1	5670	42.880	5648.400	5691.280	PASS		
		5710	43.280	5688.480	5731.760	PASS		
		5710_UNII-2C	36.520	5688.480	5725.000	PASS		
		5710_UNII-3	6.760	5725.000	5731.760	PASS		
		5755	42.720	5733.640	5776.360	PASS		
		5795	42.880	5773.560	5816.440	PASS		
		5210	82.080	5169.840	5251.920	PASS		
		5290	81.600	5248.560	5330.160	PASS		
		5530	82.240	5489.360	5571.600	PASS		
11AC80		5610	81.600	5569.200	5650.800	PASS		
MIMO	Ant1	5690	81.440	5649.200	5730.640	PASS		
IVIIIVIO		5690_UNII-2C	75.800	5649.200	5725.000	PASS		
		5690_UNII-3	5.640	5725.000	5730.640	PASS		
		5775	82.400	5733.400	5815.800	PASS		
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Remark: The two antennas had been tested, but only the worst data was recorded in the report.



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## 2) 6dB Minimum Emission Bandwidth

Test Mode	Antenna	Channel	6db EBW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11A	Ant1	5745	16.360	5736.800	5753.160	0.5	PASS
		5785	16.280	5776.840	5793.120	0.5	PASS
		5825	16.280	5816.840	5833.120	0.5	PASS
11AC20 MIMO	Ant1	5745	17.040	5736.480	5753.520	0.5	PASS
		5785	17.040	5776.360	5793.400	0.5	PASS
		5825	16.800	5816.600	5833.400	0.5	PASS
11AC40	Ant1	5755	35.760	5737.080	5772.840	0.5	PASS
MIMO		5795	35.440	5777.400	5812.840	0.5	PASS
11AC80 MIMO	Ant1	5775	75.200	5737.400	5812.600	0.5	PASS

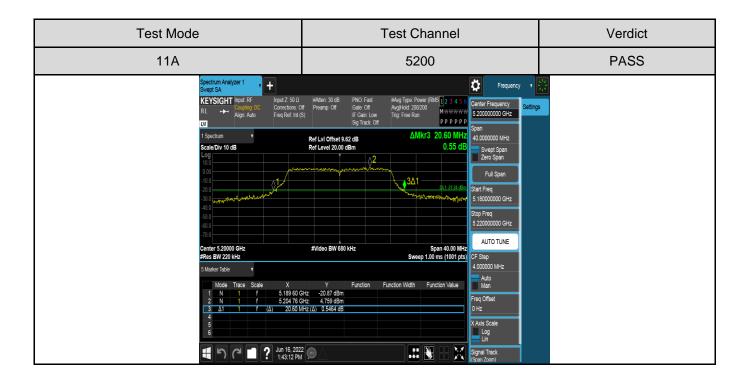
Remark: The two antennas had been tested, but only the worst data was recorded in the report.

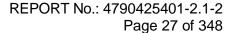


**Test Graphs** 

1) For 26 dB Emission Bandwidth Part:





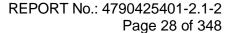




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Test Mode

Test Channel

Verdict

11A

5280

PASS

PASS

Return Analyzer 1

\*\*Test Channel

Test Channel

Test Channel

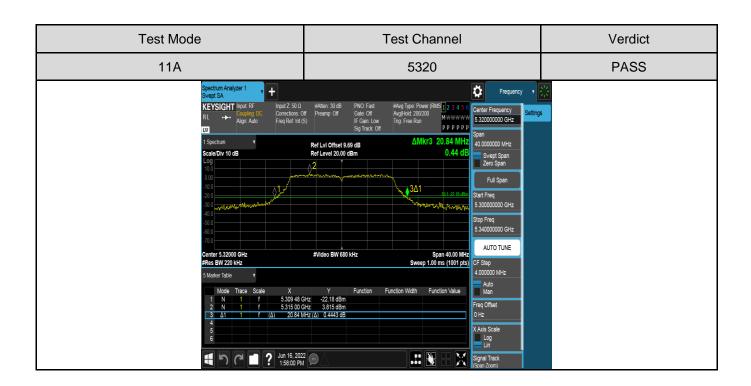
Test Channel

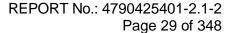
Test Channel

PASS

PA

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Test Mode

Test Channel

Verdict

11A

5500

PASS

Sector Analyzer 1

Sector 24

KEYSIGHT froe 8'F

RELEVED 10 B

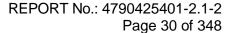
Rel Level 2010 dish

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Log Lin

III 🐺







Test Mode

Test Channel

Verdict

11A

5700

PASS

Section Analyzer 1

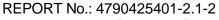
Ref Lord Solution Solu

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Log Lin

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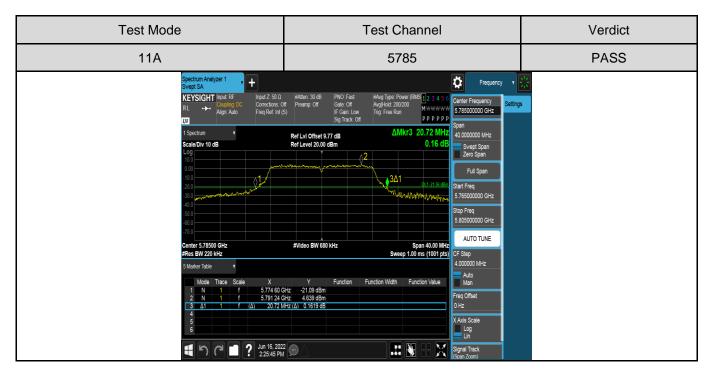


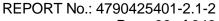




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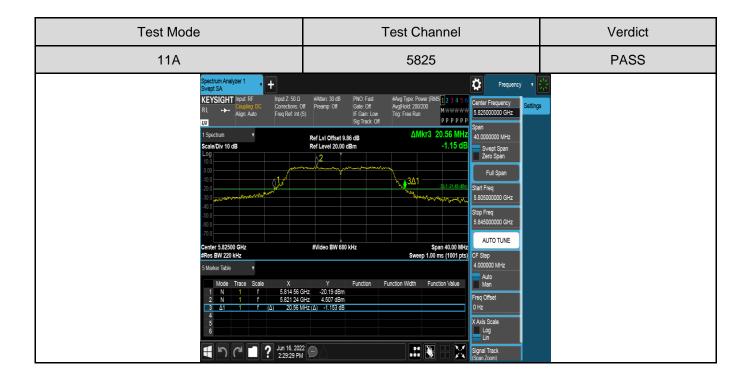




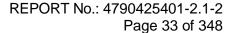




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Test Mode

Test Channel

Verdict

11AC20

5200

PASS

Spectrum Analyzer 1
Suept SA

KEVSIGHT Input IF
Correctors of Pearup Off Gete Off
Rel Appr Auto Fee Ret Int (S)
Fee Ret

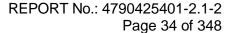
Auto Man Freq Offset 0 Hz X Axis Scale Log Lin

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#Video BW 680 kHz

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Test Mode

Test Channel

Verdict

11AC20

5260

PASS

Section Analyzer 1

Section Analyzer 1

Any Augustus 15

Section Analyzer 1

And Analyzer 1

And Analyzer 1

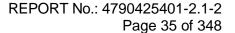
And And Analyzer 1

And

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1 5 C 7 Jun 16, 2022 2:49:04 PM

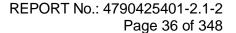






Verdict **Test Mode Test Channel** 11AC20 **PASS** 5320 ₽ ΔMkr3 21.00 MHz 0.41 d #Video BW 680 kHz Auto Man req Offset X Axis Scale Log Lin 1 5 C 7 Jun 16, 2022 55:41 PM ... 队







Test Mode

Test Channel

Verdict

11AC20

5580

PASS

Sector Analyzer 1

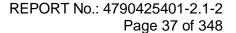
Sector Decreases City Passer 1

Experience Connectors City Passer 10 Connec

Log Lin

# ¥







Test Mode

Test Channel

Verdict

11AC20

5720

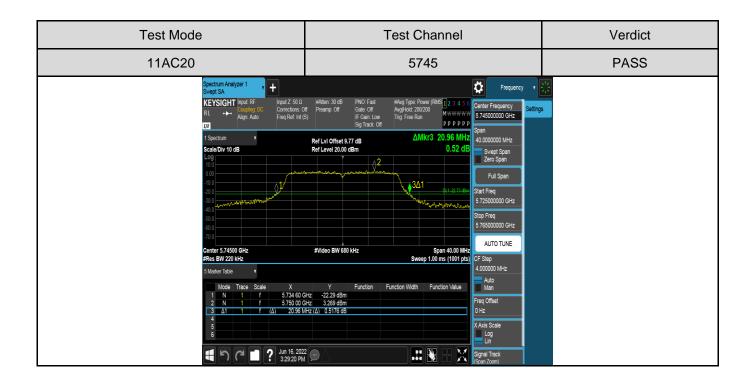
PASS

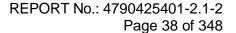
Section Analyzer 1

Head S. M. Section Convectors Of Peners of Magnetic Section Section Convectors Of Peners of Magnetic Section Section

# ¥

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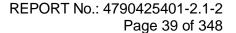










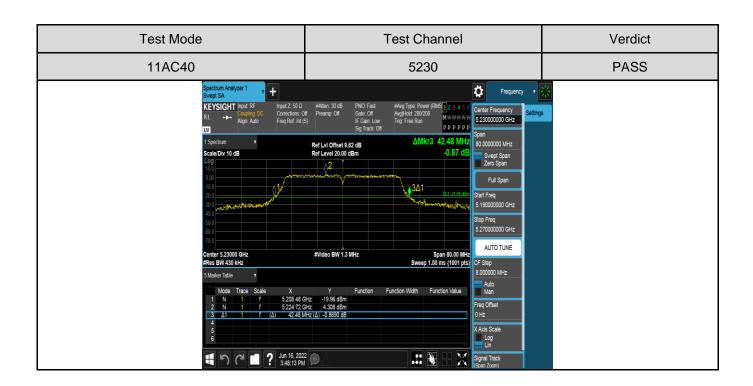


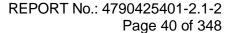


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Log Lin

# ¥







Test Mode

Test Channel

Verdict

11AC40

5270

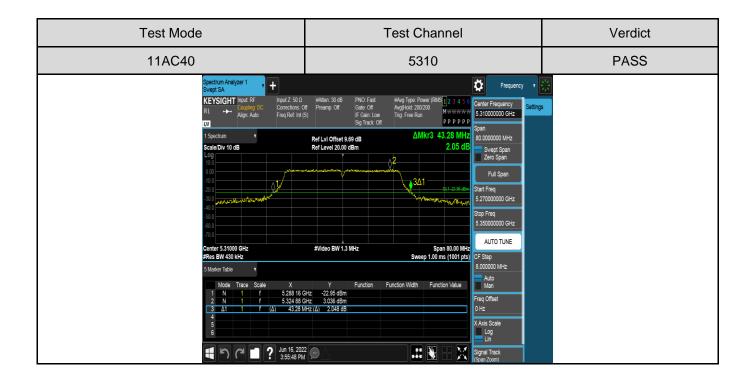
PASS

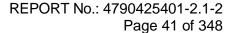
Section Analyzer1
Single Sale

KEYSIGHT from RF
KEYSIG

# ¥

1 5 C 7 Jun 16, 2022 5:52:23 PM







Test Mode

Test Channel

Verdict

11AC40

5510

PASS

Section Analyzer 1

Negri SA

KEYSIGHT Industry 1

Negri SA

Algo Adu Feld Rich (S)

Feld Rich (S)

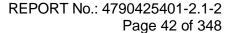
Ref Level 20 0.0 dBn

Auto Man Freq Offset 0 Hz X Axis Scale Log Lin

# ¥



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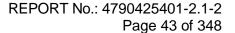


> Freq Offset 0 Hz X Axis Scale Log Lin

# ¥



1 5 C 7 Jun 16, 2022 5 4:07:31 PM





**Test Mode Test Channel** Verdict 11AC40 5755 **PASS** ₽ ΔMkr3 42.72 MHz Ref Lvi Offset 9.77 dB Ref Level 20.00 dBm -0.12 d AUTO TUNE #Video BW 1.3 MHz Auto Man req Offset X Axis Scale Log Lin Jun 16, 2022 (m) 4:16:34 PM # ¥

