

TEST REPORT

Report No.: 8133EU012003W

Applicant: HOLYBRO(H.K.) LIMITED

Address: RM 1902 EASEY COMM BLDG253-261 HENNESSY
RD WANCHAI Hongkong China

Product Name: TELEMETRY RADIO 433MHZ

Model No.: HT03-V3-433, HT03-433

Trademark: Holybro

FCC ID: 2AP22-HT03-V3-433

Test Standard(s): 47 CFR Part 15 Subpart C

Date of Receipt: Oct. 23, 2023

Test Date: Oct. 23, 2023 –Dec. 11, 2023

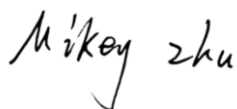
Date of Issue: Dec. 13, 2023

ISSUED BY:

SHENZHEN EU TESTING LABORATORY LIMITED



Prepared by:



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Reviewed and Approved by:



Sally Zhang/ Manager

Revision Record

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2 General Information

2.1 Applicant Information

Applicant	HOLYBRO(H.K.) LIMITED
Address	RM 1902 EASEY COMM BLDG253-261 HENNESSY RD WANCHAI Hongkong China

2.2 Manufacturer Information

Manufacturer	HOLYBRO(H.K.) LIMITED
Address	RM 1902 EASEY COMM BLDG253-261 HENNESSY RD WANCHAI Hongkong China

2.3 Factory Information

Factory	Shenzhen HolyBro Hobby Technical Co., LTD
Address	Floor 4, Jiang Hai Industry District, No.7 yonghe Road, Shi Yan Town, Bao'an District, Shenzhen City, Guangdong Province, China

2.4 General Description of E.U.T.

Product Name	TELEMETRY RADIO 433MHZ
Model No. Under Test	HT03-V3-433
List Model No.	HT03-433
Description of Model differentiation	All models are same with electrical parameters and internal circuit structure, but only differ in model name. (this information provided by the customer)
Trade Mark	Holybro
Rating(s)	5VDC, 100mA
Product Type	☐ Mobile ☒ Portable ☐ Fix Location
Test Sample No.	-1/2(Normal Sample), -2/2(Engineering Sample)
Hardware Version	N/A
Software Version	N/A
Remark	N/A

2.5 Technical Information of E.U.T.

Technology Used	433.16-434.46 MHz
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The requirement for the following technical information of the EUT was tested in this report:

Operating Frequency	433.16 - 434.46 MHz
Number of Channel	10
Modulation Type	GFSK
Antenna Type	Columnar Antenna
Antenna Gain(Peak)	2.5 dBi

All channel was listed on the following table:

Channel	Freq. (MHz)	Channel	Freq. (MHz)
01	433.16	02	433.30
03	433.45	04	433.59
05	433.74	06	433.88
07	434.03	08	434.17
09	434.32	10	434.46

3 Test Summary

3.1 Test Standard

The tests were performed according to following standards:

No.	Identity	Document Title
1	47 CFR Part 15, Subpart C Section 15.231	Intentional radiators of radio frequency equipment Periodic Operation in the band 40.66-40.70MHz and above 70MHz
2	ANSI C63.10-2020	American National Standard for Testing Unlicensed Wireless Devices

Remark:

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product maybe which result in lowering the emission/immunity should be checked to ensure compliance has been maintained.

3.2 Test Verdict

No.	Description	FCC Part No.	Verdict	Remark
1	Antenna Requirement	15.203	Pass	--
2	Conducted Emission at AC Power Line	15.207	Pass	--
3	20dB Bandwidth	15.231(c)	Pass	--
4	Transmit Time	15.231(a)	Pass	--
5	Duty Cycle	15.35	Pass	--
6	Field Strength of Fundamental Emissions and Spurious Emission	15.231(b)	Pass	--
7	Radiated Emission	15.205, 15.209, 15.231(b)	Pass	--

3.3 Test Laboratory

Test Laboratory	Shenzhen EU Testing Laboratory Limited
Address	101, Bldg. B1, Fuqiao Fourth Area, Qiaotou Community, Fuhai Subdistrict, Baoan District, Shenzhen, Guangdong, China
Designation Number	CN1368
Test Firm Registration Number	952583

4 Test Configuration

4.1 Test Environment

During the measurement, the normal environmental conditions were within the listed ranges:

Relative Humidity	30% to 60%	
Atmospheric Pressure	86 kPa to 106 kPa	
Temperature	NT (Normal Temperature)	+15°C to +35°C
Working Voltage of the EUT	NV (Normal Voltage)	120VAC, 60Hz DC 5V

4.2 Test Equipment

Conducted Emission at AC power line					
Equipment	Manufacturer	Model No	Serial No	Cal Date	Cal Due Date
L.I.S.N. Artificial Mains Network	Rohde & Schwarz	ENV216	EE-004	2023/01/10	2024/01/09
EMI Test Receiver	Rohde & Schwarz	ESCI	EE-005	2023/01/10	2024/01/09
Test Software	Farad	EZ-EMC	EE-014	N.C.R	N.C.R

Radiated Emission and RF Test					
Equipment	Manufacturer	Model No	Serial No	Cal Date	Cal Due Date
EMI Test Receiver	ROHDE & SCHWARZ	ESPI	EE-006	2023/01/10	2024/01/09
Bilog Broadband Antenna	SCHWARZBECK	VULB 9163	EE-007	2023/01/14	2026/01/09
Double Ridged Horn Antenna	A-INFOMW	LB-10180-NF	EE-008	2023/01/12	2026/01/09
Pre-amplifier	Agilent	8447D	EE-009	2023/01/10	2024/01/09
Pre-amplifier	Agilent	8449B	EE-010	2023/01/10	2024/01/09
MXA Signal Analyzer	Agilent	N9020A	EE-011	2023/01/10	2024/01/09
MXG RF Vector Signal Generator	Agilent	N5182A	EE-012	2023/01/10	2024/01/09
Test Software	Farad	EZ-EMC	EE-015	N.C.R	N.C.R
MIMO Power Measurement Module	TSTPASS	TSPS 2023R	EE-016	2023/05/17	2024/05/16
RF Test Software	TSTPASS	TS32893 V2.0	EE-017	N.C.R	N.C.R
Wideband Radio Communication Tester	ROHDE & SCHWARZ	CMW500	EE-402	2023/02/16	2024/02/15
Loop Antenna	TESEQ	HLA6121	EE-403	2023/02/16	2024/02/15
MXG RF Analog Signal Generator	Agilent	N5181A	EE-406	2023/02/16	2024/02/15
Constant Temperature Humidity Chamber	Guangxin	GXP-401	ES-002	2023/07/31	2024/07/30

4.3 Description of Support Unit

No.	Title	Manufacturer	Model No.	Serial No.
1	Adapter	Apple	A1443	--

4.4 Test Mode

No.	Test Modes	Description
TM1	TX	Keep the EUT connect to AC power line and works in continuously transmitting mode.

4.5 Measurement Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.

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

Test Item	Measurement Uncertainty
Conducted Emission	2.64 dB
Occupied Channel Bandwidth	2.8 %
RF Output Power, conducted	0.68 dB
Power Spectral Density, conducted	1.37 dB
Unwanted Emissions, conducted	1.84 dB
All Emissions, radiated	5.11 dB
Transmit Time	0.01 ms
Duty Cycle	0.05 %
Temperature	0.8°C
Humidity	4%

4.6 Deviation from Standards

None.

4.7 Abnormalities from Standard Condition

None.

5 Test Items

5.1 Antenna requirement

5.1.1 Test Requirement

Test Requirement	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. This requirement does not apply to carrier current devices or to devices operated under the provisions of § 15.211, § 15.213, § 15.217, § 15.219, or § 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded. If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. 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 FCC rule.
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5.1.2 Antenna Anti-Replacement Construction

The Antenna Anti-Replacement as following method:

Protected Method	Description
The antenna is embedded in the product.	An embedded-in antenna design is used.

Reference Documents	Item
Photo	Please refer to the EUT Photo documents.

5.1.3 Antenna Gain

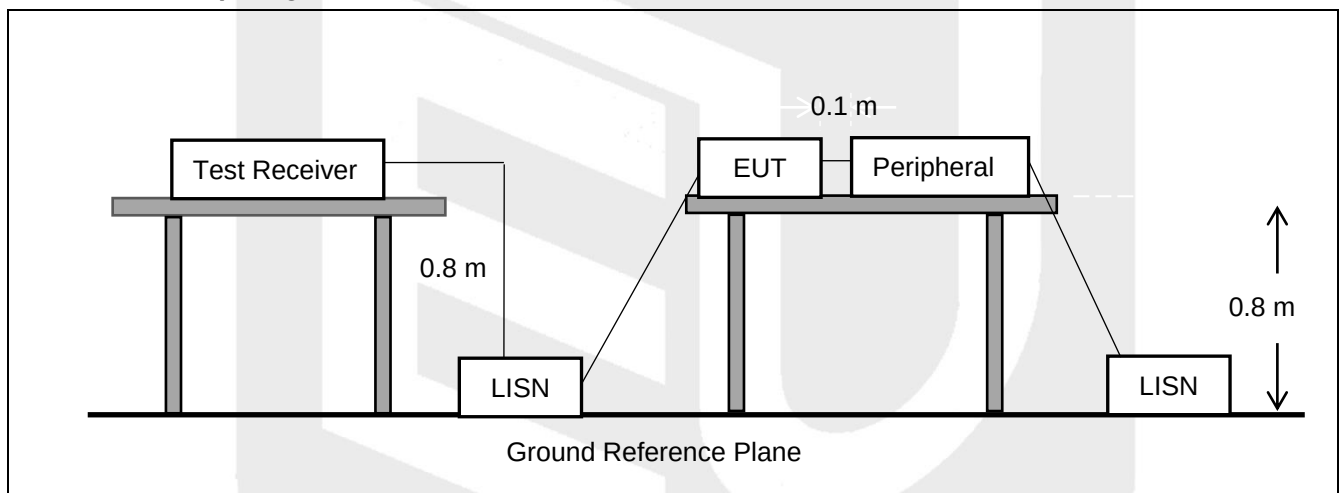
The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

5.2 Conducted Emission at AC Power Line

5.2.1 Test Requirement

Test Requirement	Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN).		
Test Limit	Frequency of emission (MHz)	Conducted limit (dB μ V)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
	*Decreases with the logarithm of the frequency.		
Test Method	ANSI C63.10-2020 section 6.2		

5.2.2 Test Setup Diagram



5.2.3 Test Procedure

The EUT is put on the plane 0.8 m high above the ground by insulating support and connected to the AC mains through Line Impedance Stability Network (L.I.S.N). This provided a 50ohm coupling impedance for the tested equipment. Both sides of AC line are investigated to find out the maximum conducted emission according to the test standard regulations during emission measurement.

The bandwidth of the field strength meter (R&S Test Receiver ESCI) is set at 9kHz in 150kHz~30MHz.

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz) for which the device is capable of operation. A device rated for 50/60 Hz operation need not be tested at both frequencies provided the radiated and line conducted emissions are the same at both frequencies.

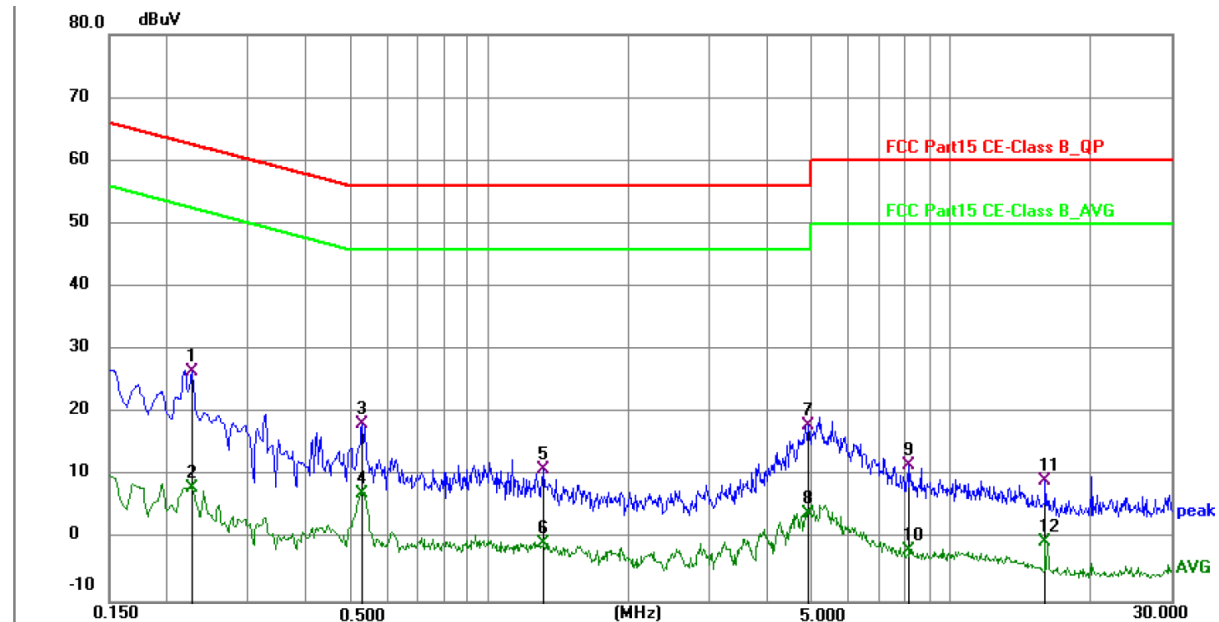
5.2.4 Test Data

PASS.

Only the worst case data was showed in the report, please to see the following pages.

Conducted Emission Test Data

Test Site: Shielded Room #1
 Test Mode: TM1/ CH Middle
 Comments: Live Line



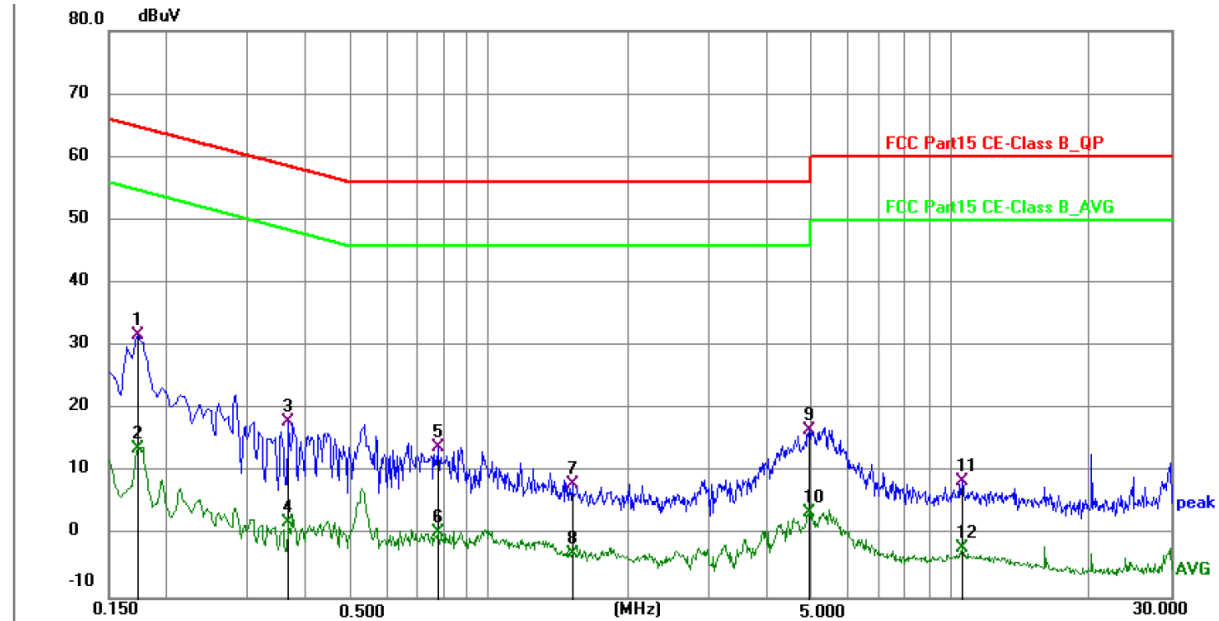
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1 *	0.2265	26.54	0.00	26.54	62.58	-36.04	QP	P	
2	0.2265	8.20	0.00	8.20	52.58	-44.38	AVG	P	
3	0.5280	18.30	0.00	18.30	56.00	-37.70	QP	P	
4	0.5280	7.32	0.00	7.32	46.00	-38.68	AVG	P	
5	1.3154	11.09	0.00	11.09	56.00	-44.91	QP	P	
6	1.3154	-0.75	0.00	-0.75	46.00	-46.75	AVG	P	
7	4.9245	17.93	0.00	17.93	56.00	-38.07	QP	P	
8	4.9245	4.10	0.00	4.10	46.00	-41.90	AVG	P	
9	8.1240	11.71	0.00	11.71	60.00	-48.29	QP	P	
10	8.1240	-1.89	0.00	-1.89	50.00	-51.89	AVG	P	
11	15.9990	9.16	0.00	9.16	60.00	-50.84	QP	P	
12	15.9990	-0.45	0.00	-0.45	50.00	-50.45	AVG	P	

Note: Level = Reading + Factor

Margin = Level - Limit

Conducted Emission Test Data

Test Site: Shielded Room #1
 Test Mode: TM1/ CH Middle
 Comments: Neutral Line



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1 *	0.1725	31.84	0.00	31.84	64.84	-33.00	QP	P	
2	0.1725	13.83	0.00	13.83	54.84	-41.01	AVG	P	
3	0.3660	18.05	0.00	18.05	58.59	-40.54	QP	P	
4	0.3660	2.00	0.00	2.00	48.59	-46.59	AVG	P	
5	0.7755	14.06	0.00	14.06	56.00	-41.94	QP	P	
6	0.7755	0.47	0.00	0.47	46.00	-45.53	AVG	P	
7	1.5180	8.04	0.00	8.04	56.00	-47.96	QP	P	
8	1.5180	-2.94	0.00	-2.94	46.00	-48.94	AVG	P	
9	4.9515	16.60	0.00	16.60	56.00	-39.40	QP	P	
10	4.9515	3.71	0.00	3.71	46.00	-42.29	AVG	P	
11	10.5720	8.66	0.00	8.66	60.00	-51.34	QP	P	
12	10.5720	-2.04	0.00	-2.04	50.00	-52.04	AVG	P	

Note: Level = Reading + Factor

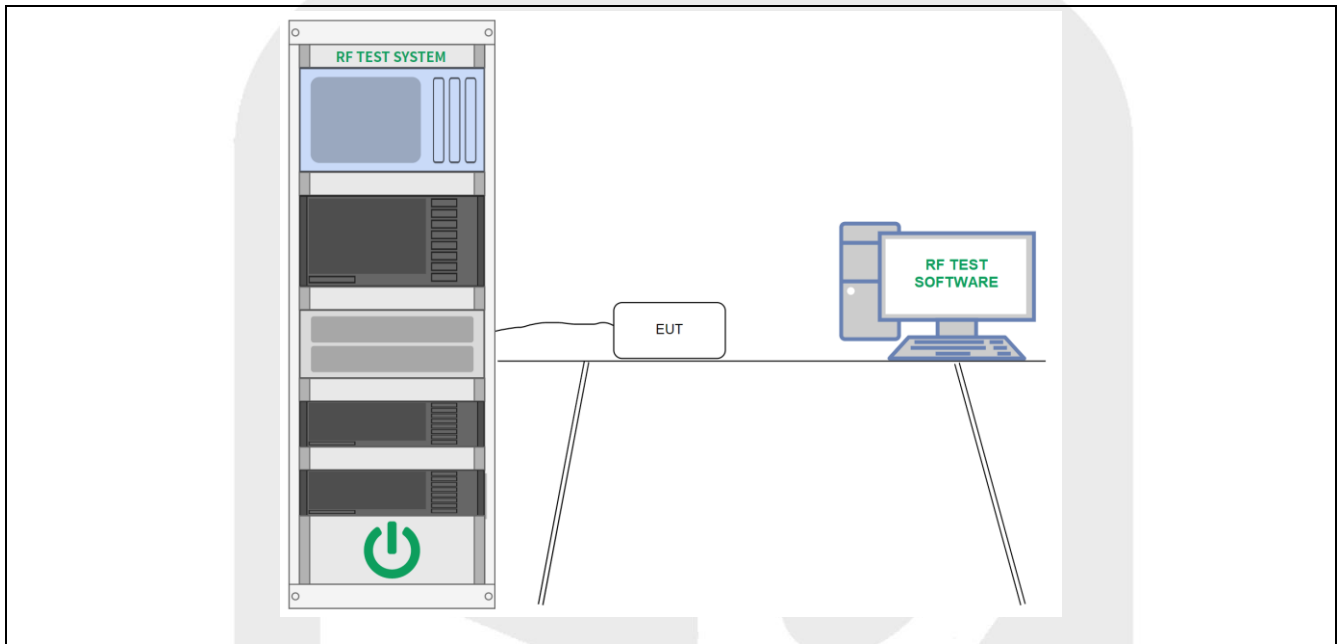
Margin = Level - Limit

5.3 20dB Bandwidth

5.3.1 Test Requirement

Test Requirement	The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.
Test Method	ANSI C63.10-2020, section 6.9.2

5.3.2 Test Setup Diagram



5.3.3 Test Procedure

- The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the EMI receiver or spectrum analyzer shall be between two times and five times the OBW.
- The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW, unless otherwise specified by the applicable requirement.
- Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than $[10 \log (OBW/RBW)]$ below the reference level. Specific guidance is given in 4.1.5.2.
- Steps a) through c) might require iteration to adjust within the specified tolerances.
- The dynamic range of the instrument at the selected RBW shall be more than 10 dB below the target “-xx dB down” requirement; that is, if the requirement calls for measuring the -20 dB OBW, the instrument noise floor at the selected RBW shall be at least 30 dB below the reference value.
- Set detection mode to peak and trace mode to maxhold.
- Determine the reference value: Set the EUT to transmit an unmodulated carrier or modulated signal, as applicable. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
- Determine the “-xx dB down amplitude” using $[(\text{reference value}) - xx]$. Alternatively, this calculation may be made by using the marker-delta function of the instrument.
- If the reference value is determined by an unmodulated carrier, then turn the EUT modulation ON, and either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to

stabilize. Otherwise, the trace from step g) shall be used for step j).

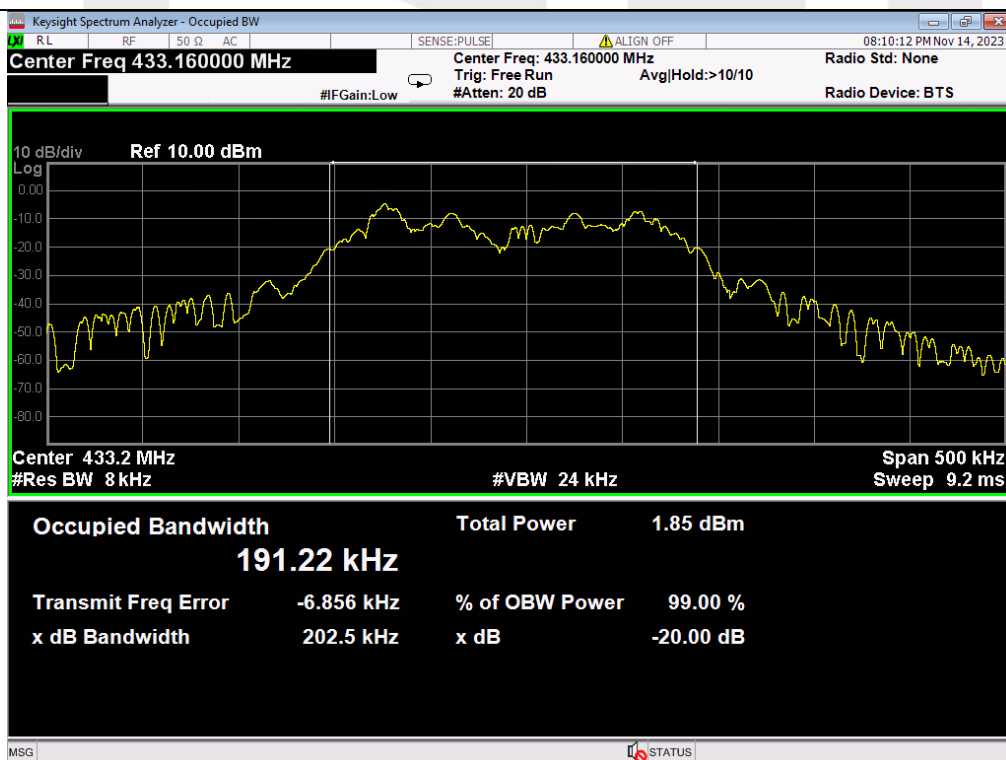
j) Place two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the “-xx dB down amplitude” determined in step h). If a marker is below this “-xx dB down amplitude” value, then it shall be as close as possible to this value. The occupied bandwidth is the frequency difference between the two markers. Alternatively, set a marker at the lowest frequency of the envelope of the spectral display, such that the marker is at or slightly below the “-xx dB down amplitude” determined in step h). Reset the marker-delta function and move the marker to the other side of the emission until the delta marker amplitude is at the same level as the reference marker amplitude. The marker-delta frequency reading at this point is the specified emission bandwidth.

The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

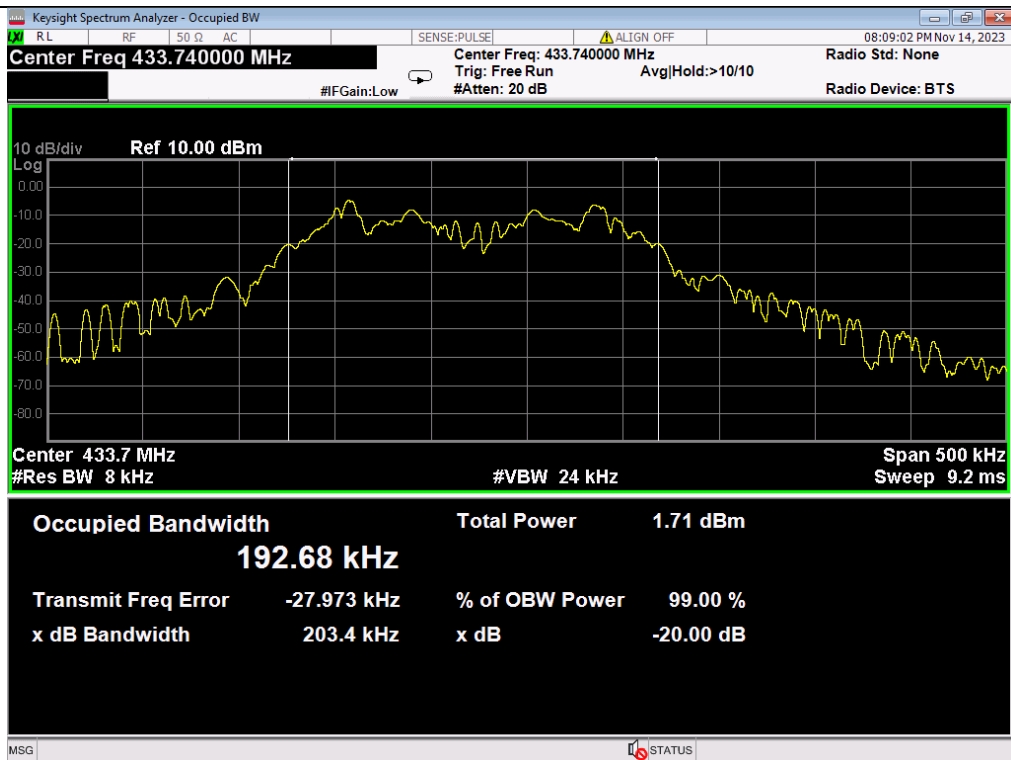
5.3.4 Test Data

CH	Frequency (MHz)	20 dB Bandwidth (kHz)	Limit (kHz)	Verdict
Low	433.16	202.5	≤1082.90	Pass
Middle	433.74	203.4	≤1084.35	Pass
High	434.46	205.7	≤1086.15	Pass

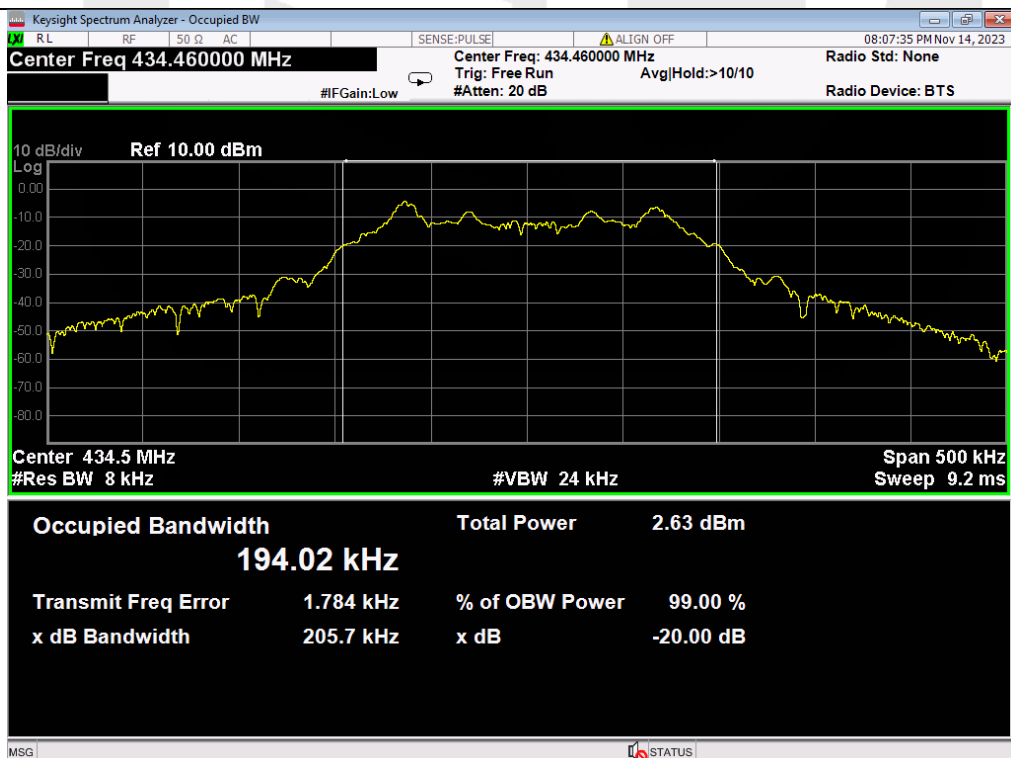
Test Plot--CH Low



Test Plot--CH Middle



Test Plot--CH High

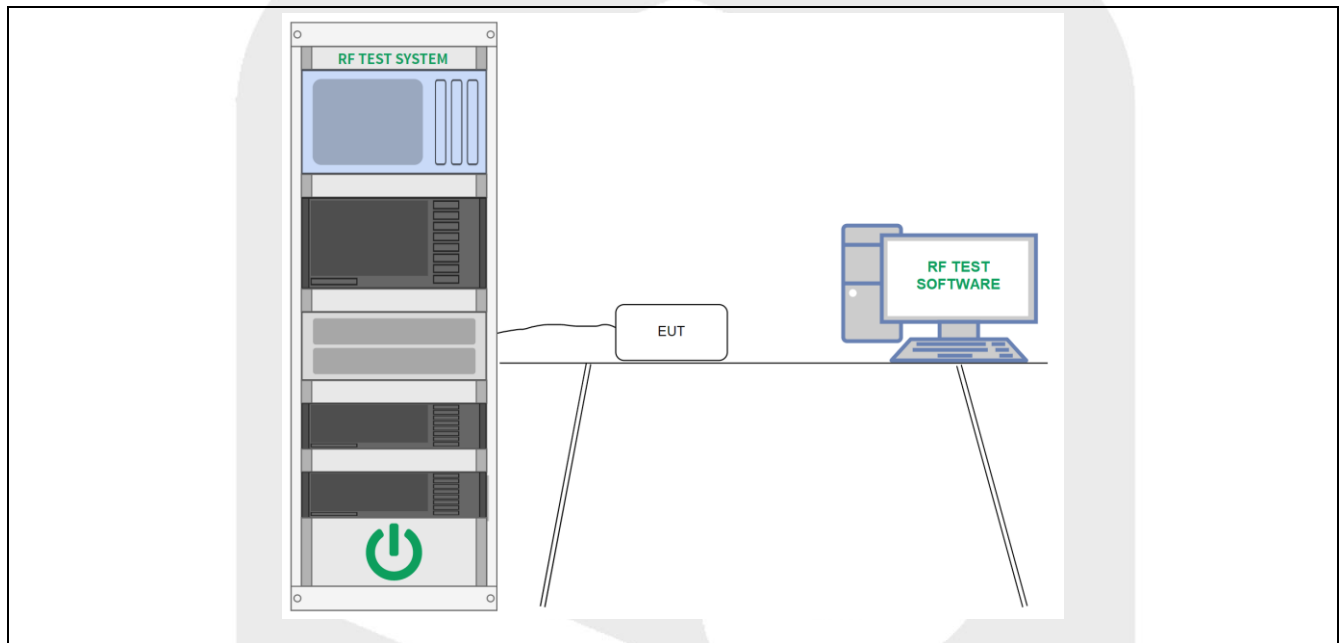


5.4 Transmit Time

5.4.1 Test Requirement

Test Requirement	The following conditions shall be met to comply with the provisions for this periodic operation: (1) A manually operated transmitter shall employ a switch that will auto-matically deactivate the transmitter within not more than 5 seconds of being released. (2)A transmitter activated automati-cally shall cease transmission within 5seconds after activation.
Test Method	ANSI C63.10-2020, section 7.4

5.4.2 Test Setup Diagram



5.4.3 Test Procedure

For evaluation of periodic operation characteristics, the following procedure may be used - Trigger the spectrum analyzer sweep on the RF waveform of the unlicensed wireless device. - Set the spectrum analyzer sweep time greater than the specified time for periodic operation. - Manually activate and deactivate the unlicensed wireless device and confirm that it ceases transmission within the specified time of deactivation. - Document the test results. - Verify and document that periodic transmissions at regular predetermined intervals do not exist except where regulatory requirements allow polling or supervision transmissions. including data, to determine system integrity. Compliance is addressed by an attestation supported by the equipment theory of operation.

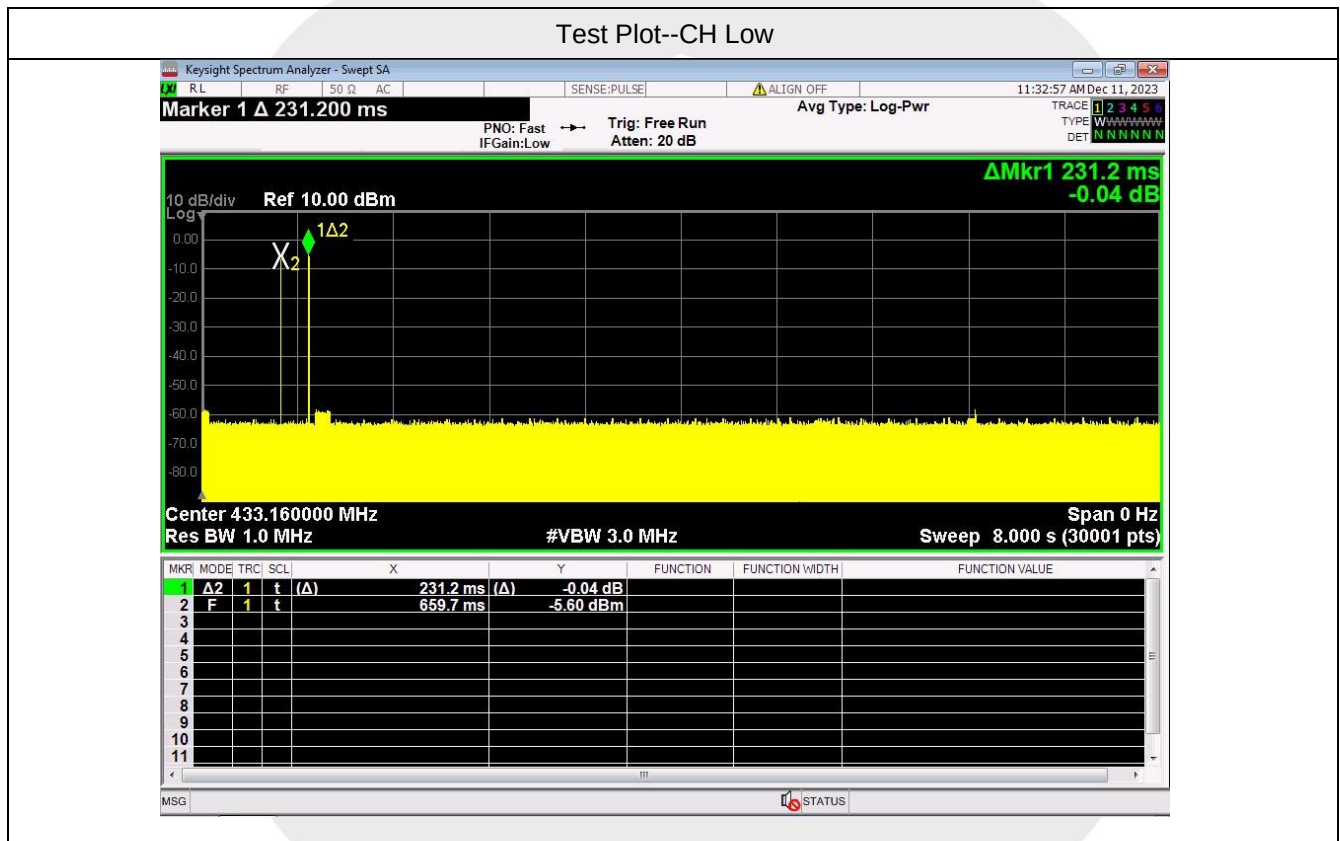
5.4.4 Test Data

PASS.

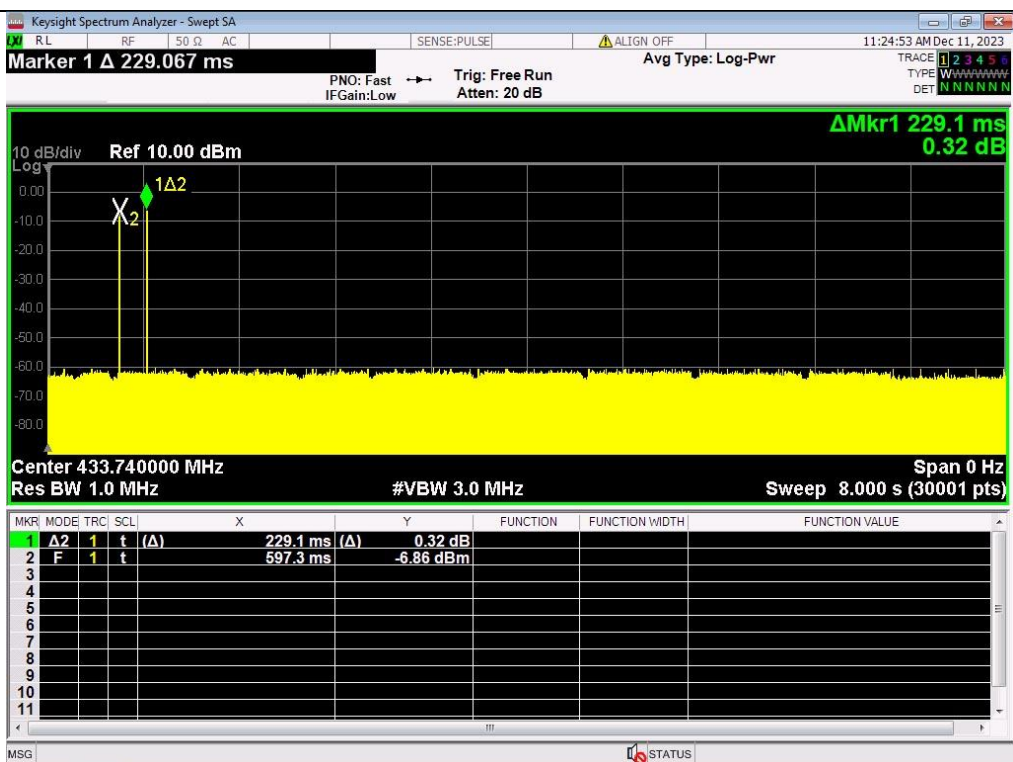
Please refer to the following pages.

Transmit Time

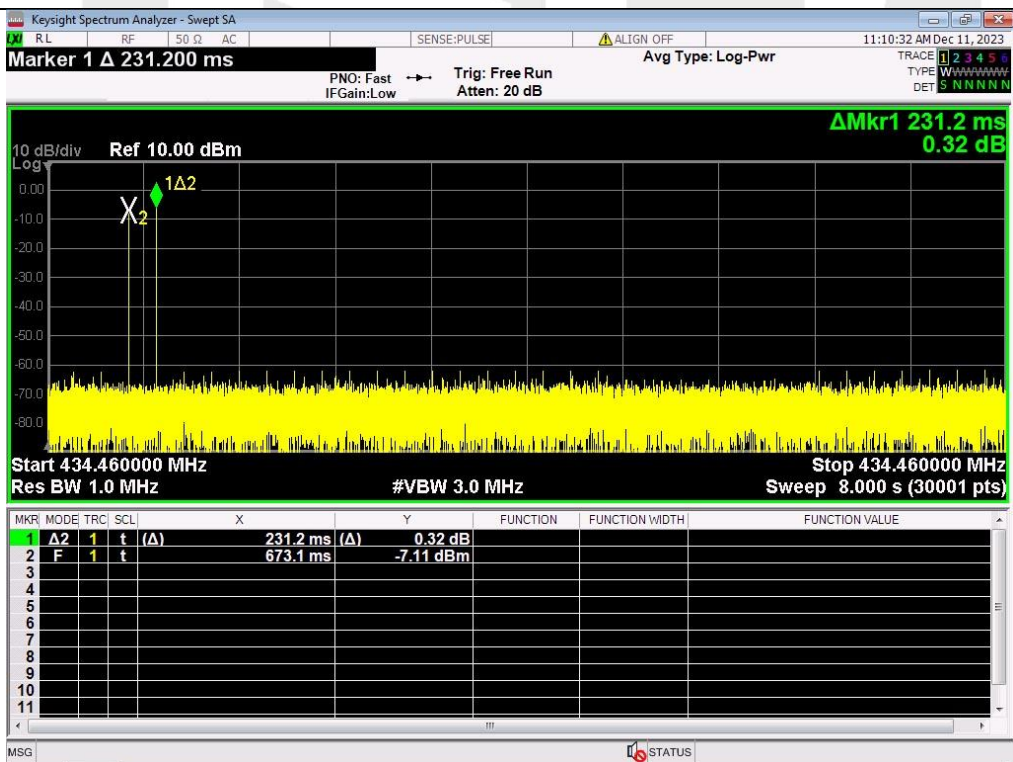
CH	Frequency (MHz)	Transmit Time (s)	Limit (s)	Verdict
Low	433.16	0.2312	≤5	Pass
Middle	433.74	0.2291	≤5	Pass
High	434.46	0.2312	≤5	Pass



Test Plot--CH Middle



Test Plot--CH High

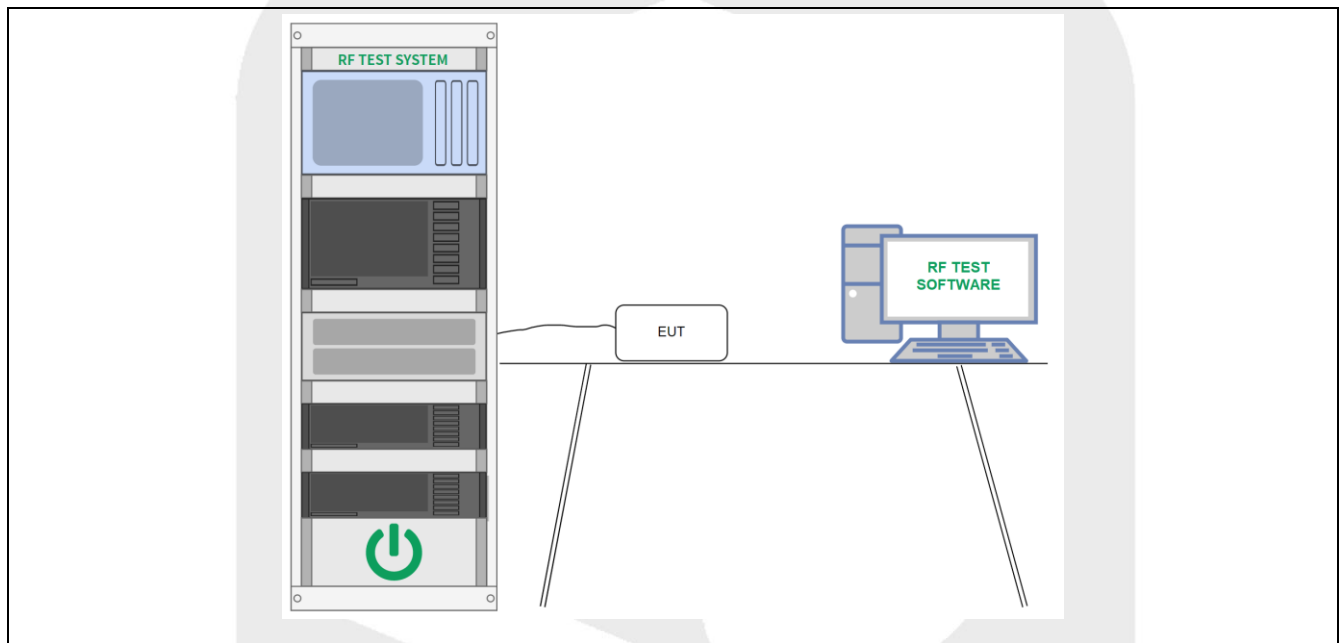


5.5 Duty Cycle

5.5.1 Test Requirement

Test Requirement	When average emission measurements below 1000MHz, there also is a limit on the peak level of the radio frequency emission. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. Note that the use of a pulse desensitization correction factor may be needed to determine the total peak emission level.
Test Method	ANSI C63.10-2020, section 7.5

5.5.2 Test Setup Diagram



5.5.3 Test Procedure

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission.
Set $RBW \geq OBW$ if possible; otherwise, set RBW to the largest available value.
Set $VBW \geq RBW$. Set detector = peak or average.

5.5.4 Test Data

PASS.

Please refer to the following pages.

Duty Cycle Correct Factor

CH	Frequency (MHz)	Single Pulse Duration T_{pulse} (ms)	Transmit Period (ms)	Duty Cycle Correct Factor (dB)
Low	433.16	2.12	230.4	-33.47
Middle	433.74	2.64	229.6	-31.57
High	434.46	2.64	230.3	-31.57

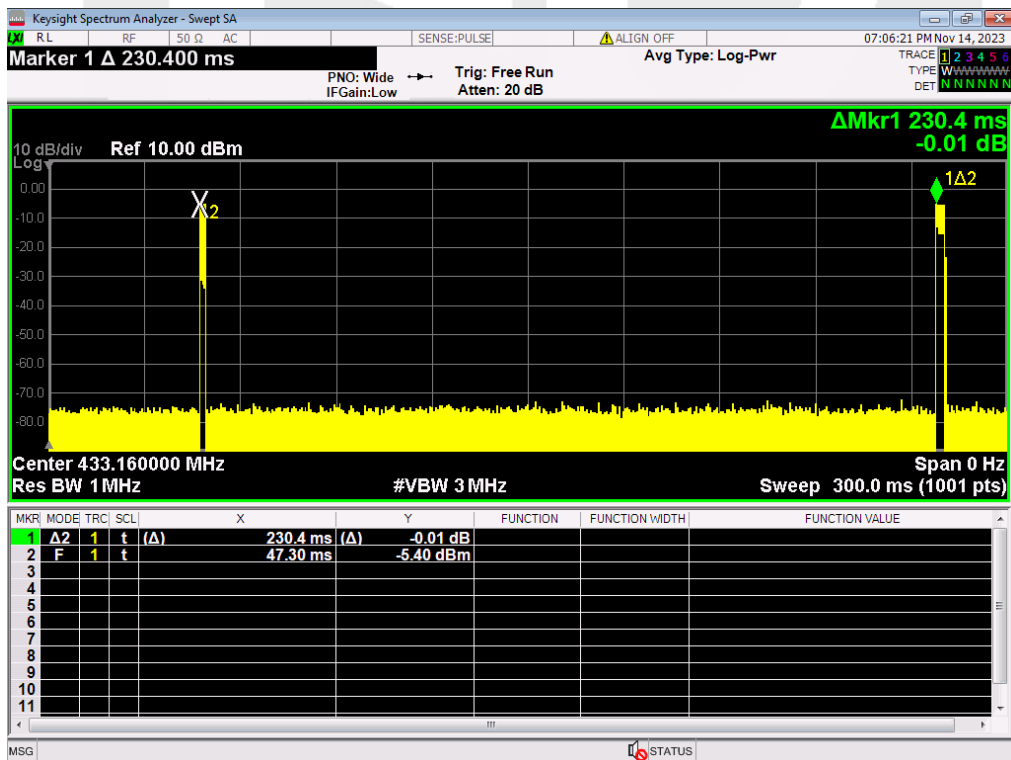
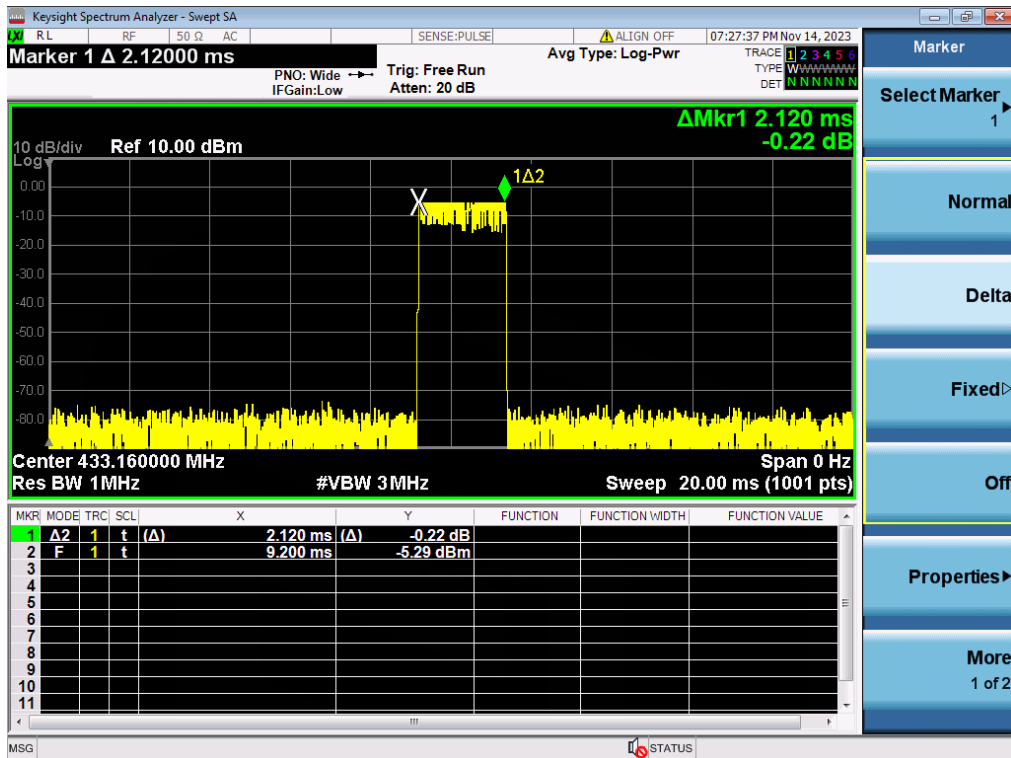
Note:

Duty Cycle Correct Factor (dB)=20log (Duty cycle) = 20log(T_{pulse} /100)

When the pulse's transmit period exceeds 100ms.

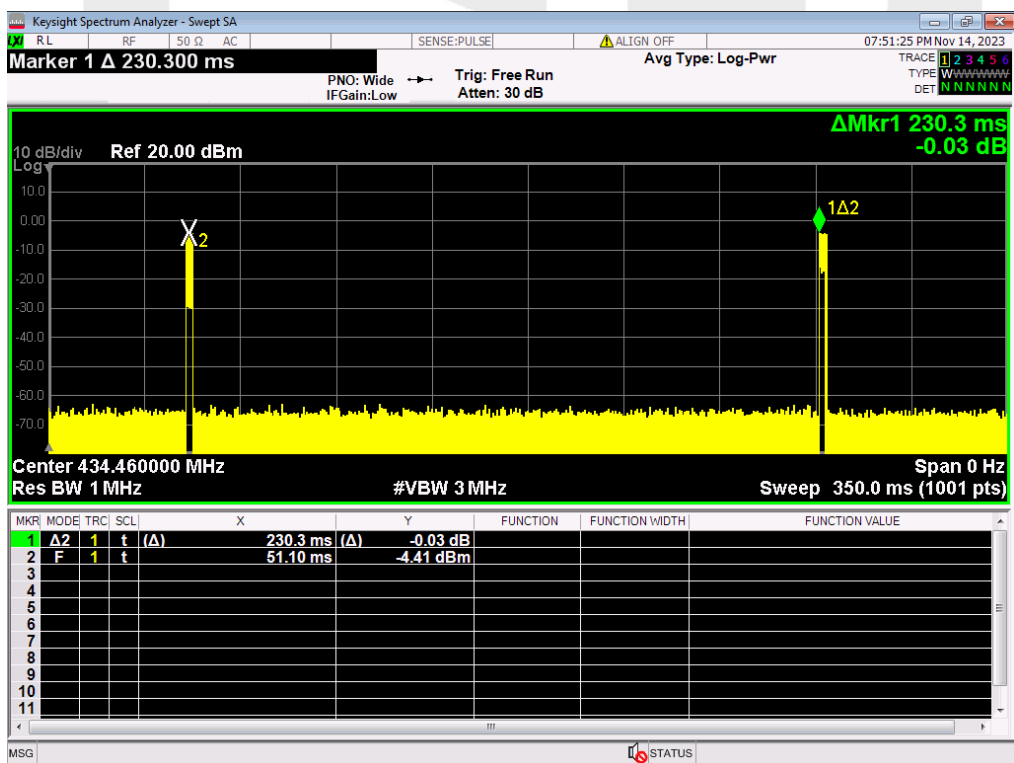
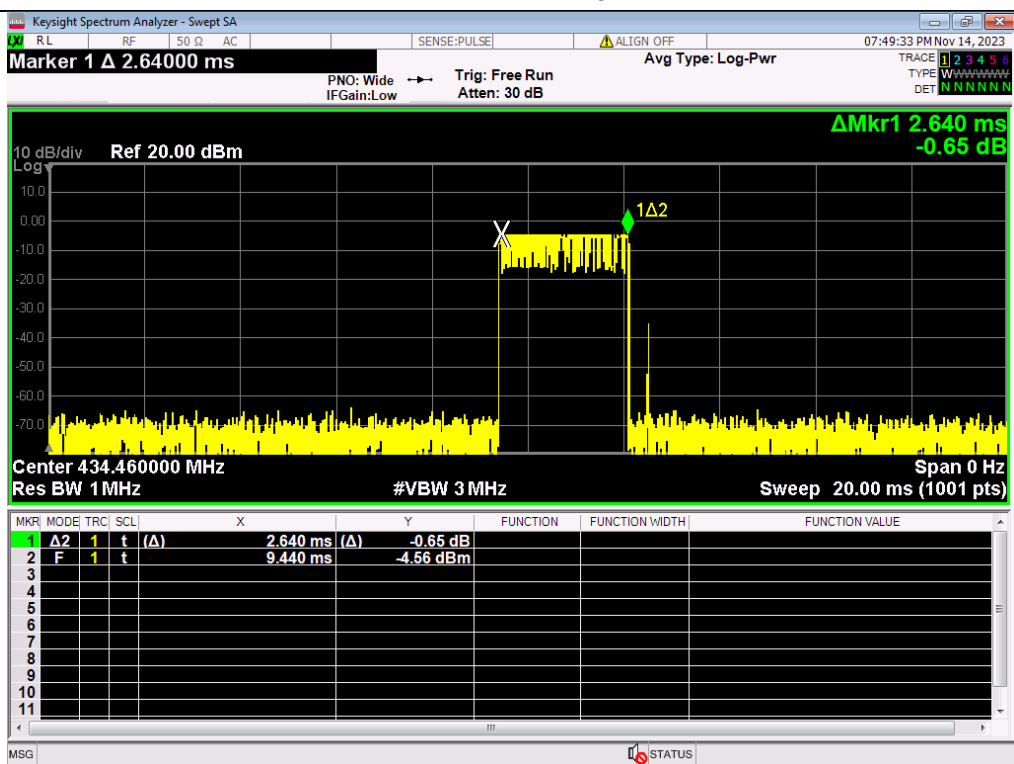


Test Plot--CH Low





Test Plot--CH High

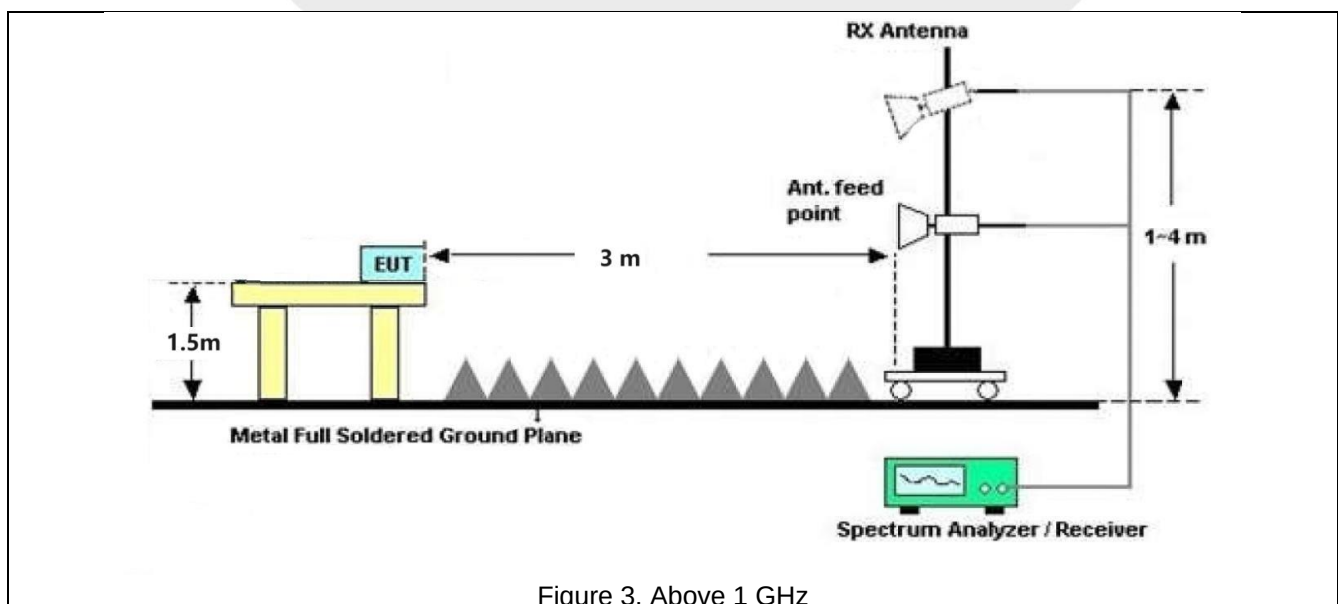
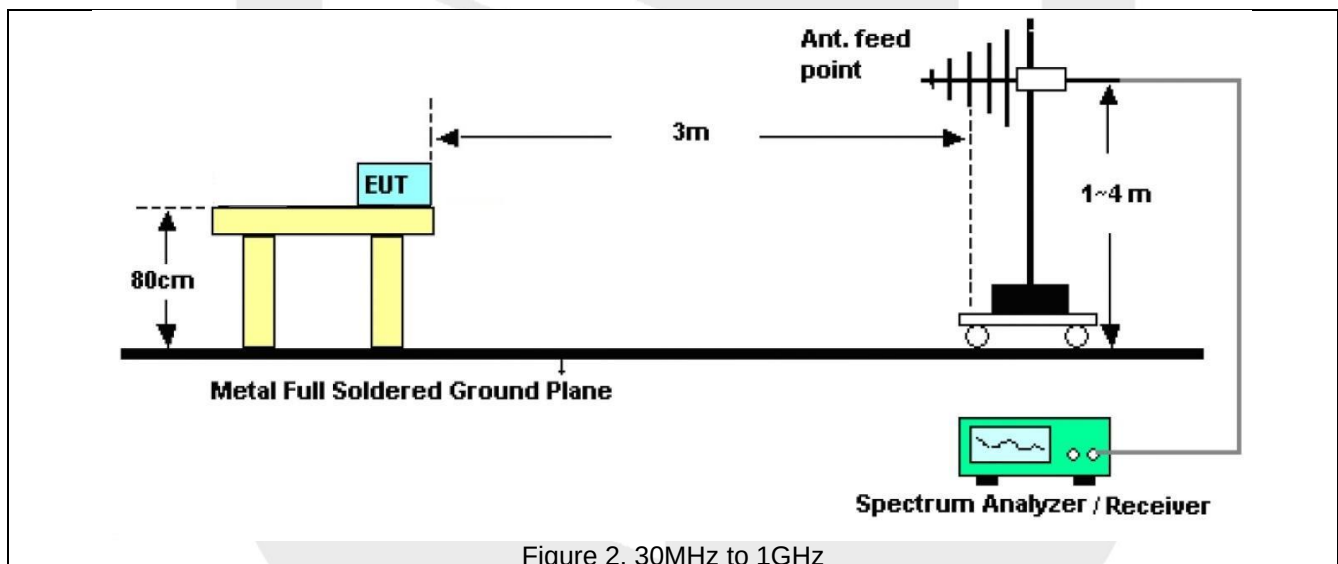
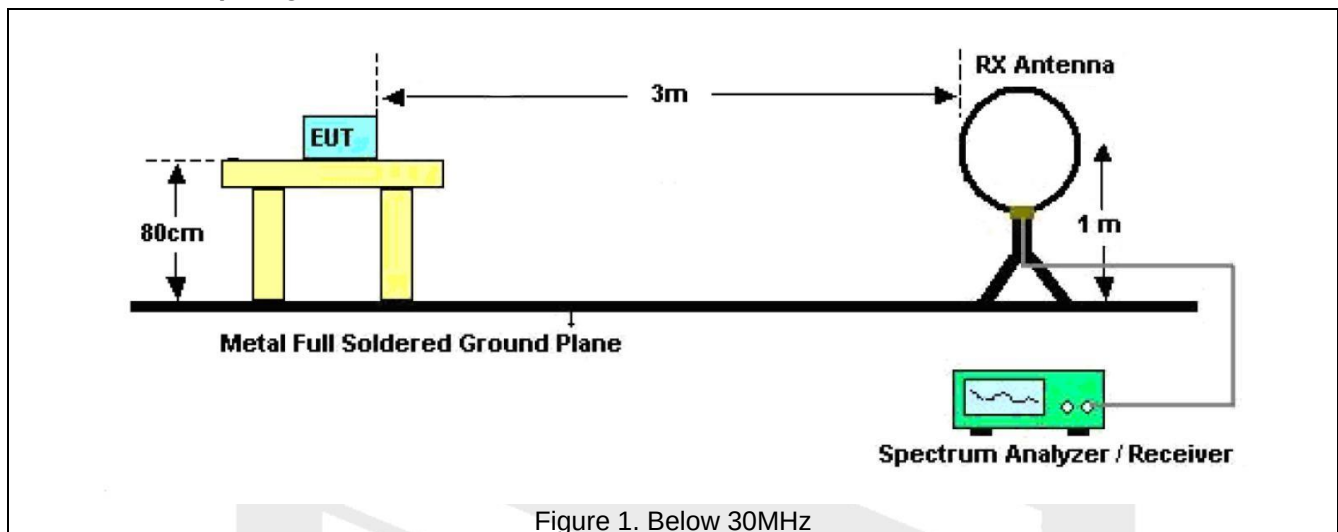


5.6 Field Strength of Fundamental Emissions and Radiated Spurious Emission

5.6.1 Test Requirement

Test Requirement	In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following.																							
	<table><tr><th>Fundamental Frequency MHz</th><th>Field Strength of Fundamental (µV/m @ 3 m)</th><th>Field Strength of Spurious Emission (µV/m @ 3 m)</th></tr><tr><td>40.66 to 40.70</td><td>2250</td><td>225</td></tr><tr><td>70 to 130</td><td>1250</td><td>125</td></tr><tr><td>130 to 174</td><td>1250 to 3750*</td><td>125 to 375*</td></tr><tr><td>174 to 260</td><td>3750</td><td>375</td></tr><tr><td>260 to 470</td><td>3750 to 12500*</td><td>375 to 1250*</td></tr><tr><td>Above 470</td><td>12500</td><td>1250</td></tr></table>	Fundamental Frequency MHz	Field Strength of Fundamental (µV/m @ 3 m)	Field Strength of Spurious Emission (µV/m @ 3 m)	40.66 to 40.70	2250	225	70 to 130	1250	125	130 to 174	1250 to 3750*	125 to 375*	174 to 260	3750	375	260 to 470	3750 to 12500*	375 to 1250*	Above 470	12500	1250		
	Fundamental Frequency MHz	Field Strength of Fundamental (µV/m @ 3 m)	Field Strength of Spurious Emission (µV/m @ 3 m)																					
	40.66 to 40.70	2250	225																					
	70 to 130	1250	125																					
	130 to 174	1250 to 3750*	125 to 375*																					
	174 to 260	3750	375																					
	260 to 470	3750 to 12500*	375 to 1250*																					
	Above 470	12500	1250																					
	** The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.																							
for the band 260-470 MHz, µV/m at 3 meters = 41.6667(F) - 7083.3333.																								
Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table. based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of 15.205 shall be demonstrated using the measurement instrumentation specified in that section.																								
The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.																								
<table><tr><th>Frequency (MHz)</th><th>Field strength (microvolts/meter)</th><th>Measurement distance (meters)</th></tr><tr><td>0.009-0.490</td><td>2400/F(kHz)</td><td>300</td></tr><tr><td>0.490-1.705</td><td>24000/F(kHz)</td><td>30</td></tr><tr><td>1.705-30.0</td><td>30</td><td>30</td></tr><tr><td>30-88</td><td>100 **</td><td>3</td></tr><tr><td>88-216</td><td>150 **</td><td>3</td></tr><tr><td>216-960</td><td>200 **</td><td>3</td></tr><tr><td>Above 960</td><td>500</td><td>3</td></tr></table>	Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)	0.009-0.490	2400/F(kHz)	300	0.490-1.705	24000/F(kHz)	30	1.705-30.0	30	30	30-88	100 **	3	88-216	150 **	3	216-960	200 **	3	Above 960	500	3
Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)																						
0.009-0.490	2400/F(kHz)	300																						
0.490-1.705	24000/F(kHz)	30																						
1.705-30.0	30	30																						
30-88	100 **	3																						
88-216	150 **	3																						
216-960	200 **	3																						
Above 960	500	3																						
Note:																								
1) Field Strength (dBµV/m) = 20*log[Field Strength (µV/m)].																								
2) In the emission tables above, the tighter limit applies at the band edges.																								
3) For Above 1000 MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.																								
4) For above 1000 MHz, limit field strength of harmonics:																								
54dBuV/m@3m (AV) and 74dBuV/m@3m (PK).																								
Test Method	ANSI C63.10-2020 section 6.6.4 Radiated emissions tests																							

5.6.2 Test Setup Diagram



5.6.3 Test Procedure

The measurement frequency range is from 9 kHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power.

Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured

For 9kHz to 150kHz, Set the spectrum analyzer as:

RBW = 200Hz, VBW = 1kHz, Detector = Quasi-Peak, Trace mode = Max hold, Sweep = auto couple.

For 150kHz to 30MHz, Set the spectrum analyzer as:

RBW = 9kHz, VBW = 30kHz, Detector = Quasi-Peak, Trace mode = Max hold, Sweep = auto couple.

For 30MHz to 1000MHz, Set the spectrum analyzer as:

RBW = 100kHz, VBW = 300kHz, Detector = Quasi-Peak, Trace mode = Max hold, Sweep = auto couple.

For above 1GHz, Set the spectrum analyzer as:

RBW = 1MHz, VBW = 1MHz, Detector = Peak, Trace mode = Max hold, Sweep = auto couple.

RBW = 1MHz, VBW = 10Hz, Detector = Average, Trace mode = Max hold, Sweep = auto couple.

For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported, Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

5.6.4 Test Data

PASS.

The test results of 9kHz-30MHz was attenuated more than 20dB below the permissible limits, so the results don't record in the report.

During the test, for 30MHz to 5000MHz, only the worst case is recorded in the report.

Fundamental and Harmonics Emissions and above 1G Test Data

Test Mode: TX					CH Low					
Pol.	Frequency (MHz)	Reading (dBuV/m)	Factor (dB/m)	Level (dBuV/m)	Duty Cycle Factor	Total Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Type	Result
V	433.1680	85.37	-9.87	75.50	--	75.50	100.80	-25.30	PK	PASS
V	866.3200	55.48	-1.15	54.33	--	54.33	80.80	-26.47	PK	PASS
V	1299.4820	44.63	0.94	45.57	--	45.57	80.80	-35.23	PK	PASS
V	1732.6340	*			--	*	80.80	*	PK	PASS
V	2165.8010	*			--	*	80.80	*	PK	PASS
V	2598.9590	*			--	*	80.80	*	PK	PASS
H	433.1520	84.75	-9.88	74.87	--	74.87	100.80	-25.93	PK	PASS
H	866.3200	55.97	-1.17	54.80	--	54.80	80.80	-26.00	PK	PASS
H	1299.4760	46.31	0.95	47.26	--	47.26	80.80	-33.54	PK	PASS
H	1732.6500	*			--	*	80.80	*	PK	PASS
H	2165.8090	*			--	*	80.80	*	PK	PASS
H	2598.9600	*			--	*	80.80	*	PK	PASS
V	433.1680	85.37	-9.87	75.50	-33.47	42.03	80.80	-38.77	AV	PASS
V	866.3200	55.48	-1.15	54.33	-33.47	20.86	60.80	-39.94	AV	PASS
V	1299.4820	44.63	0.94	45.57	-33.47	12.10	60.80	-48.70	AV	PASS
V	1732.6340	*			-33.47	*	60.80	*	AV	PASS
V	2165.8010	*			-33.47	*	60.80	*	AV	PASS
V	2598.9590	*			-33.47	*	60.80	*	AV	PASS
H	433.1520	84.75	-9.88	74.87	-33.47	41.40	80.80	-39.40	AV	PASS
H	866.3200	55.97	-1.17	54.80	-33.47	21.33	60.80	-39.47	AV	PASS
H	1299.4760	46.31	0.95	47.26	-33.47	13.79	60.80	-47.01	AV	PASS
H	1732.6500	*			-33.47	*	60.80	*	AV	PASS
H	2165.8090	*			-33.47	*	60.80	*	AV	PASS
H	2598.9600	*			-33.47	*	60.80	*	AV	PASS

Remark:

1. Level= Reading +Factor, Total Level = Level +Duty Cycle Factor, Margin=Total Level – Limit.
2. For AV detector, Duty Cycle Factor data comes from clause 5.5 calculation.
3. “*” means the test results were attenuated more than 20dB below the permissible limits, so the results don't record in the report.

Fundamental and Harmonics Emissions and above 1G Test Data

Test Mode: TX					CH Middle					
Pol.	Frequency (MHz)	Reading (dBuV/m)	Factor (dB/m)	Level (dBuV/m)	Duty Cycle Factor	Total Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Type	Result
V	433.7420	85.08	-9.58	75.50	--	75.50	100.82	-25.32	PK	PASS
V	867.4900	55.91	-1.21	54.70	--	54.70	80.82	-26.12	PK	PASS
V	1301.2270	44.12	0.98	45.10	--	45.10	80.82	-35.72	PK	PASS
V	1734.9550	*			--	*	80.82	*	PK	PASS
V	2168.6910	*			--	*	80.82	*	PK	PASS
V	2602.4490	*			--	*	80.82	*	PK	PASS
H	433.7410	84.35	-9.28	75.07	--	75.07	100.82	-25.75	PK	PASS
H	867.4700	55.70	-1.20	54.50	--	54.50	80.82	-26.32	PK	PASS
H	1301.2290	43.64	0.96	44.60	--	44.60	80.82	-36.22	PK	PASS
H	1734.9520	*			--	*	80.82	*	PK	PASS
H	2168.7080	*			--	*	80.82	*	PK	PASS
H	2602.4460	*			--	*	80.82	*	PK	PASS
V	433.7420	85.08	-9.58	75.50	-31.57	43.93	80.82	-36.89	AV	PASS
V	867.4900	55.91	-1.21	54.70	-31.57	23.13	60.82	-37.69	AV	PASS
V	1301.2270	44.12	0.98	45.10	-31.57	13.53	60.82	-47.29	AV	PASS
V	1734.9550	*			-31.57	*	60.82	*	AV	PASS
V	2168.6910	*			-31.57	*	60.82	*	AV	PASS
V	2602.4490	*			-31.57	*	60.82	*	AV	PASS
H	433.7410	84.35	-9.28	75.07	-31.57	43.50	80.82	-37.32	AV	PASS
H	867.4700	55.70	-1.20	54.50	-31.57	22.93	60.82	-37.89	AV	PASS
H	1301.2290	43.64	0.96	44.60	-31.57	13.03	60.82	-47.79	AV	PASS
H	1734.9520	*			-31.57	*	60.82	*	AV	PASS
H	2168.7080	*			-31.57	*	60.82	*	AV	PASS
H	2602.4460	*			-31.57	*	60.82	*	AV	PASS

Remark:

1. Level= Reading +Factor, Total Level = Level +Duty Cycle Factor, Margin=Total Level – Limit.
2. For AV detector, Duty Cycle Factor data comes from clause 5.5 calculation.
3. “*” means the test results were attenuated more than 20dB below the permissible limits, so the results don't record in the report.

Fundamental and Harmonics Emissions and above 1G Test Data

Test Mode: TX					CH High					
Pol.	Frequency (MHz)	Reading (dBuV/m)	Factor (dB/m)	Level (dBuV/m)	Duty Cycle Factor	Total Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Type	Result
V	434.4650	85.50	-9.23	76.27	--	76.27	100.85	-24.58	PK	PASS
V	869.2080	56.38	-1.28	55.10	--	55.10	80.85	-25.75	PK	PASS
V	1303.8030	47.65	1.03	48.68	--	48.68	80.85	-32.17	PK	PASS
V	1738.3920	*			--	*	80.85	*	PK	PASS
V	2173.0030	*			--	*	80.85	*	PK	PASS
V	2607.6020	*			--	*	80.85	*	PK	PASS
H	434.5990	84.63	-9.23	75.40	--	75.40	100.85	-25.45	PK	PASS
H	869.2060	56.30	-1.08	55.22	--	55.22	80.85	-25.63	PK	PASS
H	1303.8030	47.34	1.06	48.40	--	48.40	80.85	-32.45	PK	PASS
H	1738.3960	*			--	*	80.85	*	PK	PASS
H	2173.0010	*			--	*	80.85	*	PK	PASS
H	2607.5990	*			--	*	80.85	*	PK	PASS
V	434.4650	85.50	-9.23	76.27	-31.57	44.70	80.85	-36.15	AV	PASS
V	869.2080	56.38	-1.28	55.10	-31.57	23.53	60.85	-37.32	AV	PASS
V	1303.8030	47.65	1.03	48.68	-31.57	17.11	60.85	-43.74	AV	PASS
V	1738.3920	*			-31.57	*	60.85	*	AV	PASS
V	2173.0030	*			-31.57	*	60.85	*	AV	PASS
V	2607.6020	*			-31.57	*	60.85	*	AV	PASS
H	434.5990	84.63	-9.23	75.40	-31.57	43.83	80.85	-37.02	AV	PASS
H	869.2060	56.30	-1.08	55.22	-31.57	23.65	60.85	-37.20	AV	PASS
H	1303.8030	47.34	1.06	48.40	-31.57	16.83	60.85	-44.02	AV	PASS
H	1738.3960	*			-31.57	*	60.85	*	AV	PASS
H	2173.0010	*			-31.57	*	60.85	*	AV	PASS
H	2607.5990	*			-31.57	*	60.85	*	AV	PASS

Remark:

1. Level= Reading +Factor, Total Level = Level +Duty Cycle Factor, Margin=Total Level – Limit.
2. For AV detector, Duty Cycle Factor data comes from clause 5.5 calculation.
3. “*” means the test results were attenuated more than 20dB below the permissible limits, so the results don't record in the report.

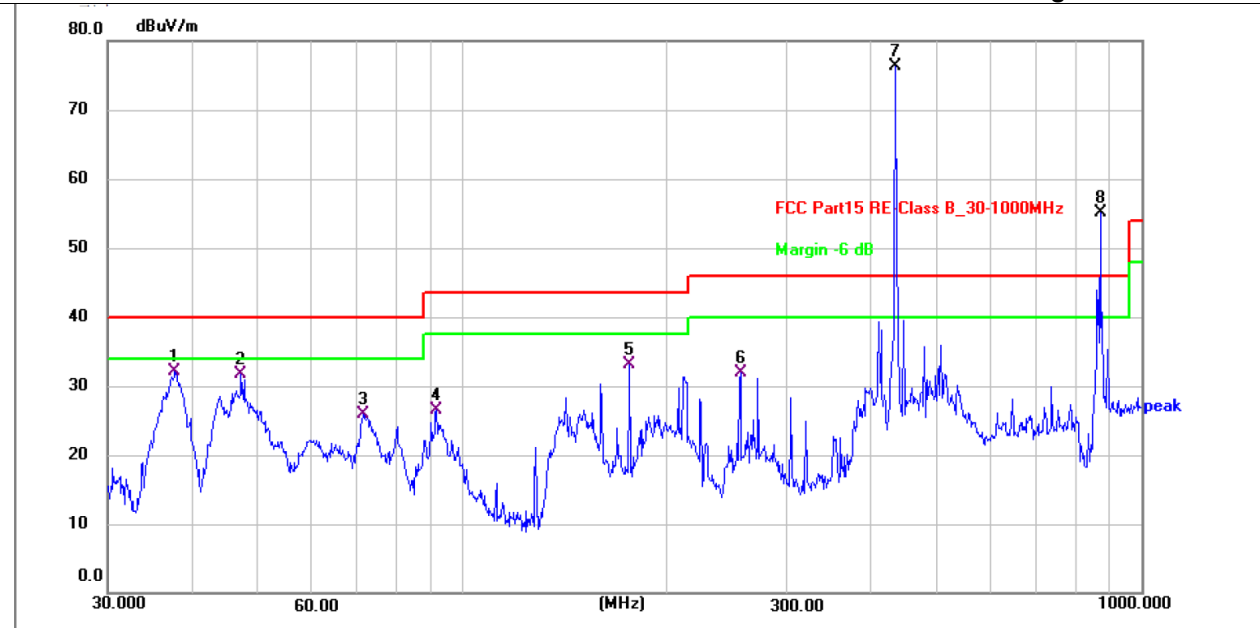
Radiated Emission Test Data (30-1000MHz)

Test item: 966 Chamber #1

Polarization: Vertical

Distance: 3m

Test Mode: TM1/ CH High



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1	37.6796	47.53	-15.44	32.09	40.00	-7.91	QP	P	
2	47.1597	45.48	-13.69	31.79	40.00	-8.21	QP	P	
3	71.3300	43.76	-17.93	25.83	40.00	-14.17	QP	P	
4	91.4946	43.36	-16.82	26.54	43.50	-16.96	QP	P	
5	176.2684	49.42	-16.36	33.06	43.50	-10.44	QP	P	
6	256.5210	44.87	-12.96	31.91	46.00	-14.09	QP	P	
7 *	434.4650	85.50	-9.23	76.27	--	--	peak		
8 X	869.2080	56.38	-1.28	55.10	--	--	peak		

Note: Level = Reading + Factor

Margin = Level - Limit

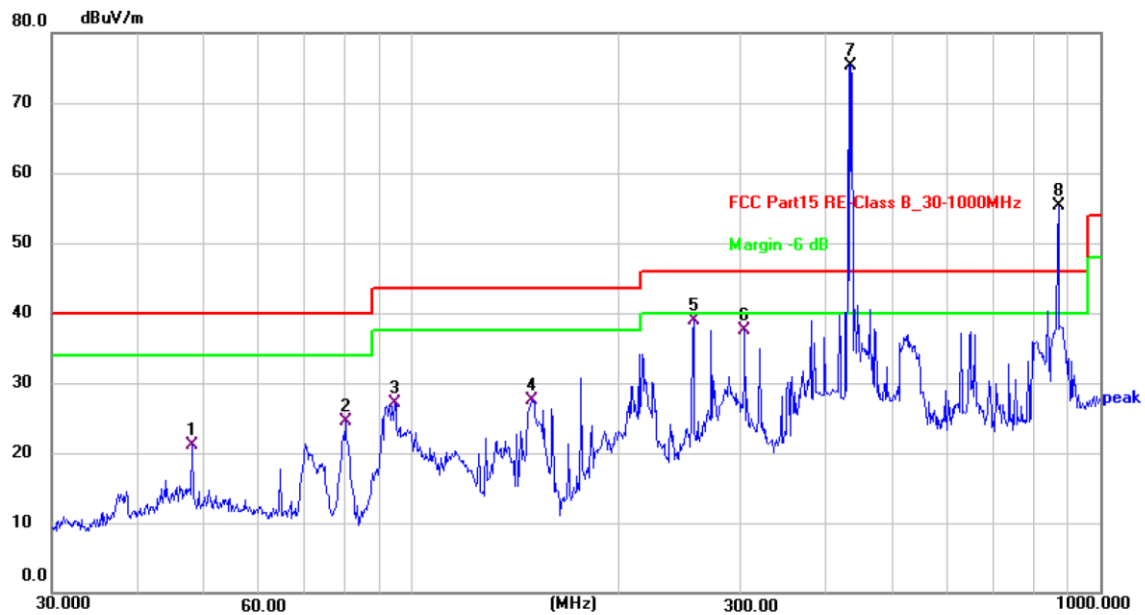
Radiated Emission Test Data (30-1000MHz)

Test item: 966 Chamber #1

Polarization: Horizontal

Distance: 3m

Test Mode: TM1/ CH High



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1	47.9940	34.81	-13.67	21.14	40.00	-18.86	QP	P	
2	80.0805	43.76	-19.35	24.41	40.00	-15.59	QP	P	
3	94.4282	43.39	-16.38	27.01	43.50	-16.49	QP	P	
4	149.4857	45.78	-18.22	27.56	43.50	-15.94	QP	P	
5	256.5210	51.64	-12.81	38.83	46.00	-7.17	QP	P	
6	304.6099	49.13	-11.60	37.53	46.00	-8.47	QP	P	
7 *	434.5990	84.63	-9.23	75.40	--	--	peak		
8 X	869.2060	56.30	-1.08	55.22	--	--	peak		

Note: Level = Reading + Factor

Margin = Level - Limit

ANNEX A TEST SETUP PHOTOS

Please refer to the document “8133EU012003W-AA.PDF”

ANNEX B EXTERNAL PHOTOS

Please refer to the document “8133EU012003W-AB.PDF”

ANNEX C INTERNAL PHOTOS

Please refer to the document “8133EU012003W-AC.PDF”



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--- End of Report ---