TEST REPORT

Applicant Name :	Shenzhen Hollyland Technology Co.,Ltd
Address :	8F,Building 5D,Skyworth Innovation Valley, Tangtou Road. Shiyan Street, Baoan District, Shenzhen, China 518055
Report Number :	SZNS220321-09684E-RF-00A
FCC ID:	2ADZC-5802R

Test Standard (s)

FCC PART 15D

Sample Description

Product Type:	FULL-DUPLEX WIRELESS INTERCOM SYSTEM
Model No.:	SOLIDCOM C1
Multiple Model(s) No.:	SOLIDCOM C2, SOLIDCOM C3, SOLIDCOM C4, SOLIDCOM S1, SOLIDCOM S2, SOLIDCOM S3, SOLIDCOM M2, SOLIDCOM M3 (Please refer to DOS for Model difference)
Trade Mark:	HOLLYLAND, HOLLYVIEW
Date Received:	2022/03/21
Report Date:	2022/05/06

Test Result:	Pass*

* In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:

Black Ding
EMC Engineer

Approved By:

Robert Li
EMC Engineer

TABLE OF CONTENTS

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Frequency Range	1921.536-1928.448MHz
Maximum conducted peak output power	20.79dBm
Modulation Technique	GFSK
Antenna Specification*	3.0dBi(It is provided by the applicant)
Voltage Range	DC 7.4V or 14.8V from battery or DC 12.0V from adapter
Sample serial number	SZNS220321-09684E-RF-S1(Assigned by ATC, Shenzhen)
Sample/EUT Status	Good condition
Normal/Extreme Condition	For adapter L.V.: Low Voltage 102V_{AC}; L.T.: Low Temperature -20℃ N.V.: Normal Voltage 120V_{AC}; N.T.: Normal Temperature +20℃ H.V.: High Voltage 138V_{AC}; H.T.: High Temperature +50℃ Note: the extreme test condition was declared by manufacturer. For battery L.V.: Low Voltage 6.5V_{DC}; L.T.: Low Temperature -20℃ N.V.: Normal Voltage 14.8V_{DC}; N.T.: Normal Temperature +20℃ H.V.: High Voltage 16.8V_{DC}; H.T.: High Temperature +50℃ Note: the extreme test condition was declared by manufacturer.
Adapter information	Model: GQ24-120200-AX Input: AC 100-240V, 50/60Hz, 1.0A Max Output: DC 12.0V, 2.0A, 24.0W

Objective

The tests were performed in order to determine the compliance of the EUT with FCC Part 15-Subpart D, section 15.207, 15.315, 15.317, 15.319 and 15.323 rules. The EMI measurements were performed according to the measurement procedure described in ANSI C63.17 – 2013.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.17 - 2013, American National Standard Methods of Measurement of the Electromagnetic and Operational Compatibility of Unlicensed Personal Communications Services (UPCS) Devices.

All emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Each test item follows test standards and with no deviation.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
RF output power, conducted		0.73dB
Unwanted Emission, conducted		1.6dB
Emissions, Radiated	30MHz - 1GHz	4.28dB
	1GHz- 18GHz	4.98dB
	18GHz- 26.5GHz	5.06dB
Temperature		1℃
Humidity		6%
Supply voltages		0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189. Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 429 7.01.

Listed by Innovation, Science and Economic Development Canada (ISEDC), the Registration Number is 5077A.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured to testing mode which is provided by the manufacturer.

Equipment Modifications

No modification was made to the EUT tested.

Local Support Equipment List and Details

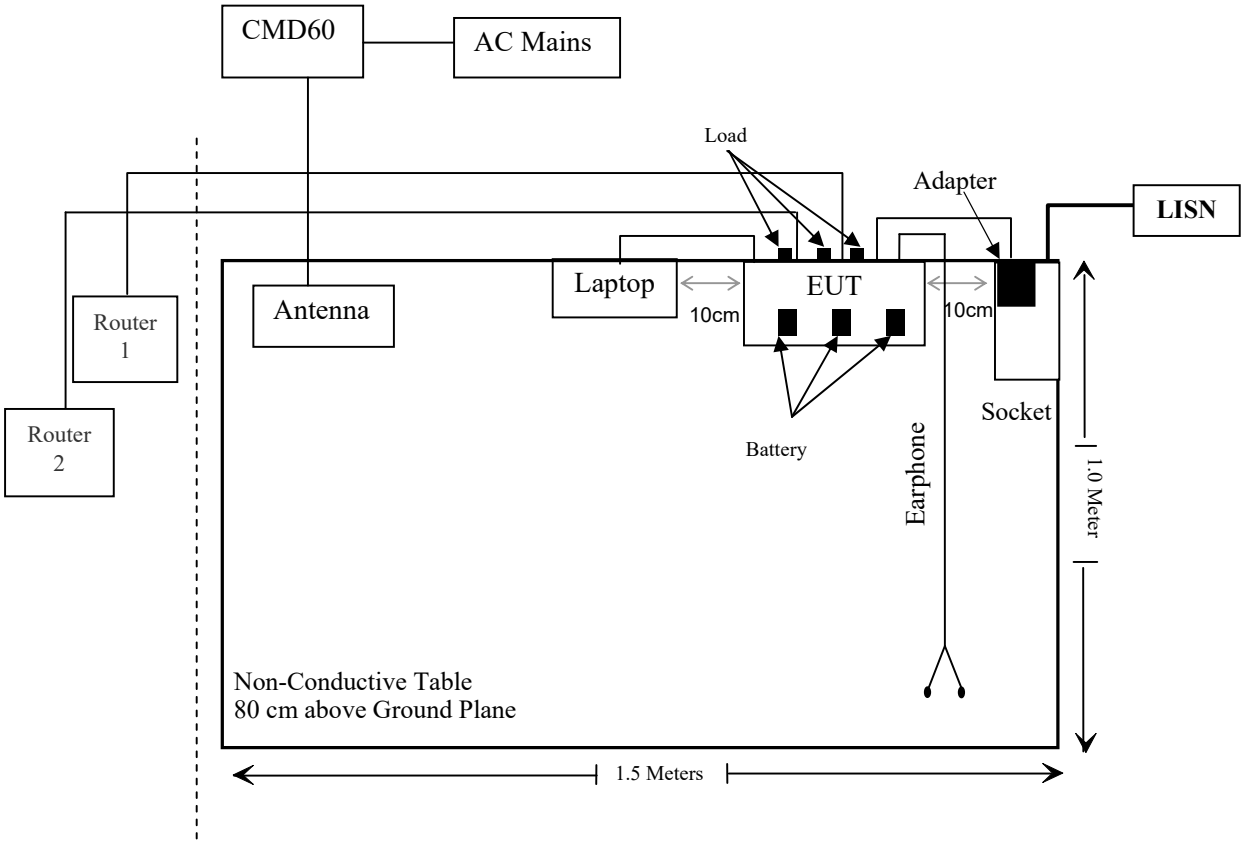
Manufacturer	Description	Model	Serial Number
Lenovo	Laptop	ThinkPad	1
Unknown	Battery*3	Unknown	Unknown
Unknown	Load*3	Unknown	Unknown
Lenovo	Earphone	Unknown	Unknown
Rohde & Schwarz	Digital Radio Communication Tester	CMD60	830861/029
Hollyland	Wireless Earphone	Solidcom C1	Unknown
Hikvision	Router*2	DS-3WR03-E	Unknown

External I/O Cable

Cable Description	Length (m)	From Port	To
Un-Shielding Detachable RJ45 Cable	8.0	EUT	Router 1
Un-Shielding Detachable RJ45 Cable	8.0	EUT	Router 2
Un-Shielding Un-detachable DC Cable	1.0	Adapter	EUT
Shielding Detachable USB Cable	1.0	EUT	Laptop

Block Diagram of Test Setup

For conducted emission



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§ 2.1091	Maximum Permissible Exposure (MPE)	Compliant
§ 15.317, § 15.203	Antenna Requirement	Compliant
§ 15.315, § 15.207	Conducted Emission	Compliant
§ 15.323 (a)	Emission Bandwidth	Compliant
§ 15.319 (c)	Peak Transmit Power	Compliant
§ 15.319 (d)	Power Spectral Density	Compliant
§ 15.323 (d)	Emission Inside and Outside the sub-band	Compliant
§ 15.323 (f)	Frequency Stability	Compliant
§ 15.323 (c)(e) § 15.319 (f)	Specific Requirements for UPCS	Compliant

Note: EUT has two antennas, pre-scan the output power, antenna 0 is higher, so antenna 0 is chosen for the full test.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde& Schwarz	EMI Test Receiver	ESCI	100784	2021/12/13	2022/12/12
Rohde & Schwarz	L.I.S.N.	ESH3-Z5	100305	2021/12/13	2022/12/12
Rohde & Schwarz	L.I.S.N.	ENV216	101314	2021/12/13	2022/12/12
Anritsu Corp	50 Coaxial Switch	MP59B	6100237248	2021/12/13	2022/12/12
Unknown	RF Coaxial Cable	No.17	N0350	2021/12/14	2022/12/13
Conducted Emission Test Software: e3 19821G (V9)					
RF Conducted test					
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101495	2021/12/13	2022/12/12
Rohde & Schwarz	Digital Radio Communication Tester	CMD60	830861/029	2021/07/09	2022/07/08
AGILENT	Vector Signal Generator	N5182A	MY50143401	2021/12/13	2022/12/12
Fluke	Multi Meter	45	7664009	2021/12/14	2022/12/13
Rohde & Schwarz	Vector Signal Generator	SMBV100A	260434	2021/12/13	2022/12/12
Mini-Circuits	Power Splitter	DC-18000MHz	SF10944151S	2021/12/14	2022/12/13
Gongwen	Temp. & Humid. Chamber	HSD-500	109	2021/10/14	2022/10/13
Unknown	RF Coaxial Cable	No.31	RF-01	Each time	
Unknown	RF Cable	Unknown	Unknown	Each time	

*** Statement of Traceability:** Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC Part §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (Minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

Result

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm^2)
P = power input to the antenna (in appropriate units, e.g., mW).
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \le 1$$

Mode	Frequency (MHz)	Antenna Gain		Max Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
DECT	1921.536-1928.448	3.0	2.0	20.8	120.23	20	0.048	1
5G Wi-Fi	5190	2.5	1.8	10.0	10.0	20	0.004	1

Note: 1. the tune up conducted power was declared by the applicant
2. the DECT and 5G Wi-Fi can transmit at the same time.

Simultaneous transmitting consideration:

The ratio=MPE_{DECT}/limit+ $MPE_{5GWi\text{-}Fi}$/limit =0.048/1+0.004/1=0.052＜1.0

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Pass

§ 15.317, §15.203 ANTENNA REQUIREMENT

Applicable Standard

According to FCC § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Antenna Connector Construction

The EUT has two antennas which are TNC connector. And the antenna gain is 3dBi, fulfill the requirement of this section. Please refer to the EUT photos.

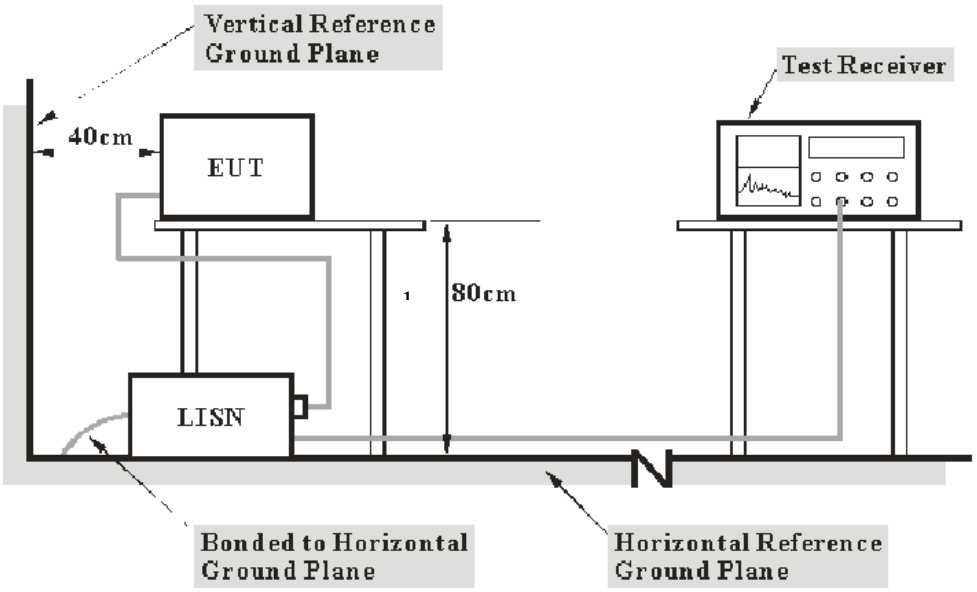
Result: Compliance.

FCC§15.315 & §15.207 - CONDUCTED EMISSIONS

Applicable Standard

FCC§15.315, an unlicensed PCS device that is designed to be connected to the public utility (AC) power line must meet the limits specified in §15.207.

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC 15.315 and FCC 15.207 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

The adapter was connected to a 120 VAC/60 Hz power source.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, adapter was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

Factor & Margin Calculation

The Factor is calculated by adding the LISN Insertion Loss, Cable Loss. The basic equation is as follows:

Factor = LISN Insertion Loss + Cable Loss

The "**Over Limit**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a over limit of -7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Over Limit = Level –Limit
Level = Read level + Factor

Test Data

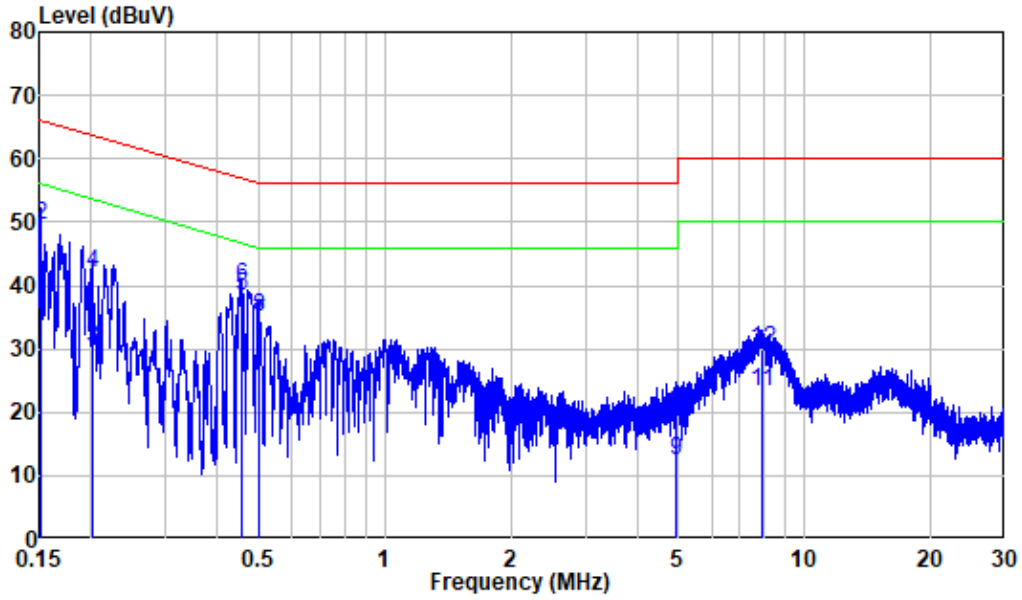
Environmental Conditions

Temperature:	23 ℃
Relative Humidity:	46 %
ATM Pressure:	101.0 kPa

The testing was performed by Caro Hu on 2022-05-05.

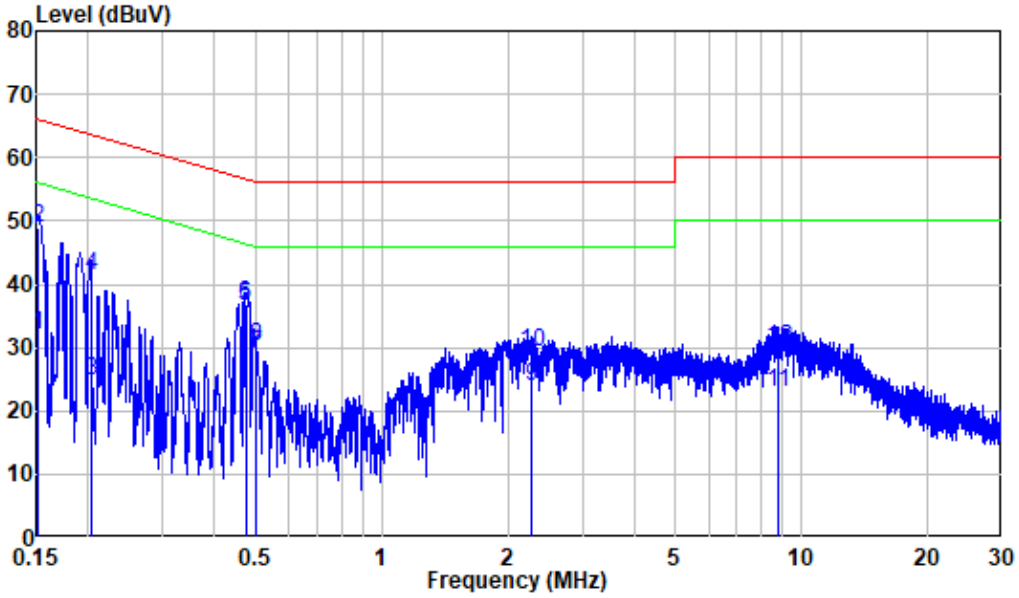
Test mode: Transmitting

AC 120V/60 Hz, Line



	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.151	9.80	25.29	35.09	55.93	-20.84	Average
2	0.151	9.80	39.65	49.45	65.93	-16.48	QP
3	0.200	9.80	20.51	30.31	53.59	-23.28	Average
4	0.200	9.80	32.27	42.07	63.59	-21.52	QP
5	0.455	9.80	28.42	38.22	46.79	-8.57	Average
6	0.455	9.80	29.92	39.72	56.79	-17.07	QP
7	0.500	9.80	24.29	34.09	46.00	-11.91	Average
8	0.500	9.80	25.23	35.03	56.00	-20.97	QP
9	4.939	9.85	2.59	12.44	46.00	-33.56	Average
10	4.939	9.85	9.67	19.52	56.00	-36.48	QP
11	7.904	9.88	13.41	23.29	50.00	-26.71	Average
12	7.904	9.88	19.89	29.77	60.00	-30.23	QP

AC 120V/60 Hz, Neutral



	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.152	9.80	22.22	32.02	55.88	-23.86	Average
2	0.152	9.80	39.10	48.90	65.88	-16.98	QP
3	0.203	9.80	14.98	24.78	53.50	-28.72	Average
4	0.203	9.80	31.55	41.35	63.50	-22.15	QP
5	0.473	9.80	26.80	36.60	46.46	-9.86	Average
6	0.473	9.80	26.97	36.77	56.46	-19.69	QP
7	0.500	9.80	19.27	29.07	46.00	-16.93	Average
8	0.500	9.80	20.49	30.29	56.00	-25.71	QP
9	2.271	9.82	13.98	23.80	46.00	-22.20	Average
10	2.271	9.82	19.58	29.40	56.00	-26.60	QP
11	8.752	9.99	13.08	23.07	50.00	-26.93	Average
12	8.752	9.99	20.00	29.99	60.00	-30.01	QP

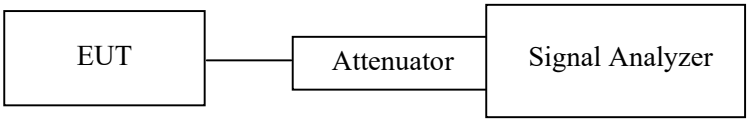
FCC§15.323 (a) - EMISSION BANDWIDTH

Applicable Standard

Operation shall be contained within the 1920–1930 MHz band. The emission bandwidth shall be less than 2.5 MHz and greater than 50 kHz.

The emission bandwidth is measured in accordance with ANSI C63.17 sub-clause 6.1.3 using the setup below:

Test Setup 1:



The width, in Hz, of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that is 26 dB down relative to the maximum level of the modulated carrier. It is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1% of the emission band-width of the device under measurement. [Extraction from 47 CFR 15, subpart D, 15.303 (C)].

Test Procedure

Using the manufacturer's information on occupied bandwidth set the spectrum analyzer as follows:

Resolution bandwidth	1.0% of the emission bandwidth (as close as possible)
Video bandwidth	>3 times the resolution bandwidth
Number of sweeps	sufficient to stability the trace
Detection mode	peak detection with maximum hold

Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	64 %
ATM Pressure:	101.0 kPa

The testing was performed by Ting Lü on 2022-04-18.

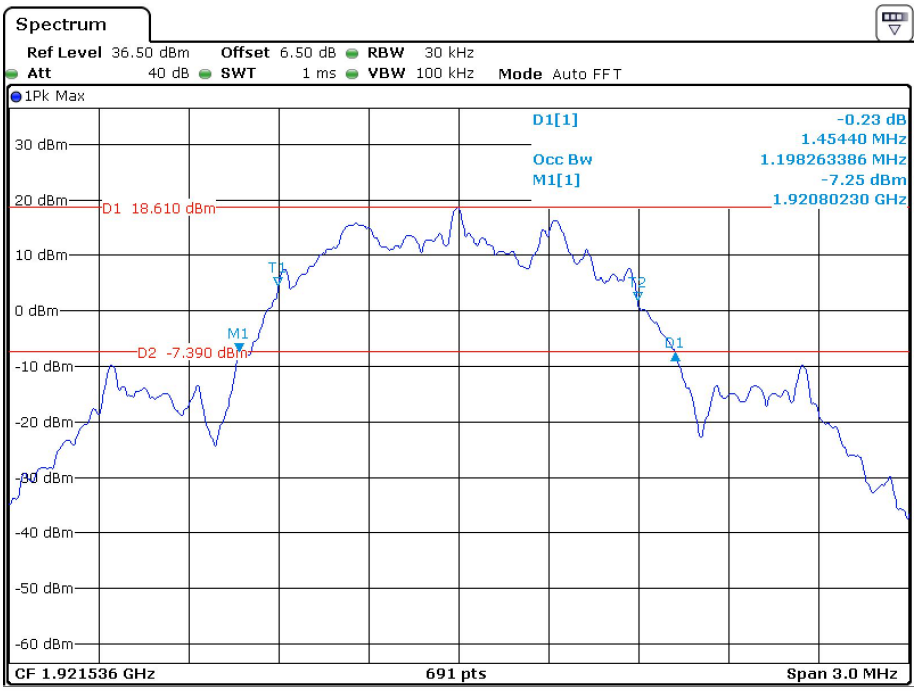
Test mode: Transmitting

Channel	Frequency (MHz)	99% Emission Bandwidth (MHz)	26 dB Emission Bandwidth (MHz)	Limit
Low	1921.536	1.198	1.454	50 kHz ~ 2.5 MHz
Middle	1924.992	1.194	1.454	50 kHz ~ 2.5 MHz
High	1928.448	1.194	1.463	50 kHz ~ 2.5 MHz

Test Result: Pass

Please refer to the following plots.

Low Channel



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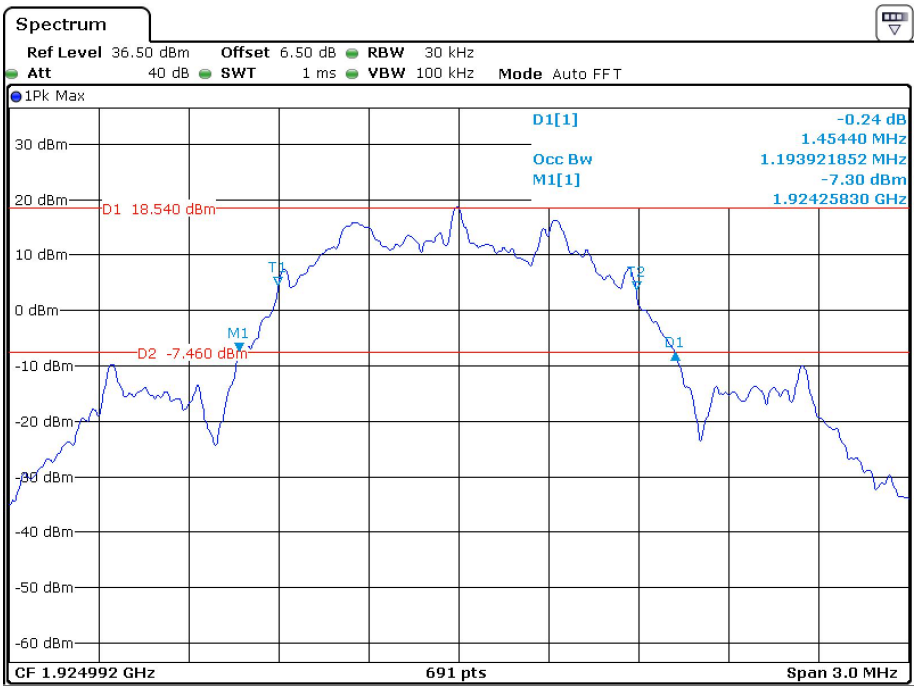
Middle Channel



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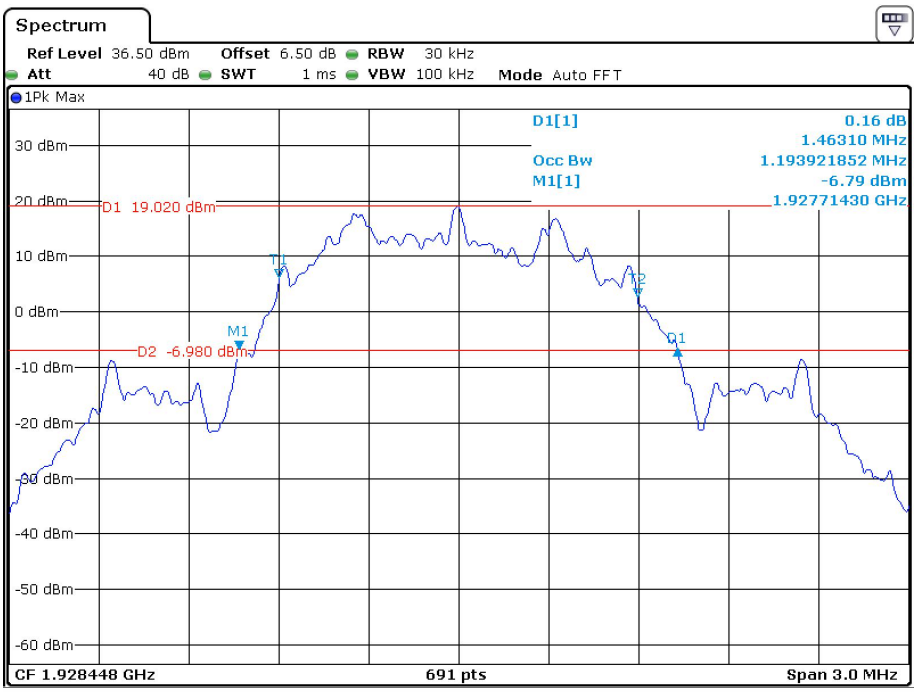
High Channel



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FCC§15.319 (c) - PEAK TRANSMIT POWER

Applicable Standard

The peak power output as measured over an interval of time equal to the frame rate or transmission burst of the device under all conditions of modulation. Usually this parameter is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used[47 CFR 15, subpart D, 15.303].

The peak transmit power is according to ANSI C63.17-2013 §6.1.2

Per FCC Part15.319 (c) Peak transmit power shall not exceed 100 microwatts multiplied by the square root of the emission bandwidth in hertz. Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

Per FCC Part15.319 (e), the peak transmit power shall be reduced by the amount in decibels that the maximum directional gain of the antenna exceeds 3 dBi.

Calculation of Peak Transmit Power Limit:
Peak Transmit Power Limit = $100\mu W \times (EBW)^{1/2}$
EBW is the transmit emission bandwidth in Hz determined in the other test item:

Test Procedure

Using the manufacturer's information on occupied bandwidth set the spectrum analyzer as follows:

RBW	≥ Emission bandwidth
Video bandwidth	≥ RBW
Span	Zero
Center frequency	Nominal center frequency of channels
Amplitude scale	Log (linear may be used if analyzer has sufficient linear dynamic range and accuracy)
Detection	Peak detection
Trigger	Video
Sweep rate	Sufficiently rapid to permit the transmit pulse to be resolved accurately

Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	64 %
ATM Pressure:	101.0 kPa

The testing was performed by Ting Lü on 2022-04-18.

Test Result: Pass. Please refer to the following table and plots.

Test mode: Transmitting:

Antenna 0

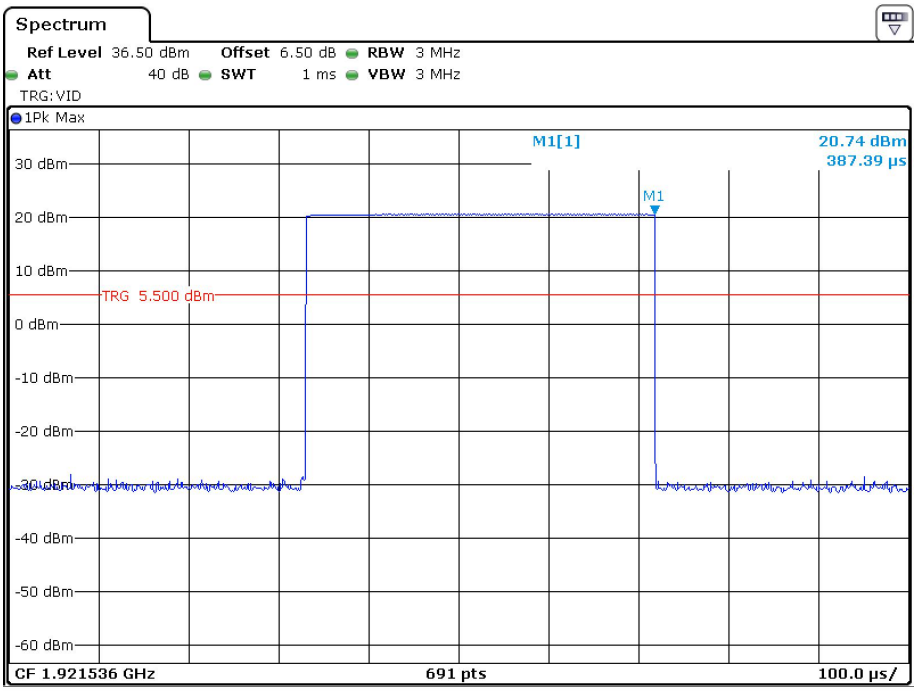
Channel	Frequency (MHz)	Peak Transmit Power (dBm)	Limit (dBm)
Low	1921.536	20.74	20.81
Middle	1924.992	20.66	20.81
High	1928.448	20.79	20.83
$BW_{Middle\ channel}$ = 1454000 Hz, $EBW_{Middle\ channel}$ = 1454000 Hz, $EBW_{High\ channel}$ = 1463000 Hz Peak Transmit Power Limit = $100(EBW)^{1/2}$ μW			

Antenna 1

Channel	Frequency (MHz)	Peak Transmit Power (dBm)	Limit (dBm)
Low	1921.536	20.22	20.81
Middle	1924.992	20.08	20.81
High	1928.448	20.12	20.83
$BW_{Middle\ channel}$ = 1454000 Hz, $EBW_{Middle\ channel}$ = 1454000 Hz, $EBW_{High\ channel}$ = 1463000 Hz Peak Transmit Power Limit = $100(EBW)^{1/2}$ μW			

Antenna 0

Low Channel



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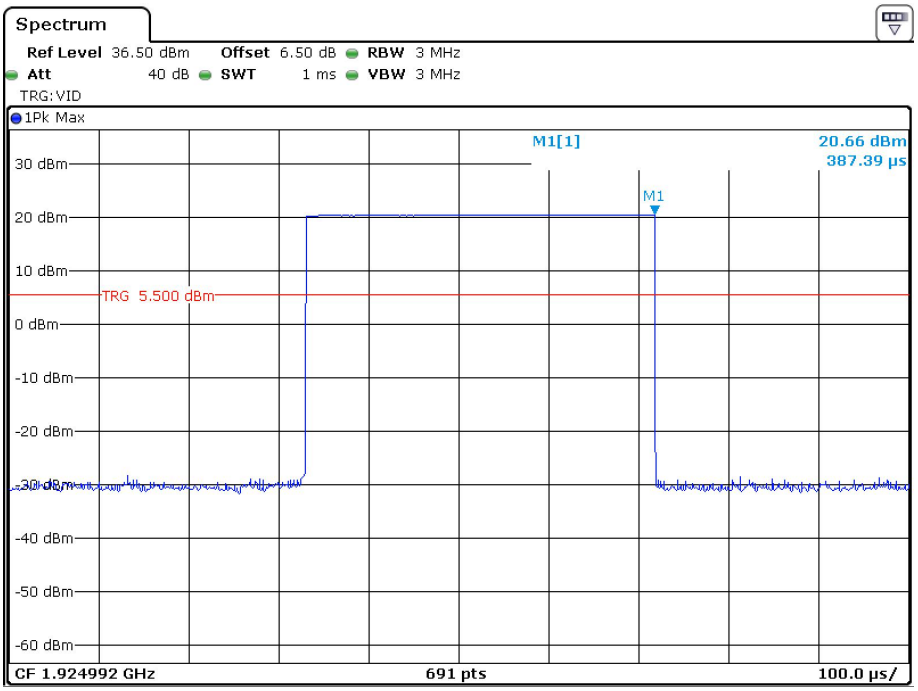
Middle Channel



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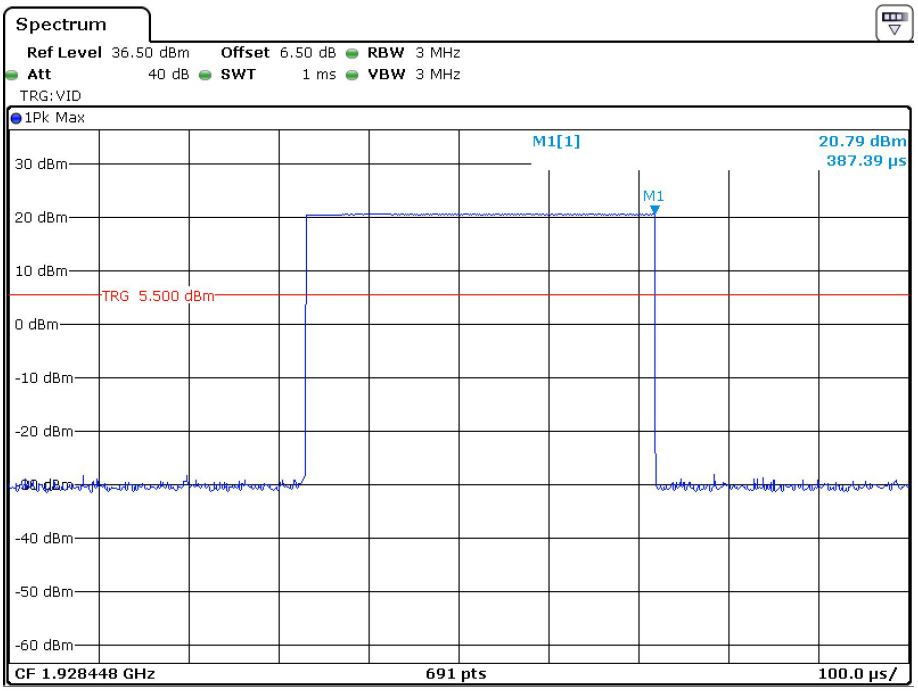
High Channel



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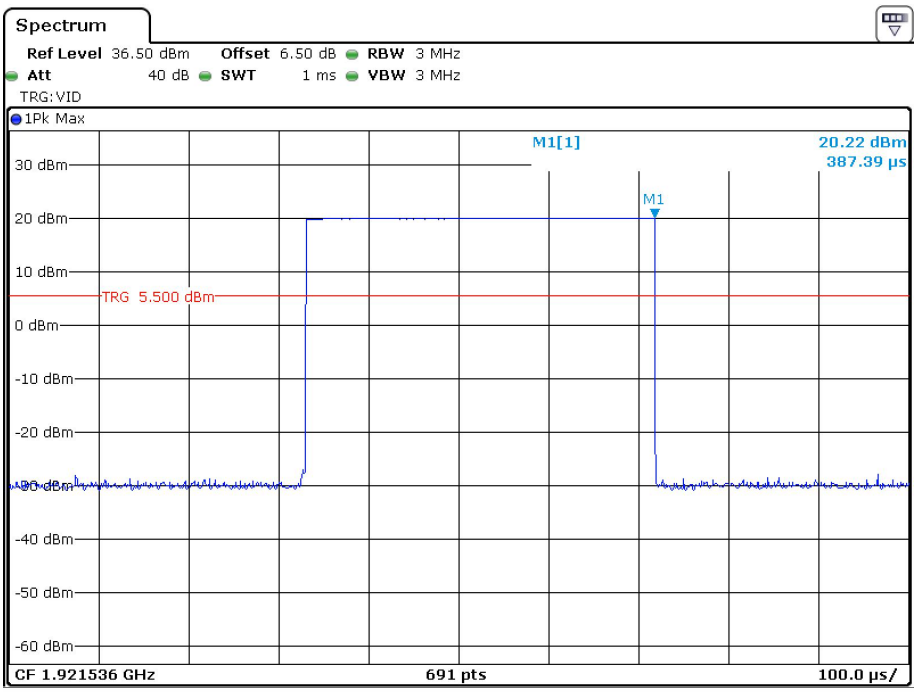
Antenna 1

Low Channel



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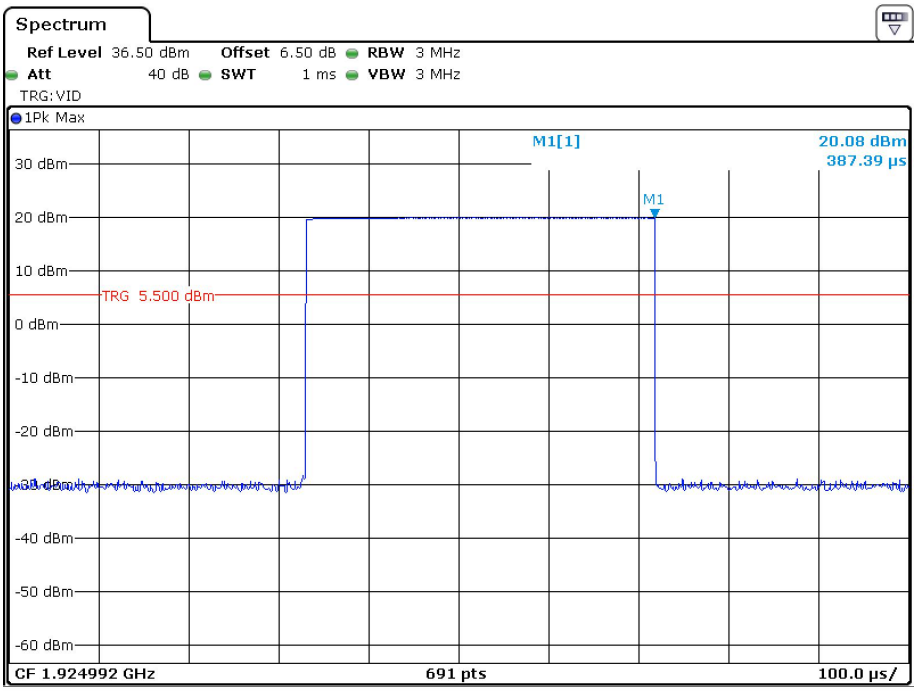
Middle Channel



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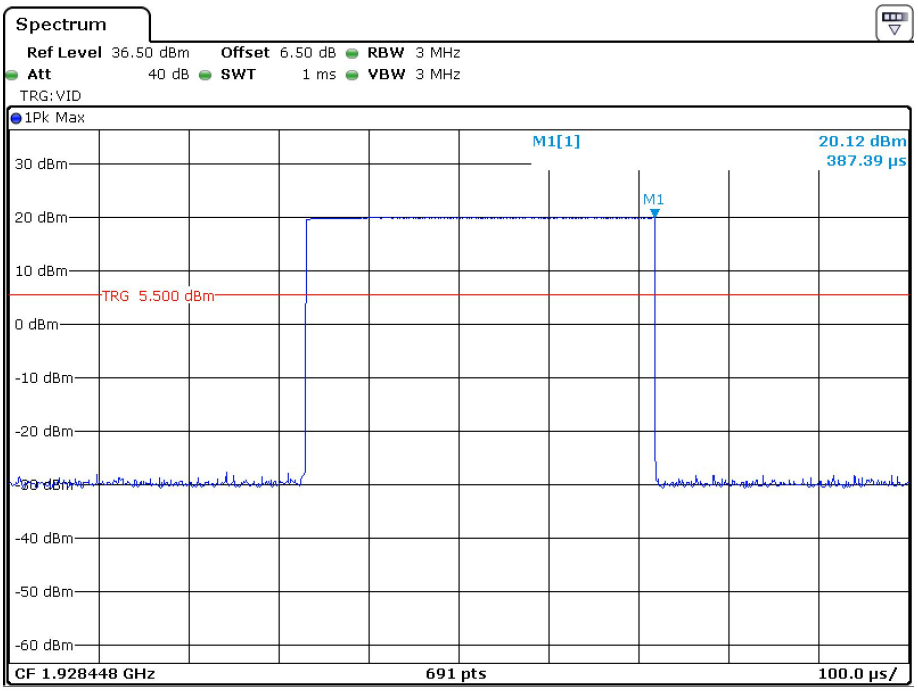
High Channel



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FCC§15.319 (d) - POWER SPECTRAL DENSITY

Applicable Standard

The average pulse energy in a 3 kHz bandwidth is divided by the pulse duration.

The power spectral density shall not exceed 3mW in any 3 kHz bandwidth as measured with a spectrum analyzer having a resolution bandwidth of 3 kHz.

The power spectral density is measured in accordance with ANSI C63.17.2013 Clause 6.1.5.

Test Procedure

Using the manufacturer's information on occupied bandwidth set the spectrum analyzer as follows:

RBW	3 kHz
Video bandwidth	≥ 3 × RBW
Span	Zero span at frequency with the maximum level (frequency determined in 6.1.3 if the same type of signal (continuous versus burst) was used in 6.1.3)
Center frequency	Spectral peak as determined in 6.1.3
Sweep time	For burst signals, sufficient to include essentially all of the maximum length burst at the output of a 3 kHz filter (e.g., maximum input burst duration plus 600 μs). For continuous signals, 20 ms.
Amplitude scale	Log power
Detection	Sample detection and averaged for a minimum of 100 sweeps
Trigger	External or internal

Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	64 %
ATM Pressure:	101.0 kPa

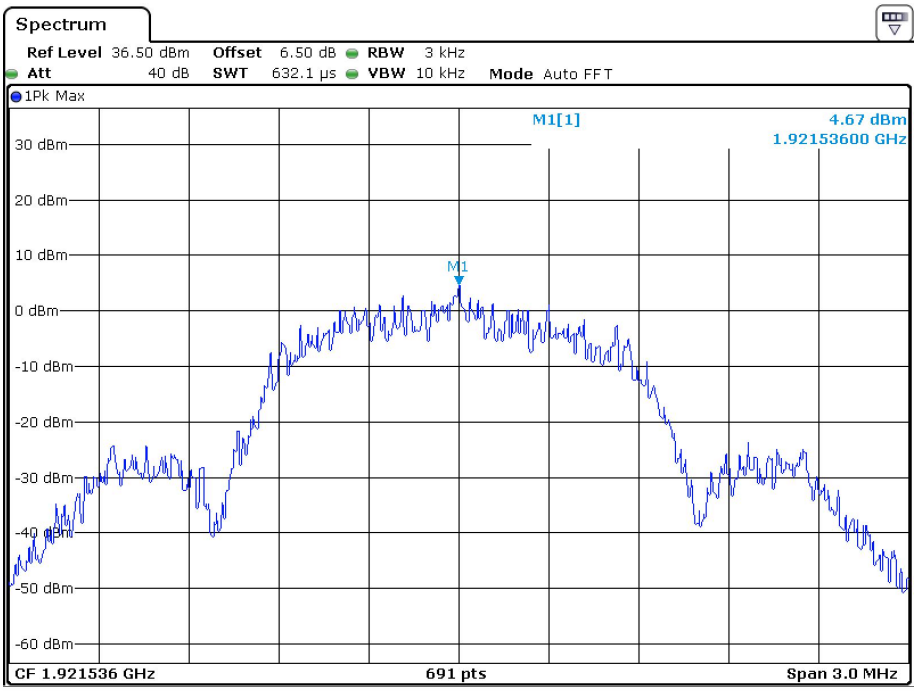
The testing was performed by Ting Lü on 2022-04-18.

Test Result: Pass. Please refer to following table and plots

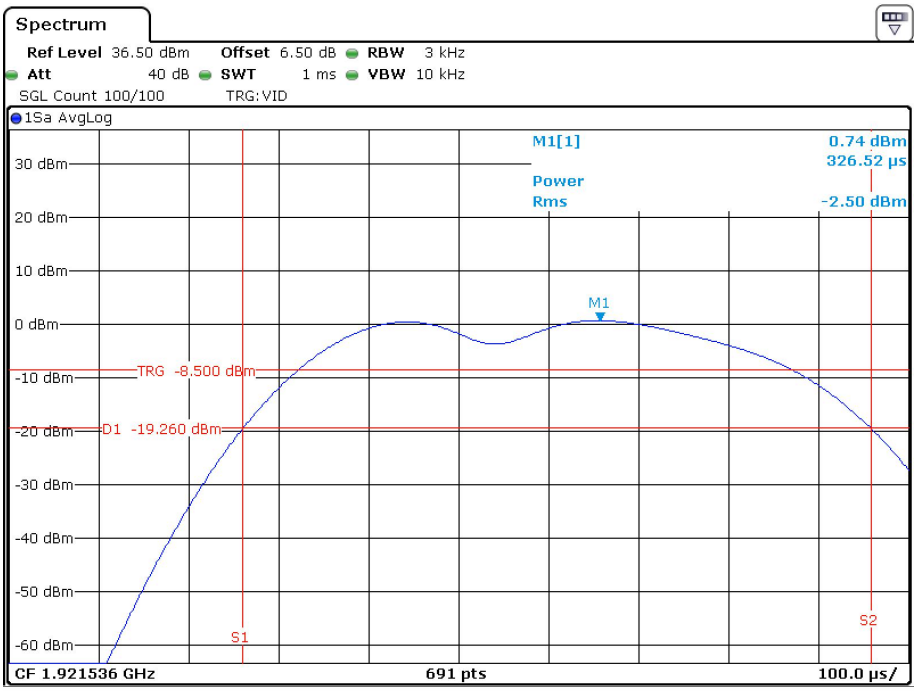
Test mode: Transmitting

Channel	Frequency (MHz)	Power Spectral Density		Limit (mW/3kHz)	Result
		(dBm/3kHz)	(mW/3kHz)		
Low	1921.536	-2.50	0.56	3	Pass
Middle	1924.992	-2.58	0.55	3	Pass
High	1928.448	-2.17	0.61	3	Pass

Low Channel

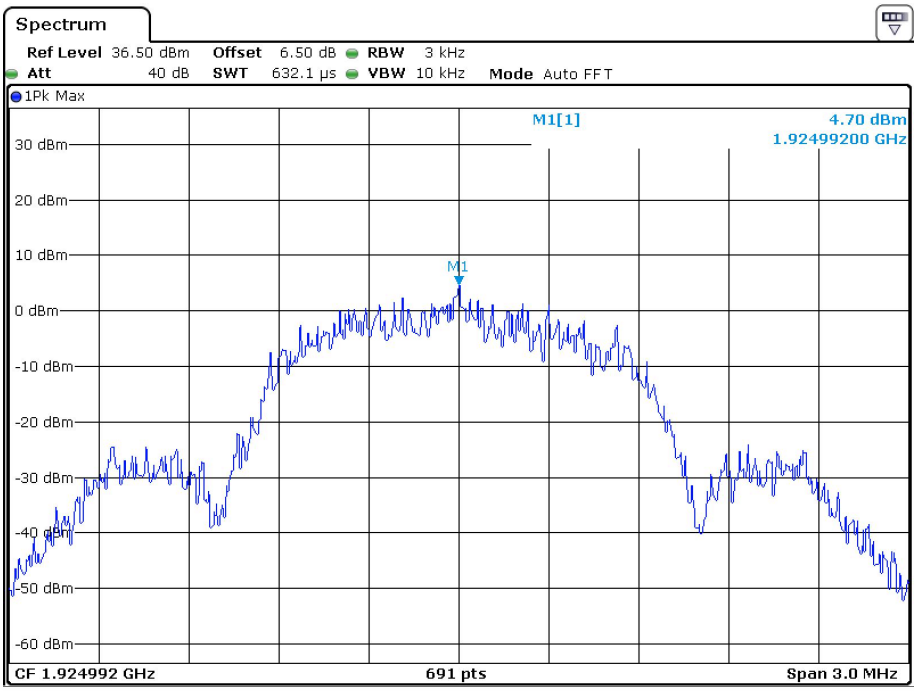


Date: 18.APR.2022 17:36:31

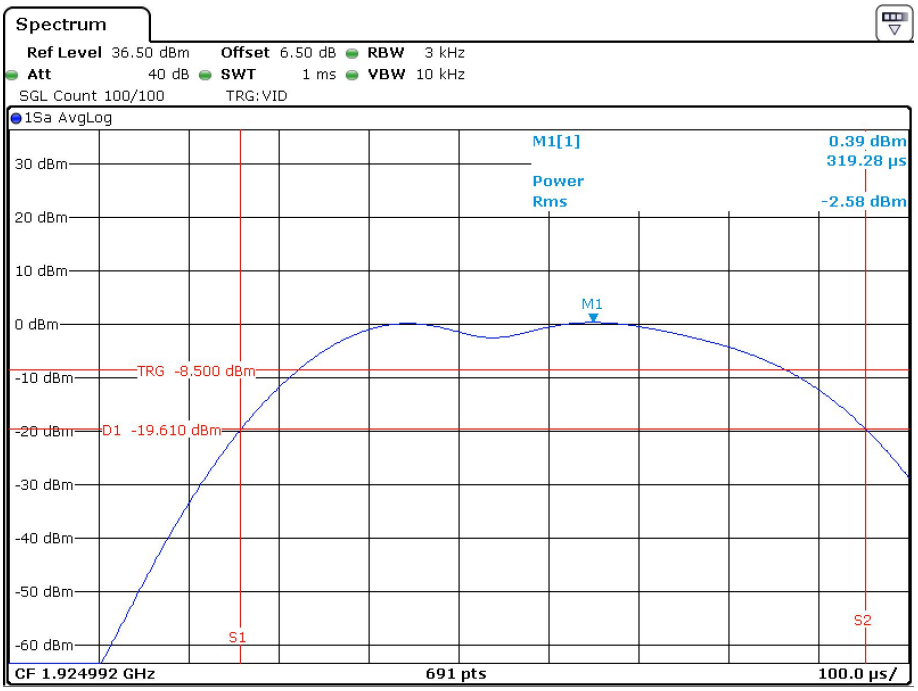


Date: 18.APR.2022 17:39:04

Middle Channel

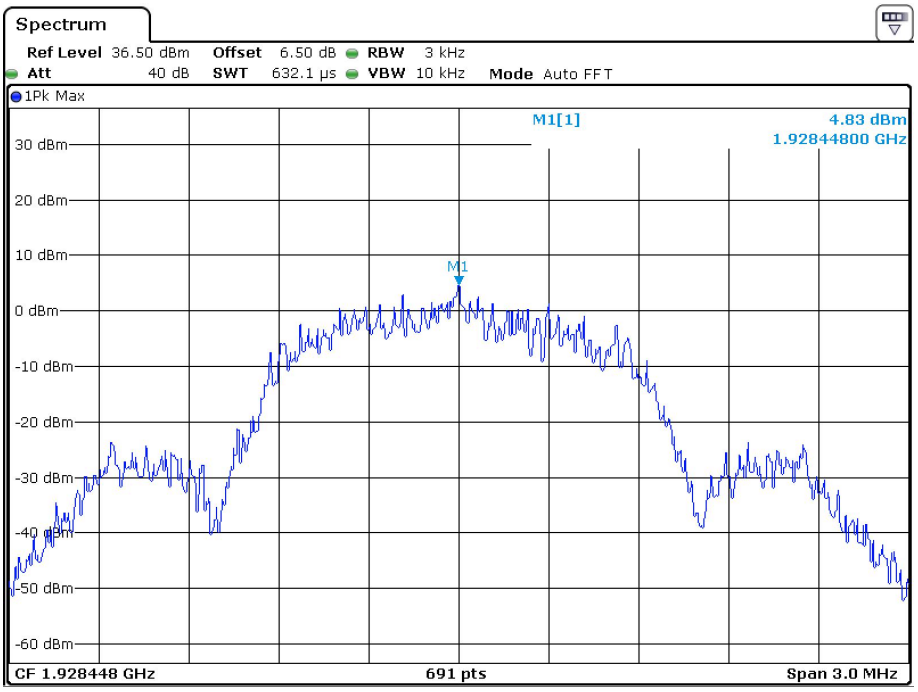


Date: 18.APR.2022 17:40:07

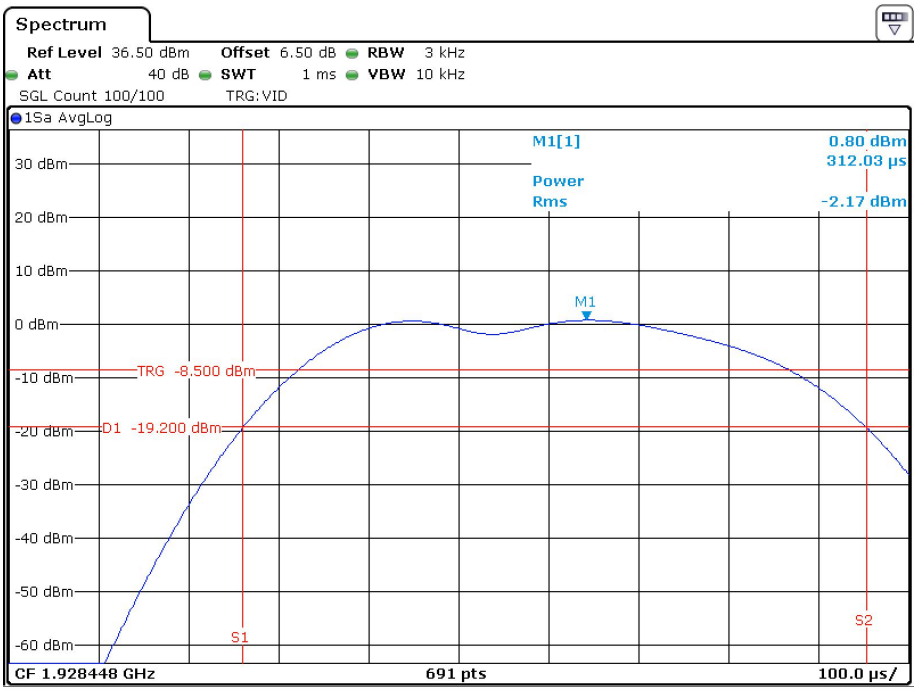


Date: 18.APR.2022 17:42:54

High Channel



Date: 18.APR.2022 17:43:39



Date: 18.APR.2022 17:45:30

FCC§15.323 (d) - EMISSION INSIDE AND OUTSIDE THE SUB-BAND

Applicable Standard

Emissions inside the sub-band must comply with the following emission mask:

1. In the bands between 1B and 2B measured from the center of the emission bandwidth the total power emitted by the device shall be at least 30 dB below the transmit power permitted for that device;
2. in the bands between 2B and 3B measured from the center of the emission bandwidth the total power emitted by an intentional radiator shall be at least 50 dB below the transmit power permitted for that radiator;
3. in the bands between 3B and the sub-band edge the total power emitted by an intentional radiator in the measurement bandwidth shall be at least 60 dB below the transmit power permitted for that radiator.

   Where B = emission bandwidth

Emission Outside the sub-band shall be attenuated below a reference power of 112 mw (20.5 dBm) as follows:

1. 30 dB between the sub-band and 1.25 MHz above or below the sub-band;
2. 50 dB between 1.25 and 2.5 MHz above or below the sub-band;
3. 60 dB at 2.5 MHz or greater above or below the sub-band.

Test Procedure

According to ANSI C63.17-2013 Clause 6.1.6.

Test Data

Environmental Conditions

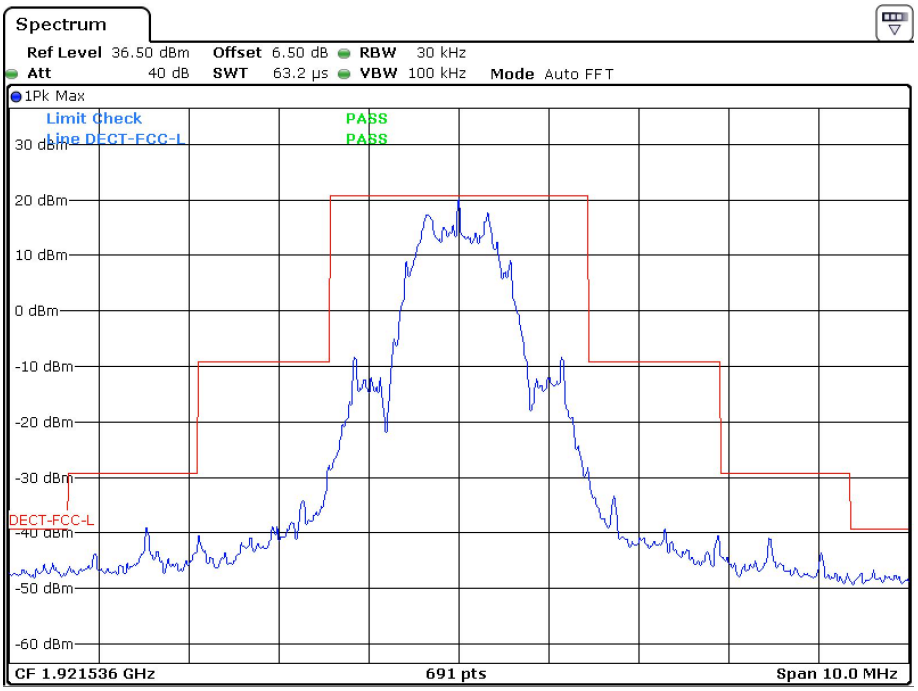
Temperature:	24 ℃
Relative Humidity:	64 %
ATM Pressure:	101.0 kPa

The testing was performed by Ting Lü on 2022-04-18.

Test mode: Transmitting

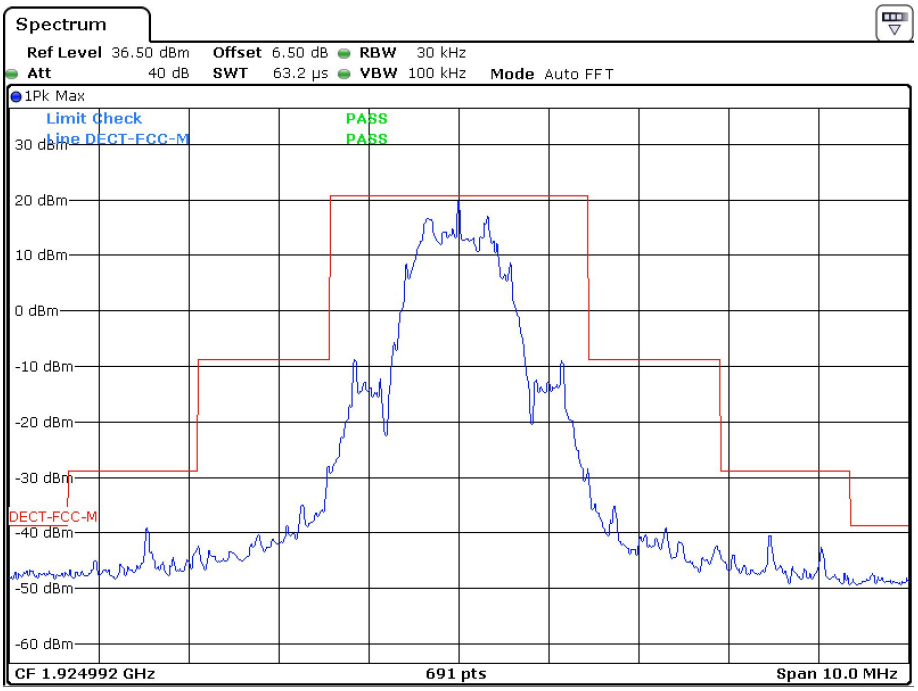
Test Result: Pass. Please refer to following plots

Low Channel (Unwanted Emission inside the Sub-band)



Date: 18.APR.2022 18:05:54

Middle Channel (Unwanted Emission inside the Sub-band)



Date: 18.APR.2022 18:07:35