

FCC 47 CFR PART 15 SUBPART C ISED RSS-210 ISSUE 11

TEST REPORT

FOR

57-71 GHz WIRELESS TRANSMITTER

MODEL NUMBERS: C420 / P421 / D621 / P621

FCC ID: 2AMP5-46211 IC: 22992-46211

REPORT NUMBER: R15397752-E1b

ISSUE DATE: 2024-10-30

Prepared for ALTOWAV INC 7801 E. BUSH LAKE RD. SUITE 300 MINNEAPOLIS, MN, 55439, USA

Prepared by UL LLC 12 LABORATORY DR. RESEARCH TRIANGLE PARK, NC 27709 USA TEL: (919) 549-1400



Revision History

Rev.	lssue Date	Revisions	Revised By
V1	2024-10-11	Initial Issue	Mike Antola
V2	2024-10-30	Misc. editorial updates	Mike Antola

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	Altowav Inc 7801 E. Bush Lake Rd., Suite 300 Minneapolis, MN, 55439, USA
EUT DESCRIPTION:	57-71 GHz Wireless Transmitter
MODEL:	D621 / C420 / P421 / P621
SERIAL NUMBER:	KB-C0-00-DA / KB-C0-01-02
SAMPLE RECEIPT DATE:	2024-08-20
DATES TESTED:	2024-08-23 to 2024-10-02

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Compliant
ISED RSS-210 Issue 11 Annex J	Compliant
ISED RSS-GEN Issue 5 + A1 + A2	Compliant

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document.

Approved & Released For UL LLC By:

Gia-piao Chin **Operations Leader** CONSUMER TECHNOLOGY DIVISION **UL LLC**

Prepared By:

Mirtiel 20

Mike Antola Staff Engineer CONSUMER TECHNOLOGY DIVISION **UL LLC**

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2020, FCC CFR 47 Part 2, FCC CFR 47 Part 15 Subpart C, RSS-GEN Issue 5 + A1 + A2, and RSS-210 Issue 11.

This report contains data provided by the applicant which can impact the validity of results. UL LLC is only responsible for the validity of results after the integration of the data provided by the customer.

Customer provided data includes:

1.) Antenna Gain (See section 5.3)

3. FACILITIES AND ACCREDITATION

UL LLC is accredited by A2LA, Cert. No. 751.06, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
	12 Laboratory Drive Research Triangle Park, NC 27709, U.S.A.	US0067	2180C	825374
\boxtimes	2800 Perimeter Dr., Suite B, Morrisville, NC 27560, U.S.A.		27265	

4. DECISION RULES AND MEASUREMENT UNCERTAINTY

4.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

4.2. **DECISION RULES**

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	U _{Lab}
Conducted Disturbance, 0.15 to 30 MHz	3.4
Radiated Emissions, 9 kHz - 30 MHz	2.9
Radiated Emissions, 30-1000 MHz	6.0
Radiated Emissions, 1-18 GHz	4.7
Radiated Emissions, 18-26 GHz	4.5
Radiated Emissions, 26-40 GHz	5.3
Radiated Emissions, 40-200 GHz	2.9

Uncertainty figures are valid to a confidence level of 95%.

4.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB) 36.5 dBuV + 18.7 dB/m + 0.6 dB - 26.9 dB = 28.9 dBuV/m

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided: Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.

36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a 60 GHz data communications radio. The models covered in this test report are C420, P421, D621, P621. Model differences are discussed in Section 5.5 and only the worst-case model was tested.

5.2. OUTPUT POWER

The antenna is integral thus radiated measurements are made. The EIRP was measured at the worst-case condition, thus the EIRP measurement conditions correspond to the maximum EUT antenna gain. Therefore the maximum antenna gain is used to calculate the Peak Conducted Output Power.

The highest peak output radiated power is 41.26 dBm (13.37 W) EIRP.

5.3. MANUFACTURER'S DESCRIPTION OF AVAILABLE ANTENNA

A single antenna array model has a maximum antenna gain of 21.36 dBi. The models included as part of this evaluation utilize a two antenna array configuration having equal gain. Thus, the total maximum antenna gain is 24.36 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was version 10.11.0.108.

The test utility software used during testing was QRCT, Version 4.0.211.0.

5.5. WORST-CASE CONFIGURATION AND MODE

All models utilize two antenna tile configuration. The only difference between models is the use of a different processor (i.e., non-RF related circuitry). Preliminary measurements were made it was determined that model D621 yielded worst-case results. As such, full testing was performed on model D621 only.

For in-band tests, each model was tested at all four supported channels. For spurious emissions in the frequency range of 40 – 110 GHz, testing was performed at the low, mid and high channels. For all other spurious emissions frequency ranges, testing was performed on the worst-case channel only (mid, Channel 2).

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6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List						
Description	Manufacturer	Model	Serial Number			
Desktop computer	Dell	D07S	12XG942			
Monitor	Viewsonic	VS15562	WAV2403G3834			
Keyboard	Microsoft	1031	7619804016525			
Mouse	Dell	MS111-P	-			
Ethernet switch	SSCEE	IG204	IG2042403096031			
POE for D621	Procet	AA01040	PT2411020850			
POE for C420	Procet	EN30GT	PT2411020857			

I/O CABLES

I/O Cable List							
Cable Port # of Identical Cable Type Cable Remarks					Remarks		
No		Ports		Length (m)			
1	Power	1	IEC	< 3	Power for desktop computer		
2	Power	1	IEC	< 3	Power for monitor		
3	Video	1	VGA	< 3	Video cable for desktop to monitor		
4	Ethernet	1	RJ45	> 3	Ethernet from PoE to EUT		
5	Ethernet	1	RJ45	> 3	Ethernet from Desktop to PoE		
6	Power	1	IEC	< 3	Power for PoE		

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TEST SETUP



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SETUP DIAGRAM FOR TESTS





7. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	0.009-30MHz				
135144	Active Loop Antenna	ETS-Lindgren	6502	2024-01-24	2025-01-24
	1-18 GHz				
89509	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2023-05-23	2025-05-23
	Gain-Loss Chains				
207638	Gain-loss string: 0.009-30MHz	Various	Various	2024-05-22	2025-05-22
207640	Gain-loss string: 1- 18GHz	Various	Various	2024-05-22	2025-05-22
	Receiver & Software				
197955	Spectrum Analyzer	Rohde & Schwarz	ESW44	2024-04-16	2025-04-16
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		21)
	Additional Equipment used				
241204	Environmental Meter	Fisher Scientific	15-077-963	2023-09-05	2025-09-05

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 4)

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 1)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	30-1000 MHz				
90629	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2024-01-30	2026-01-30
	Gain-Loss Chains				
91976	Gain-loss string: 25- 1000MHz	Various	Various	2024-05-08	2025-05-08
	Receiver & Software				
197954	Spectrum Analyzer	Rohde & Schwarz	ESW44	2024-03-05	2025-03-05
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		21)
	Additional Equipment used				
241205	Environmental Meter	Fisher Scientific	15-077-963	2023-09-05	2025-09-05

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Test Equipment Used - Line-Conducted Emissions / Frequency Stability (Morrisville – Conducted 1)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
CBL087	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3W06143-240	2024-04-04	2025-04-04
179892	Environmental Meter	Fisher Scientific	15-077-963	2024-08-12	2025-08-12
80391	LISN, 50-ohm/50-uH, 250uH 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50/250-25- 2-01	2024-08-01	2025-08-01
70374	EMI Test Receiver 9kHz- 7GHz	Rohde & Schwarz	ESCI 7	2024-07-30	2025-07-30
52859	Transient Limiter, 0.009- 100MHz	Electro-Metrics	EM-7600	2024-04-04	2025-04-04
PS214	AC Power Source	Elgar	CW2501M	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		1)
91432	LISN, 50-ohm/50-uH, 2- conductor, 25A (For support gear only.)	Solar Electronics	8012-50-R-24-BNC	NA	NA
207726	Temp/Humid Chamber	Thermotron	SM-32-8200	2024-01-12	2025-01-12
206203	Standard Gain Horn, 50- 75GHz	Custom Microwave Inc.	HO15R	2024-02-14	2025-02-28
206607	WR15 Downconverter	VDI	WR15.0SAX-F	2024-04-16	2025-04-30
206459	Spectrum Analyzer	Rohde & Schwarz	FSW50	2023-11-15	2024-11-15

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Test Equipment Used - mmWave Test Equipment (Morrisville - Chamber 3)

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	18-40 GHz				
204907	Horn Antenna, 18- 26.5GHz	Com Power	AH-826	2024-02-14	2025-02-28
204908	Horn Antenna, 26.5- 40GHz	Com Power	AH-640	2024-02-14	2025-02-28
240019	18-40GHz Amplifier	Amplical	AMP18G40-50	2024-03-05	2025-03-31
	40-50 GHz				
206209	Standard Gain Horn, 40-50GHz	Custom Microwave Inc.	HO22R	2024-02-14	2025-02-28
205910	Low Noise Amplifier	Eravant	SBL- 3335033040- 2222-E1	2024-03-14	2025-03-31
207949	Band Pass Filter	Eravant	SWF-4510460- 2F2F-B1	2024-03-14	2025-03-31
	50-75 GHz				
206203	Standard Gain Horn, 50-75GHz	Custom Microwave Inc.	HO15R	2024-02-14	2025-02-28
206607	WR15 Downconverter	VDI	WR15.0SAX-F	2024-04-16	2025-04-30
253266	Band Pass Filter	Eravant	SWF-53304330- 15-B1	2024-10-01	2025-10-01
	75-110 GHz				
206222	Standard Gain Horn, 75-110GHz	Custom Microwave Inc.	HO10R	2024-02-14	2025-02-28
207249	WR10 Downconverter	VDI	WR10.0SAX-F	2024-04-16	2025-04-30
205913	Low Noise Amplifier	Eravant	SBL- 7531142050- 1010-E1	2024-04-03	2025-04-30
	110-170 GHz				
206242	Standard Gain Horn, 110-170GHz	Custom Microwave Inc.	HO6R	2024-02-14	2025-02-28
206555	WR6.5 Downconverter	VDI	WR6.5SAX-F	2024-04-16	2025-04-30
205912	Low Noise Amplifier	Eravant	SBL- 1141741860- 0606-E1	2024-04-18	2025-04-30
	170-260 GHz				
206244	Standard Gain Horn, 170-260GHz	Custom Microwave Inc.	HO4R	2024-02-14	2025-02-28
206556	WR4.3 Downconverter	VDI	WR4.3SAX-F	2024-04-16	2025-04-30
	Receiver & Software				
206459	Spectrum Analyzer	Rohde & Schwarz	FSW50	2023-11-15	2024-11-15
mmWave	mmWave Software	UL	V	2022.7.29	
	Additional Equipment used				
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Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
207161	Signal Generator	Rohde and Schwarz	SMA100B	2024-07-11	2025-07-11
226395	Thermal Power Sensor	Rohde and Schwarz	NRP75WG	2024-01-09	2025-01-09
206568	Isolator, 50-75GHz	Mi-Wave	115V/385	NA	NA
206569	Diode Detector, 50- 75GHz	Mi-Wave	950V/385	NA	NA
239539	Environmental Meter	Fisher Scientific	15-077-963	2023-07-19	2025-07-19
208201	350 MHz High- Definition Oscilloscope	Teledyne Lecroy	HDO6034A	2023-12-21	2024-12-21
211004	200 MHz Low-Noise Voltage Amplifier	Femto	HVA-200M-40-B	NA	NA
211009	Signal Generator Extension Module, WR15 (50-75GHz)	VDI	WR15SGX	NA	NA

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8. SUMMARY TABLE

FCC Section	RSS Section	Test Description	Test Limit	Test Result
15.255 (e)	RSS-210 J.3.3 d) RSS-GEN 6.7	Occupied Bandwidth (6dB / 99%)	N/A	Compliant
15.255 (c) (1) (i)	RSS-210 J.3.3 a)	EIRP (non-FDS/Radar)	43 dBm (Peak) 40 dBm (Average)	Compliant
15.255 (e)	RSS-210 J.4 (b), J.4 (a)	Conducted Power (non-FDS/Radar)	500 mW (Peak)	Compliant
15.255 (d)	RSS-210 J.4, J.5	Spurious Emissions < 40GHz	FCC 15.209 RSS-Gen	Compliant
15.255 (d)	RSS-210 J.4, J.5	Spurious Emissions 40 – 200GHz	90 pW/cm ²	Compliant
15.255 (f)	RSS-210 J.6	Frequency Stability	Within Band	Compliant
15.255 (h)	RSS-210 J.7	Group installation	No Beam Forming / Phase Locking	Compliant

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9. APPLICABLE LIMITS AND TEST RESULTS

9.1. FAR-FIELD DISTANCE AND MEASUREMENT DISTANCE

The measurement distance is in the far field per formula $2D^2/\lambda$ where D is the largest dimension of the antenna.

For fundamental / band edge emissions, the largest far-field distance of either the EUT antenna or measurement antenna shall be used. In this case, the measurement antenna has the largest far-field distance. For above 18 GHz spurious emissions, the far-field distance shall be based on the measurement antenna. The EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest EIRP reading on the receive spectrum analyzer.

Frequency Range (GHz)	Wavelength (m)	Far Field Distance (m)	Measurement Distance Used (m)
18-26.5	0.0113	2.11	3
26.5-40	0.0075	1.65	3
40-50	0.0060	1.01	3
50-75	0.0040	0.66	3
75-110	0.0027	0.44	3
110-170	0.0018	0.29	3
170-200	0.0015	0.15	3

Radiated spurious emissions limits above 18 GHz are based on a 3-meter measurement distance. As such, testing from 18-200GHz was performed at 3-meters.

In-band testing was performed at a 3-meter distance, which was still in the far-field based on the maximum EUT / measurement antenna dimension.

Radiated power levels are investigated while the receive antenna was rotated through all angles to determine the worst-case polarization/positioning. The worse-case orientation of the EUT was with the front facing the RX antenna, which was polarized vertically. Refer to test setup photos exhibit for details.

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6 dB / 99% BANDWIDTHS 9.2.

REQUIREMENT

§15.255 (e) (2) / RSS-210 Clause J.3.3 d)

Devices other than field disturbance sensors/radars with an emission bandwidth of less than 100 megahertz must limit their peak transmitter conducted output power to the product of 500 mW times their emission bandwidth divided by 100 megahertz. For the purposes of this paragraph, emission bandwidth is defined as the instantaneous frequency range occupied by a steady state radiated signal with modulation, outside which the radiated power spectral density never exceeds 6 dB below the maximum radiated power spectral density in the band, as measured with a 100 kilohertz resolution bandwidth spectrum analyzer. The center frequency must be stationary during the measurement interval, even if not stationary during normal operation (e.g., for frequency hopping devices).

§RSS-GEN 6.7

The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

TEST PROCEDURE

The spectrum analyzer and external mixer are set up to measure the radiated output of the transmitter. Refer to C63.10-2020. Clause 9 for details.

TESTED BY

Employee IDs: 23854 Test Dates: 2024-08-27 Test Location: Chamber 3

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RESULTS

Model	Channel	Frequency (GHz)	Marker M3 (GHz)	Marker M2 (GHz)	6 dB Bandwidth (GHz)
	1	58.32	59.259	57.499	1.760
D601	2	60.48	61.263	59.856	1.407
D021	3	62.64	63.382	61.818	1.564
	4	64.80	65.540	63.895	1.645

Model	Channel	Frequency (GHz)	99% Bandwidth (GHz)
	1	58.32	2.078
De01	2	60.48	2.274
D021	3	62.64	2.324
	4	64.80	2.527

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6 dB BANDWIDTH

Ref Level 50	.00 dBm Offset	60.00 dB • RBV	₩ 100 kHz	de Auto Swoon	_	_	-		
TDF "RF" Inp: I	ExtMix V	52.4 ms - VBY	1 500 KHZ MIC	de Auto Sweep	0				1Dk May Auto ID
1 Frequency a	sweep			4					IPK Max Auto ID
40 dBm								-	
30 dBm									
0.0									
20 dBm									
10 dBm		01.3		5	N. 21 M	M1		43	
0 dBm	H1 -0.660 dBr	M2	Marry Martin	Mar Marken	homenon	anananan	manpanent		
-10 dBm		mark my very y					17	Minu me	
00 40	www							the Key	
and a stand when the second	mum								- market have an
-30 dBm									
-40 dBm							+		
CE 58.32 GH-			1001 pte		30	4.0 MHz/			Snan 3 24 CH
2 Marker Tab	le		1001 pt		52			_	- Span 5.2 r Griz
M1	1 Irc	X-Value 58.676 GHz	z	Y-Value 5.34 dBm		Function		Function	Result
M2 M3	1	57.4994 GHZ 59.2591 GHZ	- -	0.45 dBm 2.23 dBm					
	~						Measuring		2024-08-23 12:47:05
12:47:06 PM	08/23/2024								
MultiView	Enectrum	V 6d	R obw	Char	nnel 1				
MultiView Ref Level 50	Spectrum .00 dBm Offset	★ 6di	B obw	Char	nnel 1				•
MultiView Ref Level 50 TDF "RF" Inp:	Spectrum .00 dBm Offse SWT ExtMix V	 ★ 6dl ★ 6dl ★ 6dl ★ 88% ★ 88% ★ 88% ★ 98% ★ 98% 	B obw 3 V 100 kHz V 300 kHz Mo	Char	nnel 1				•
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 9	Spectrum .00 dBm Offset SWT ExtMix V Sweep	 ✗ 6dl action 60 ≤ 88% action 60 ≤	B obw 2 W 100 kHz W 300 kHz Mo	Char 99% obv de Auto Sweep				0	1Pk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 9 40 dBm-	Spectrum .00 dBm Offse SWT ExtMix V Sweep	★ 6dl 60.00 dB ● RBV 32.4 ms ● VBV	B obw 3 V 100 kHz V 300 kHz Mc	Char 99% obv Mde Auto Sweep	nnel 1			0	1Pk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency \$ 40 dBm	Spectrum 00 dBm Offsei SWT ExtMix V Weep	X 6dl 60.00 dB • RBV 32.4 ms • VBV	B obw 3 W 100 kHz V 300 kHz Mc	Char 99% obv				0	1Pk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 5 40 dBm	Spectrum .00 dBm Offse SWT ExtMix V Sweep	× 6dl 560,00 dB • RB 32.4 ms • VBV	B obw 3 V 100 kHz V V 300 kHz Mc	Char 99% obv				0	1Pk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 5 40 dBm- 30 dBm- 20 dBm-	Spectrum 00 dBm Offse SWT ExtMix V Sweep	 ★ 6dJ ≤ 60.00 dB ● RBV 32.4 ms ● VBV 	B obw X V 100 kHz V 300 kHz Mc	Char 99% obv de Auto Sweep			M3	0	1Pk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 9 40 dBm 30 dBm 20 dBm 10 dBm	Spectrum .00 dBm Offset SWT ExtMix V Sweep HI 9.290 dBm	 6dJ 60.00 dB 88 32.4 ms VBV 	B obw 2 W 100 kHz W W 300 kHz Mc	Char 99% obv de Auto Sweep			EM My My My My Al		1Pk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency S 40 d8m 30 d8m 20 d8m 10 d8m 0 d8m	Spectrum O0 dBm Offset SWT ExtMix V Weep HI 9.290 dBm	■ 6dl 60.00 dB ■ RBV 32.4 ms ■ VBV	B obw 2 V 100 kHz We V 300 kHz Me	Char 99% obv ade Auto Sweep			M3	A MAMALL	IPk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency \$ 40 dBm 30 dBm 20 dBm 10 dBm 0 dBm 40 dBm	Spectrum Od Bm Offset SWT ExtMix V Weep HI 9:290 dbm HI 9:290 dbm	■ 60.00 dB ■ RBV 32.4 ms ■ VBV	B obw X V 100 kHz Mc V 300 kHz Mc	Char 99% obv vde Auto Sweep			M3 WWWWWWWW		1Pk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 5 40 dBm 30 dBm 20 dBm 10 dBm 0 dBm	Spectrum Od Bm Offset SWT ExtMix V V Veep HI 9:290 dBm HI 9:290 dBm	X 6dl 60.00 dB = RBV 32.4 ms = VBV	B obw 3 V 100 kHz W V 300 kHz Ma	Char			M3 WANNAA		1Pk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 5 40 dBm 30 dBm 20 dBm 10 dBm 0 dBm -20 dBm	Spectrum O0 dBm Offset SWT ExtMix V Weep H1 9:290 dBm H1 9:290 dBm	6dl 6dl 32.4 ms v v	B obw 3 W 100 kHz We 300 kHz Me	Char	v ×		M3	A manufacture	1Pk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 5 40 dBm 30 dBm 20 dBm 10 dBm 0 dBm -20 dBm -20 dBm -30 dBm	Spectrum Od Bm Offset SWT ExtMix V Weep HI 9.290 dBm HI 9.290 dBm	6dl 6dl 32.4 ms v	B obw 2 W 100 kHz W V 300 kHz Mc	Char			M3		1Pk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 5 40 dBm 30 dBm 20 dBm 10 dBm 0 dBm -20 dBm -30 dBm -40 dBm	Spectrum Od Bm Offset SWT ExtMix V Weep HI 9.290 dBm HI 9.290 dBm	6du 6du 32.4 ms VBV	B obw X V 100 kHz V V 300 kHz Mc	Char			M3		1Pk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 5 40 dBm 30 dBm 20 dBm 10 dBm 0 dBm -20 dBm -30 dBm -30 dBm -40 dBm	Spectrum Od Bm Offse SWT ExtMix V Weep HI 9.290 dBm HI 9.290 dBm	6du 6du 32.4 ms vbv	B obw 2 V 100 kHz V V 300 kHz Mc	Char			M3		1Pk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 9 40 dBm 30 dBm 20 dBm 10 dBm 0 dBm 20 dBm -20 dBm -30 dBm -30 dBm -20 dBm -30 dBm -40 dBm CF 60.48 GHz 2 Marker Tab	Spectrum Od dBm Offse SWT Sweep HI 9.290 dBm HI 9.290 dB	6du 6du 32.4 ms VBv	B obw 2 V 100 kHz We V 300 kHz Me	Char					1Pk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 9 40 dBm 30 dBm 20 dBm 10.dBm 0 dBm -20 dBm -30 dBm -30 dBm -20 dBm -20 dBm -30 dBm -20 dBm -20 dBm -20 dBm -20 dBm -20 dBm -30 dBm -40 dBm CF 60.48 GHz 2 Marker Tab Type Re	Spectrum Od Bm Offset SWT ExtMix V Weep HI 9:290 dBm HI	× 6dJ : 60.00 dB = RB 32.4 ms = VBV 	B obw 2 V 100 kHz We V 300 kHz Me 1001 pts z 1	Char			M3		IPk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 5 40 dBm 30 dBm 20 dBm 10 dBm -20 dBm -30 dBm -20 dBm -20 dBm -20 dBm -30 dBm -20 dBm -30 dBm -40 dBm CF 60.48 GHz 2 Marker Tab Type M2 M3	Spectrum Od Bm Offset SWT ExtMix V V Veep HI 9:290 dBm H	× 6dl : 60.00 dB = RBV 32.4 ms = VBV 	B obw 2 V 100 kHz We 300 kHz Me	Char	nnel 1 v × ×	4.0 MHz/		Punction	1Pk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 5 40 d8m 30 d8m 20 d8m -20 d8m -30 d8m -20 d8m -20 d8m -20 d8m -20 d8m -20 d8m -30 d8m -20 d8m -30 d8m -30 d8m -40 d8m 2 Marker Tab Type M3	Spectrum Od Bm Offsei SWT ExtMix V Weep HI 9:290 dBm HI	× 6dl : 60.00 dB = RBV 32.4 ms = VBV 	B obw 3 V 100 kHz V V 300 kHz Me	Char		4.0 MHz/	M3	Function	1Pk Max Auto ID

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Ref Level 50	• Spectrum	6di t 60.00 dB = RBV	3 obw	< 99% obv	×				•
TDF "RF" Inp:	SWT ExtMix V	32.4 ms 😑 VBV	V 300 kHz Mo	de Auto Sweep)				
1 Frequency	Sweep	1				Ĩ		0	1Pk Max Auto ID
40 dBm									
30 dBm							_	_	
20 dBm									
		M2		1 are der well	1. brace is a	B	M3		
10 dBm	H1 7.580 dBm	White	M. Kandy S. M. May and	M. M	W. W. M. Marcher.	- and an and a superior	manna	1	
0 dBm	mannew						- wh	Manhan	
ALCONDER LANA	MMANA.							and the second	unhormon
-20 dBm									
-30 dBm					-				
-40 dBm									
CF 62.64 GHz 2 Marker Tat	z ole		1001 pts	;	3:	24.0 MHz/			Span 3.24 GHz
Type Re M1	ef Trc	X-Value 62.452 3 GHz	. 1	Y-Value 3.58 dBm		Function		Function	Result
M2 M3	1	61.8176 GHz 63.3818 GHz	1	0.79 dBm 8.18 dBm					
				Char	nnel 3				
MultiView Ref Level 50	 Spectrum 0.00 dBm Offset SWT 	× 6dt t 60.00 dB • RBV 32.4 ms • VBV	3 obw 3 V 100 kHz V 300 kHz Mo	Char 99% obv	nnel 3				•
MultiView Ref Level 50 TDF "RF" Inp: I Frequency	 Spectrum 0.00 dBm Offset SWT Styrep 	★ 6dt t 60.00 dB ● RBV 32.4 ms ● VBV	3 obw 3 V 100 kHz V 300 kHz Mo	Char 99% obv	nnel 3			٥	Pk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency	Spectrum 0.00 dBm Offset SWT ExtMix V Sweep	 ★ 6dt ± 60.00 dB ● RBV 32.4 ms ● VBV 	3 obw ≯ ¥ 100 kHz ¥ 300 kHz Mo	Char 99% obv	nnel 3			0	LPk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: I Frequency 40 dBm-	Spectrum 0.00 dBm Offse SWT ExtMix V Sweep	★ 6d8 t 60,00 dB ● RBV 32.4 ms ● VBV	3 obw > V 100 kHz V 300 kHz Mo	Char 99% obv	nnel 3			0	IPk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 40 dBm	Spectrum 0.00 dBm Offset SWT ExtMix V Sweep	x 6dt t 60.00 dB = RBV 32.4 ms • VBV	3 obw 3 9 100 kHz 9 300 kHz Mo	Char 99% obv	x ×			0	IPk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: I Frequency 40 dBm	Spectrum Sweep	★ 6dt 4	3 obw X 9 100 kHz 9 300 kHz Mo	Char 99% obv	x x			0	LPk Max Auto ID
MultiView Ref Level 50 TDF "BF" Inp: 1 Frequency 40 dBm 30 dBm 20 dBm 10 dBm	Spectrum O.00 dBm Offset SWT ExtMix V Sweep	60.00 dB • RBV 32.4 ms • VBV	3 obw ≥ 9 100 kHz 9 300 kHz Mo	Char 99% obv de Auto Sweep			HS-	0	IPk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 40 dBm 30 dBm 20 dBm 10 dBm 0 dBm	Spectrum O.00 dBm Offset SWT ExtMix V Sweep H1 4.670 dBm H1 4.670 dBm	60.00 dB = RBV 32.4 ms = VBV	3 obw 3 V 100 kHz Wo V 300 kHz Mo	Char 99% obv de Auto Sweep		- Marthartown	M3		LPk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 40 dBm 30 dBm 20 dBm 10 dBm 0 dBm 10 dBm	Spectrum O SWT SWT ExtMix V Sweep H1 4.670 dBm H1 4.670 dBm MMMM	K 6dt Constant A consta	3 obw 3 9 100 kHz Mo	Char 99% obv de Auto Sweep			M3 MA		IPk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 40 dBm 30 dBm 20 dBm 10 dBm 0 dBm 20 dBm	Spectrum OOO dBm Offset SWT ExtMix V Sweep H1 4.670 dBm H1 4.670 dBm MMMM	K 6dt Co.co dB ● RBV 32.4 ms ● VBV	3 obw 3 V 100 kHz V 300 kHz Mo	Char		- Washington	Mrs way	O L L L L L L L L L L L L L L L L L L L	IPk Max Auto ID
MultiView Ref Level 50 TDF "BF" Inp: 1 Frequency 40 dBm 30 dBm 20 dBm 10 dBm 0 dBm -20 dBm -20 dBm	Spectrum O.00 dBm Offset SWT ExtMix V Sweep H1 4.670 dBm H1 4.670 dBm MMMM	K 6dB Control Contro Control Control Control Control Control Control Control Control	3 obw 3 V 100 kHz Wo V 300 kHz Mo	Char			M3	O Landon March	(Pk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 40 dBm 30 dBm 20 dBm 10 dBm 0 dBm -20 dBm -30 dBm	Spectrum O.00 dBm Offset SWT ExtMix V Sweep H1 4.670 dBm MMMMMMMM	6dt	3 obw 3 9 100 kHz 9 300 kHz Mo	Char			M3 My My My My	O L L L	LPK Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 40 dBm 30 dBm 20 dBm 10 dBm 0 dBm -20 dBm -30 dBm -30 dBm -40 dBm	Spectrum O SWT SWT ExtMix V Sweep H1 4.670 dBm MMMMMMM		3 obw 3 9 100 kHz Mo	Char				0	IPk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 40 dBm 30 dBm 20 dBm 10 dBm -20 dBm -30 dBm -30 dBm -20 dBm -20 dBm -20 dBm -20 dBm -20 dBm -20 dBm -30 dBm -40 dBm	Spectrum OO dBm Offset SWT ExtMix V Sweep	K 6dt Constant	3 obw 3 9 100 kHz Mo	Char		24.0 MHz/			IPk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 40 dBm 30 dBm 20 dBm 10 dBm 0 dBm -20 dBm -30 dBm -20 dBm	Spectrum OO dBm Offset SWT ExtMix V Sweep	60.00 dB • RBV 32.4 ms • VBV	3 obw 3 9 100 kHz 9 300 kHz Mo	Char		24.0 MHz/		O C C C C C C C C C C C C C C C C C C C	(Pk Max Auto ID
MultiView Ref Level 50 TDF "BF" Inp: 1 Frequency 40 dBm 30 dBm 20 dBm 10 dBm 0 dBm -20 dBm -30 dBm -20 dBm -20 dBm -20 dBm -30 dBm -40 dBm CF 64.8 GHz 2 Marker Tat Type Rem M1 M2 M3	Spectrum O O O dBm Offset SWT ExtMix V Sweep H14.670 dBm MMMMMMM MMMMMMM Set St Trc Trc Tr	× 6dt t 60.00 dB = RBV 32.4 ms = VBV 	3 obw 3 9 100 kHz Wo 300 kHz Mo 40,00 kHz Mo 1001 pts 1001 pts	Char		24.0 MHz/		O C C C C C C C C C C C C C C C C C C C	LPk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Frequency 40 dBm 30 dBm 20 dBm 10 dBm 0 dBm 20 dBm 10 dBm -20 dBm -30 dBm -20 dBm -30 dBm -20 dBm -20 dBm -30 dBm -20 dBm -30 dBm -40 dBm -20 dBm -30 dBm -40 dBm -30 dBm -40 dBm -30 dBm -40 dBm	Spectrum O S S S S S S S S S S S S S S S S S S	X 6db t 60.00 dB = RBV 32.4 ms = VBV	3 obw 3 9 100 kHz 40 9 300 kHz Mo 40 40 40 1001 pts 1001 pts	Char		Punction	Measuring	Function	1Pk Max Auto ID

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99% BANDWIDTH

							<u>v</u>
MultiView	Spectrum	× Spectrum 2	× Spectrum 3	X Spectrum 4	<		•
Ref Level 50	.00 dBm Offset SWT	: 60.00 dB ● RBW 2 9.72 ms ● VBW 8	28 MHz 30 MHz Mode Auto Sweep				
TDF "RF" Inp: 1 Occupied Ba	ExtMix V andwidth					01	Pk Max Auto ID
10 40.00							
40 UBM							
30 dBm				Mi minimum	min		
20 dBm		1 mm			· · · ·	T2	
10 dBm	when					X	
0 dBm	man						
-10 dBm							
-20 dBm							
-30 dBm							
-40 dBm							
CF 58.32 GHz	 !	1 1	1001 pts	324.0 MHz/	1	1	Span 3.24 GHz
Z Marker Tab	f Trc	X-Value	Y-Value	Function		Function F	
T1 T2	1	57.346 01 GHz 59.423 88 GHz	12.66 dBm 13.52 dBm	Occ Bw Centroid Occ Bw Fred Offset		58.3849 64.944.8	44 839 GHz 38 525 MHz
		00.12000 0.12	10.02 0011		Measuring		2024-08-23
			Chai	nnel 1			¢
MultiView	Spectrum	× 6dB o	bw × 99% ob	w x			 •
MultiView Ref Level 50	Spectrum .00 dBm Offset SWT	6dB o 60.00 dB • RBW 2 9.72 ms • VBW 8	bw × 99% ob R8 MHz R0 MHz Mode Auto Sweep	nnel 1 w ×			•
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied B	Spectrum .00 dBm Offset SWT ExtMix V andwidth	 ★ 6dB o 60.00 dB ● RBW 2 9.72 ms ● VBW 8 	bw 99% ob 18 MHz 18 MHz Mode Auto Sweep	nnel 1 w x		01	Pk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied Br 40 dBm-	Spectrum .00 dBm Offset SWT ExtMix V andwidth	 ★ 6dB o 6dB ● RBW 2 9.72 ms ● VBW 8 	bw × 99% ob 28 MHz 30 MHz Mode Auto Sweep	w ×		01 M1[]	Pk Max Auto ID 37.45 dBn 60.528 60 GH;
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied Br 40 dBm	Spectrum Od Bm Offset SWT ExtMix V andwidth	6dB o 60.00 dB • RBW 2 9.72 ms • VBW 8	bw × 99% ob 28 MHz 20 MHz Mode Auto Sweep	mel 1 •• ×		01 M1[1	2k Max Auto ID] 37.45 dBn 60.528 60 GH;
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied B 40 dBm	Spectrum OdBm Offset SWT ExtMix V andwidth T1	 ★ 6dB o 60,00 dB = RBW 2 9,72 ms = VBW 8 	bw 299% ob 28 MHz 30 MHz Mode Auto Sweep	<u>mnel 1</u>		01 M1[1	Pk Max Auto ID] 37.45 dBn 60.528 60 GH;
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied B 40 dBm	Spectrum Od Bm Offset SWT ExtMix V andwidth	5 6dB o 60.00 dB • RBW 2 9.72 ms • VBW 8	bw × 99% ob 18 MHz 10 MHz Mode Auto Sweep	nnel 1 w X		01 M1[1	% %
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied Br 40 dBm 30 dBm 20 dBm 10 dBm 0 dBm	Spectrum Od Bm Offset SWT ExtMix V andwidth	★ 6dB o 6dB o 9.72 ms ● VBW s	bw 299% ob 28 MHz 30 MHz Mode Auto Sweep	mel 1		01 M1[1	% Max Auto ID] 37.45 dBn 60.528 60 GH:
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied B; 40 dBm	Spectrum O0 dBm Offset SWT ExtMix V andwidth T1	6dB o 60.00 dB • RBW 2 9.72 ms • VBW 8	bw × 99% ob 28 MHz 30 MHz Mode Auto Sweep	mnel 1		01 M1[]	k Max Auto ID] 37.45 dBn 60.528 60 GH:
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied B; 40 dBm 30 dBm 20 dBm 10 dBm -10 dBm -20 dBm	Spectrum Od Bm Offset SWT ExtMix V andwidth	6dB o 60.00 dB • RBW 2 9.72 ms • VBW 8	Chai	mnel 1		01 M1[1	2k Max Auto ID] 37.45 dBn 60.528 60 GH
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied B; 40 dBm 30 dBm 20 dBm 10 dBm 0 dBm -10 dBm -20 dBm	Spectrum Od Bm Offset SWT ExtMx V andwidth T1	6dB o 60.00 dB • RBW 2 9.72 ms • VBW 8	bw × 99% ob 28 MHz 20 MHz Mode Auto Sweep	mnel 1		01 M1[1	% Auto ID 37.45 dBn 60.528 60 GH;
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied B: 40 dBm 30 dBm 20 dBm 10 dBm -10 dBm -20 dBm -30 dBm	Spectrum O dBm Offset SWT ExtMx V andwidth T1	6dB o 60.00 dB = RBW 2 9.72 ms = VBW 8	bw × 99% ob 28 MHz 20 MHz Mode Auto Sweep	M1		01 M1[1	k. Max Auto ID 37.45 dBn 60.528 60 GH;
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied Br 30 dBm 20 dBm 10 dBm 10 dBm -10 dBm -20 dBm -30 dBm -40 dBm	Spectrum Od Bm Offset SWT ExtMix V andwidth	6dB o 60.00 dB • RBW 2 9.72 ms • VBW 8	bw × 99% ob 28 MHz 30 MHz Mode Auto Sweep	mnel 1		01 M1[1	k Max Auto ID] 37.45 dBn 60.528 60 GH:] j 37.45 dBn
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied B: 40 dBm 30 dBm 20 dBm 10 dBm -10 dBm -20 dBm -30 dBm -40 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -40 dBm	Spectrum Od Bm Offset SWT ExtMix V andwidth	6dB o 60.00 dB • RBW 2 9.72 ms • VBW 8	bw × 99% ob R8 MHz 1001 pts	nnel 1		01 M1[1	* Max Auto ID] 37.45 dBn 60.528 60 GH;] • <t< td=""></t<>
MultiView Ref Level 50 TDF "RF" Inp; 1 Occupied B 40 dBm 30 dBm 20 dBm -10 dBm -20 dBm -30 dBm -20 dBm -20 dBm -20 dBm -20 dBm -20 dBm -20 dBm -30 dBm -40 dBm Type Re	Spectrum Od Bm Offset SWT SWT SWT I I I I I I I I I I I I I I I I I I I	Control Contro Control Control Control Control Control Control Control Control Co	Chai	mnel 1 w X M1		01 M1[1	% %
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied B 40 dBm 30 dBm 20 dBm -10 dBm -20 dBm -30 dBm -20 dBm -10 dBm -20 dBm -20 dBm -10 dBm -10 dBm -20 dBm -20 dBm -10 dBm -10 dBm -10 dBm -10 dBm -20 dBm -10 dBm	Spectrum Od Bm Offset SWT SWT Table T T T T T T T T T T T T T T T T T T T	Control Contro Control Control Control Control Control Control Control Control Co	bw × 99% ob 28 MHz 20 MHz Mode Auto Sweep 	Annel 1		01 M1[]	Ck Max Auto ID 37.45 dBn 60.528 60 GHz 60.528 60 GHz 60 50 GHz Span 3.24 GHz 60 50 GHz 60 51 77.17 GHz
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied Br 40 dBm 30 dBm 20 dBm 10 dBm 10 dBm -10 dBm -20 dBm -40 dBm 20 dBm 10 dBm -10 dBm -20 dBm -20 dBm -20 dBm -20 dBm -20 dBm -10 dBm -20 dBm -10 dBm -20 dBm -10 dBm -10 dBm -10 dBm -10 dBm -10 dBm -20 dBm -10 dBm	Spectrum Od Bm Offset SWT ExtMix V T1	Control Contro Control Control Control Control Control Control Control Control Co	bw X 99% ob R MHZ Mode Auto Sweep Mode Auto Sweep 1001 pts Y-Value 37.45 dBm 20.77 dBm 19.03 dBm	nnel 1	Measuring	01 M1[]	k Max Auto ID] 37.45 dBn 60.528 60 GH: -
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied B: 40 dBm 30 dBm 20 dBm 10 dBm -10 dBm -20 dBm -30 dBm -40 dBm -20 dBm -30 dBm -40 dBm -10 dBm -10 dBm -10 dBm -20 dBm -30 dBm -40 dBm EF 60.48 GHz 2 Marker Tab Type M1 T1 T2 L1:47:06 BM	Spectrum Od Bm Offset SWT ExtMix V andwidth	X 6dB o 60.00 dB • RBW 2 9.72 ms • VBW 8 9.72 ms • VBW 8 0 0 0	bw SP9% ob 28 MHz Mode Auto Sweep 20 MHz Mode Auto S	mel 1	Measuring	011 M1[1 77 77 77 77 77 77 77 77 77 77 77 77 77	2k Max Auto ID 37.45 dBn 60.528 60 GH2 60.528 60 GH2 9 Span 3.24 GH2 9 Span 3.24 GH2 1171 GH2 11402 MH2 2024-08-27 11402 MH2 2024-08-27

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DATE: 2024-10-30
IC: 22992-46211

MultiView Ref Level 50	Spectrum .00 dBm Offset 6	6dB obw	× 99% obv	a X			•
TDF "RF" Inp:	SWT : ExtMix V	9.72 ms 🖷 VBW 80 MI	Hz Mode Auto Sweep				
1 Occupied Ba	andwidth				1	01F M1[1	k Max Auto ID 35,57 dBn
40 dBm				- <u>M1</u>		-	62.695 00 GH
30 dBm		man	more	Ammun	m		
20 dBm	TI man				- m	T2	
	Munt					m	man
10 dBm							
0 dBm							
-10 dBm							-
-20 dBm							
-30 dBm							
-40 dBm							
CF 62.64 GHz 2 Marker Tab	le		1001 pts	324.0 MHz/			Span 3.24 GHz
Type Re	f Trc	X-Value 62.695 GHz	Y-Value 35.57 dBm	Function Occ Bw		Function R 2.323 801	esult 912 GHz
T1 T2	1	61.36511 GHz 63.68891 GHz	18.01 dBm 19.29 dBm	Occ Bw Centroid Occ Bw Freq Offset		62.5270 -112.9876	012369 GHz 530928 MHz
L1:52:10 AM	08/27/2024		Chan	nel 3			<u>k</u>
MultiView	08/27/2024	× 6dB obw	Chan × 99% obv	nel 3			
MultiView RefLevel 50	• Spectrum .00 dBm Offset 6 SWT	 ★ 6dB obw 50.00 dB ● RBW 28 MI 9.72 ms ● VBW 80 MI 	Chan × 99% obv Hz Hz Mode Auto Sweep	nel 3			•
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied Ba	• Spectrum • Odbm Offset 6 SWT • ExtMix V	 ★ 6dB obw 0,00 dB ● RBW 28 Mi 9,72 ms ● VBW 80 Mi 	Chan Sector System Hz Hz Mode Auto Sweep	nel 3		01	vk Max Auto ID
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied B:	• Spectrum • Spectrum • OO dBm Offset 6 SWT 5 ExtMix V andwidth	56dB obw 0.00 dB ● RBW 28 M 9.72 ms ● VBW 80 M	Chan 99% obv Hz Hz Mode Auto Sweep	nel 3		01F M1[1	* Max Auto ID 32.32 dBn 64.848 60 GH
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied B: 40 dBm	• Spectrum • Spectrum • Od Bm Offset 6 SWT 3 ExtMix V andwidth	★ 6dB obw 00.00 dB ● RBW 28 MI 9.72 ms ● VBW 80 MI	Chan	x x		01F M1[1	* Max Auto ID 32.32 dBn 64.848 60 GH:
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied B: 40 dBm	• Spectrum • Spectrum • Od Bm Offset 6 SWT • ExtMix V andwidth	5dB obw 0.00 dB ● RBW 28 MI 9.72 ms ● VBW 80 MI	Chan	nel 3		01: MI[1	K Max Auto ID 32.32 dBn 64.848 60 GH:
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied Ba 40 dBm 30 dBm 20 dBm	• Spectrum • Spectrum • OU dBm Offset 6 SWT 9 • Andwidth	✓ 6dB obw 0.00 dB ● RBW 28 M 9.72 ms ● VBW 80 M	Chan	nel 3		01F M1[1	* Max Auto ID 32.32 dBn 64.848 60 GH
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied Ba 40 dBm 30 dBm 20 dBm 10 dBm	• Spectrum • Spectrum • OU dBm Offset 6 SWT 5 ExtMix V andwidth	566B obw 50.00 dB • RBW 28 MI 9.72 ms • VBW 80 MI	Chan	nel 3 ×		01F M1[1	*k Max Auto ID 32.32 dBn 64.848 60 GH;
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied Ba 40 dBm- 20 dBm- 10 dBm- 0 dBm-	• Spectrum • Spectrum .00 dBm Offset 6 SWT 9 ExtMix V andwidth	6dB obw 0.00 db • RBW 28 MI 9.72 ms • VBW 80 MI	Chan	M1		01; MI[1	* Max Auto ID 32.32 dBn 64.84860 GH
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied B: 40 dBm	• Spectrum • Spectrum • Od Bm Offset 6 SWT • SWT •	6dB obw 0.00 dB • RBw 28 M 9.72 ms • VBW 80 M	Chan	mel 3		01F M1[1	* Max Auto ID 32.32 dBn 64.848 60 GH:
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied Ba 40 dBm 20 dBm 10 dBm 0 dBm -10 dBm -20 dBm	• Spectrum • Spectrum • OU dBm Offset 6 SWT * • andwidth	6dB obw 6dB obw 9.72 ms VBW 80 M	Chan	x x		01F M1[1	* Max Auto ID 32.32 dBn 64.848 60 GH
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied B: 40 dBm- 30 dBm- 10 dBm- -10 dBm- -20 dBm- -30 dBm-	• Spectrum • Spectrum • OU dBm Offset 6 SWT 12 andwidth	6dB obw 800 dB 80 M 9.72 ms VBW 80 M	Chan	M1 ×		01 MI[1	k Max Auto ID 32.32 dBn 64.848 60 GH
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied Br 40 dBm 30 dBm 10 dBm -10 dBm -10 dBm -20 dBm -30 dBm -20 dBm	OB/27/2024	6dB obw 9.72 ms VBW 80 Mi	Chan	M1		01 MI[1	k Max Auto ID 32.32 dBn 64.848 60 GH:
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied B: 40 dBm 30 dBm 20 dBm -10 dBm -20 dBm -30 dBm	• Spectrum • Spectrum 00 dBm Offset 6 SWT • ExtMix V andwidth	6dB obw 0.00 dB • RBW 28 MI 9,72 ms • VBW 80 MI	Chan	M1		01; MI[1	K Max Auto ID 32.32 dBn 64.848 60 GH
11:52:10 AM MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied B: 40 dBm 30 dBm 20 dBm -10 dBm -20 dBm -30 dBm -40 dBm -20 dBm -20 dBm -30 dBm -40 dBm -20 dBm -30 dBm -30 dBm	OB/27/2024 Spectrum Od Bm Offset 6 SWT Conduction Od Bm Offset 1 SWT Oddate Od	6dB obw 0.00 dB • RBW 28 M 9.72 ms • VBW 80 M	Chan	mel 3		01F M1[1	k Max Auto ID 32.32 dBn 64.848 60 GH:
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied Ba 40 dBm 30 dBm 20 dBm 10 dBm -10 dBm -20 dBm -30 dBm -20 dBm	08/27/2024 Spectrum Od Bm Offset 6 SWT Condwidth	6dB obw 0.00 db • RBW 28 M 9.72 ms • VBW 80 M	Chan	M3 M3 M3 M3 M3 M3 M3 M3 M4 M4 M4 M4 M4 M4 M4 M4 M4 M4		0 1F	k Max Auto ID 32.32 dBn 64.848 60 GH: 64.848 60 GH: 9 Span 3.24 GHz 9
MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied B: 40 dBm 30 dBm 20 dBg -10 dBm -20 dBm -30 dBm -20 dBm -30 dBm -20 dBm -20 dBm -20 dBm -30 dBm -20 dBm -20 dBm -20 dBm -20 dBm -20 dBm -30 dBm -20 dBm	08/27/2024	6dB obw 800 dB • RBW 28 M 9.72 ms • VBW 80 M	Chan	Ma Ma Ma Ma Ma Ma Ma Ma Ma Ma		01f M1[1 12 12 12 12 12 12 12 12 12 12 12 12 12	k Max Auto ID 32.32 dBn 64.848 60 GH 64.848 60 GH 57.612 Mar Span 3.24 GHz 86 842 GHz 86 642 GHz 86 642 GHz
11:52:10 M MultiView Ref Level 50 TDF "RF" Inp: 1 Occupied B: 40 dBm 30 dBm 20 dBm 10 dBm -20 dBm -30 dBm -40 dBm 20 dBm 20 dBm -20 dBm -20 dBm -20 dBm -20 dBm -20 dBm -30 dBm -40 dBm Type Re M1 T1 T2	08/27/2024	Control C	Chan	Ma Ma Ma Ma Ma Ma Ma Ma Ma Ma	Meosuring	OI MI[1 72 72 72 72 72 72 72 72 72 72 72 72 72	K Max Auto ID 32.32 dBn 64.848 60 GH 64.848 60 GH 52.32 dBn 52.32 dBn 64.848 60 GH 52.32 dBn 52.32 dBn

9.3. RADIATED POWER

REQUIREMENT

FCC

§15.255 (c)

Within the 57-71 GHz band, emission levels shall not exceed the following equivalent isotropically radiated power (EIRP):

(1) Devices other than field disturbance sensors shall comply with one of the following power limits, as measured during the transmit interval:

(i) The average power of any emission shall not exceed 40 dBm and the peak power of any emission shall not exceed 43 dBm; or

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RSS-210 Clause J.3.3

Following are the conditions for devices other than FDS:

a) Except when J.3.3(b) applies, the average e.i.r.p. of any emission shall not exceed 40 dBm and the peak e.i.r.p. of any emission shall not exceed 43 dBm.

b) For fixed point-to-point equipment located outdoors:

- (i) The average e.i.r.p. of any emission shall not exceed 82 dBm minus 2 dB for every dB the antenna gain is less than 51 dBi. The peak e.i.r.p. of any emission shall not exceed 85 dBm minus 2 dB for every dB the antenna gain is less than 51 dBi.
- (ii) The provisions for reducing the transmit power based on the antenna gain, as per J.3.3(b)(i), shall not require that the power levels be reduced below the limits specified in J.3.3(a).
- (iii) Compliance testing shall be performed using the highest gain and the lowest gain antennas with which the equipment is certified. Further, this equipment shall not be marketed and operated with antennas other than those listed in the certification application with which the equipment is certified.

TEST PROCEDURE

ANSI C63.10-2020 Clause 9.9

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(23)

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The measured power level is converted to EIRP using ANSI C63.10 Eqs. (22) and (23):

Calculate the EIRP from the radiated measurement in the far-field using Equation (22):

$$EIRP = 21.98 - 20\log(\lambda) + 20\log(d_{Max}) + P - G$$
(22)

where

EIRP	is the equivalent isotropic radiated power, in dBm
λ	is the wavelength of the emission under investigation [300/f(MHz)], in m
d_{Meas}	is the measurement distance, in m
Р	is the power measured at the output of the measurement antenna, in dBm
G	is the gain of the measurement antenna, in dBi

NOTE-The measured power P includes all applicable instrument correction factors up to the connection to the measurement antenna.

Calculate the EIRP from the conducted power using Equation (23):

$$EIRP = P_{Cond} + G_{EUT}$$

where

EIRP	is the equivalent isotropic radiated power, in dBm
$P_{\rm Cond}$	is the measured power at feedpoint of the EUT antenna, in dBm
$G_{\rm EUT}$	is the gain of the EUT radiating element (antenna), in dBi

FAR FIELD BOUNDARY CALCULATIONS

The far-field boundary is given in ANSI C63.10-2020 Clause 9.1.4 as:

 $R_{far field} = 2D^2 / \lambda$

where:

D = Largest Antenna Dimension, including the reflector, in meters

 λ = wavelength in meters

The single antenna array configuration has dimensions of 25mm x 18mm. The two antenna array configuration measures 50mm x 18mm. Far-field boundary was calculated using the largest antenna dimension (50mm) and highest operating frequency (64.8GHz) as the worstcase.

Frequency	L	Lambda	R (Far Field)		
(GHz)	(m)	(m)	(m)		
64.8	0.050	0.0046	1.08		

All measurements were made at a 3-meter distance, thus ensuring the far-field boundary was maintained.

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RESULTS

Model	Frequency (GHz)	Meas Distance (m)	DSO Value (mV)	Detector (Pk/Av)	Substitution Power (dBm)	Gain/Loss (dB)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
D621	58.32	3	56.5	Pk	-15.54	54.99	39.45	43	-3.55
	58.32	3	41.32	Av	-16.95	54.99	38.04	40	-1.96
	60.48	3	82.9	Pk	-13.85	55.11	41.26	43	-1.74
	60.48	3	62.25	Av	-15.21	55.11	39.90	40	-0.10
	62.64	3	66.3	Pk	-14.17	55.37	41.20	43	-1.80
	62.64	3	45.83	Av	-15.82	55.37	39.55	40	-0.45
	64.80	3	38	Pk	-16.02	55.50	39.48	43	-3.52
	64.80	3	24.53	Av	-18.34	55.50	37.16	40	-2.84

Where:

DSO Value = Value measured from the EUT on the oscilloscope via connection using an RF detector

Substitution Power = Power value recorded that matched the DSO value when EUT is replaced with a mmWave source

Gain/Loss = Total measurement system path loss (i.e., Free-space path loss + Waveguide loss - Rx antenna gain)

EIRP (dBm) = Substitution Power (dBm) + Gain/Loss (dB)

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9.4. CONDUCTED OUTPUT POWER

REQUIREMENT

FCC

§15.255 (e)

- (1) Except as specified in paragraph (e)(2) of this section, the peak transmitter conducted output power of devices other than field disturbance sensors/radars shall not exceed 500 mW. Depending on the gain of the antenna, it may be necessary to operate the intentional radiator using a lower peak transmitter output power in order to comply with the EIRP limits specified in paragraph (c) of this section.
- (2) Devices other than field disturbance sensors/radars with an emission bandwidth of less than 100 megahertz must limit their peak transmitter conducted output power to the product of 500 mW times their emission bandwidth divided by 100 megahertz. For the purposes of this paragraph, emission bandwidth is defined as the instantaneous frequency range occupied by a steady state radiated signal with modulation, outside which the radiated power spectral density never exceeds 6 dB below the maximum radiated power spectral density in the band, as measured with a 100 kilohertz resolution bandwidth spectrum analyzer. The center frequency must be stationary during the measurement interval, even if not stationary during normal operation (*e.g.,* for frequency hopping devices).

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RSS-210 Clause J.3.3

c) Except as specified in J.3.3(d), the peak transmitter conducted output power shall not exceed 500 mW. Depending on the gain of the antenna, it may be necessary to operate the intentional radiator using a lower peak transmitter output power in order to comply with the e.i.r.p. limits specified in J.3.3(a) and J.3.3(b).

d) For devices with an emission bandwidth less than 100 MHz, the peak transmitter conducted output power (PTCOP) shall be less than or equal to the product of 500 mW times their emission bandwidth divided by 100 MHz. For the purpose of J.3.3(d), emission bandwidth is the instantaneous frequency range occupied by a steady radiated signal with modulation, outside which the radiated power spectral density is 6 dB below the maximum radiated power spectral density in the band, as measured with a 100 kHz resolution bandwidth. The centre frequency shall be stationary during the measurement interval, even if not stationary during normal operation (e.g. for frequency hopping devices).

TEST PROCEDURE

The maximum EUT antenna gain is subtracted from the Peak EIRP.

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<u>RESULTS</u>

Model	Frequency (GHz)	Peak EIRP (dBm)	EUT Antenna Gain (dBi)	Peak Conducted Power (dBm)	Conducted Limit (dBm) ¹	Margin (dB)
D621	58.32	39.45	24.36	15.09	27	-11.91
	60.48	41.26	24.36	16.90	27	-10.10
	62.64	41.20	24.36	16.84	27	-10.16
	64.80	39.48	24.36	15.12	27	-11.88

Notes:

1-Conducted limit is 500mW, which equates to 27 dBm

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9.5. SPURIOUS EMISSIONS

REQUIREMENT

FCC

§15.255 (e)

(1) The power density of any emissions outside the 57-71 GHz band shall consist solely of spurious emissions.

(2) Radiated emissions below 40 GHz shall not exceed the general limits in § 15.209.

(3) Between 40 GHz and 200 GHz, the level of these emissions shall not exceed 90 pW/cm² at a distance of 3 meters.

(4) The levels of the spurious emissions shall not exceed the level of the fundamental emission.

<u>ISED</u>

RSS-210 Clause J.4

Any emissions outside the band 57-71 GHz shall consist solely of spurious emissions and shall not exceed:

(a) the fundamental emission levels

(b) the general field strength limits specified in RSS-Gen, *General Requirements for Compliance of Radio Apparatus*, for emissions below 40 GHz

(c) 90 pW/cm² at a distance of 3 m for emissions between 40 GHz and 200 GHz

TEST PROCEDURE - BELOW 18 GHz

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1 GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10 and set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements in the 30-1000MHz range. Peak detection is used unless otherwise noted as quasi-peak or average.

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements.

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For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements; as applicable for linear voltage averaging measurements.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

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.

OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

TEST PROCEDURE – ABOVE 18 GHz

ANSI C63.10-2020 Clause 9.10

External harmonic mixers, waveguides and LNA's are utilized, where appropriate.

The measurement antenna is scanned around the entire perimeter surface of the EUT, in both horizontal and vertical polarizations.

A final test is made at any frequencies at which emissions are found. During this final scan, the measurement antenna is kept no further from the EUT than the maximum distance calculated for each mixer band that yields a minimum system noise floor at least 6 dB below the spurious emissions limit.

The power is measured, the EIRP is calculated, then the extrapolated power density at a 3 meter distance is calculated.

Above 40 GHz, the 90 pW/cm² limit was converted to dBm as follows:

10 * log(90 [pW/cm²] * 100^{2} * 10^{-12} * 4pi* (3m)² *1000) = -9.92 dBm

From 18 – 40 GHz, the 500 uV/m limit was converted to dBm as follows:

 $[20 * \log (500)] - 95.2 = -41.2 \text{ dBm}$

In the frequency range of 40 – 110 GHz, testing was performed at the low, mid and high channels. For all other spurious emissions frequency ranges, testing was performed on the worst-case channel only (mid, Channel 2).

For the investigation of simultaneous transmission of multiple wireless technologies of 2.4GHz WLAN and 60GHz data communication, no noticeable new emissions with high amplitude was found.

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