



RF MEASUREMENT REPORT

FCC ID: DD4ADX3K54
Applicant: Shure Incorporated
Product: Digital Plug-on Transmitter
Model No.: ADX3 K54
Brand Name: 
FCC Classification: Part 15 Wireless Microphone (DWM)
FCC Rule Part(s): Part 15 Subpart C (Section 15.236)
Result: Complies
Received Date: 2022-12-26
Test Date: 2023-01-03 ~ 2023-02-07

Reviewed By:



Jame Yuan

Approved By:



Robin Wu



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standards through the calibration of the equipment and evaluated measurement uncertainty herein.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
2211RSU077-U5	V01	Initial Report	2023-02-16	Valid

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1.4. Product Information

Product Name	Digital Plug-on Transmitter
Model No.	ADX3 K54
Serial No.	3BK03154131 (Radiated Testing) 95B52358 01 (Conducted Testing)
ZigBee Specification	802.15.4, 2405 ~ 2480 MHz
Wireless Microphone	UHF band, 606 ~ 663 MHz
Power Type	Two AA batteries (3.0Vdc) or Li-ion battery
Operating Temperature	-10 ~ 50°C
Antenna Information	Refer to selection 1.5
Accessories	
Rechargeable Li-ion Battery	Model: SB900B Output: 3.7Vdc, 1240mAh, 4.59Wh
Note: The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.	

1.5. Radio Specification under Test

Frequency Range	606 ~ 608 MHz & 614 ~ 616 MHz & 657 ~ 663MHz
Working Mode	STD Mode and HD Mode (Note 2)
Declared Power Level	<u>606 ~ 608 MHz</u> STD: 2mW & 10mW & 35mW, HD: 2mW <u>614 ~ 616 MHz & 657 ~ 663MHz</u> STD: 2mW & 10mW, HD: 2mW
Type of Modulation	16QAM
Channel Spacing	25kHz
Antenna Type	Dipole
Antenna Gain	4.0 dBi

Note 1: Power level and transmit frequency can be selected using the front panel controls.

Note 2: STD means normal channel bandwidth mode, HD means high density channel bandwidth. End user can switch working modes through the digital wireless receiver.

1.6. Working Frequencies

Bottom Channel (MHz)	Top Channel (MHz)
606 ~ 608 MHz Band	
606.000	607.875
614 ~ 616 MHz Band	
614.125	615.875
657 ~ 663 MHz Band	
657.125	662.875

Note 1: The frequency selection can be offset from the upper or lower band limits by 25 kHz. This upper or lower band means 470~616 MHz frequency range is defined in FCC Part15.236 title.

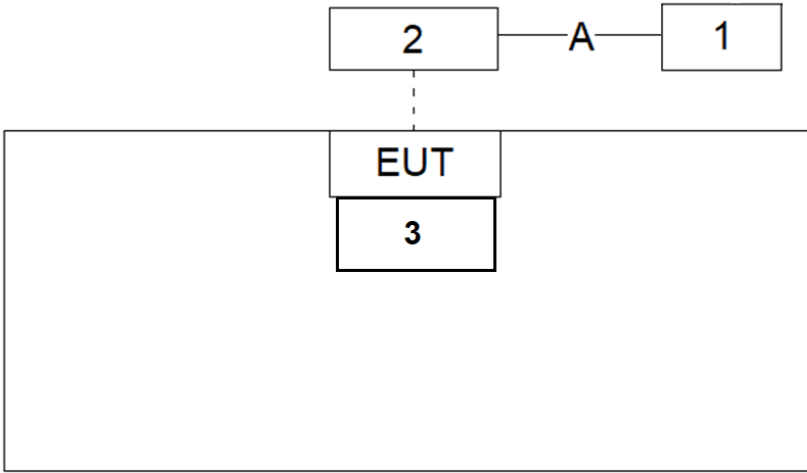
Note 2: Refer ANSI C63.10 clause 5.6.1 table 4, frequency range fall within 1 - 10 MHz, only two channels (Top and Bottom) shall be tested.

2. Test Configuration

2.1. Test Mode

Mode 1: Transmit by STD Mode
Mode 2: Transmit by HD Mode

2.2. Test System Connection Diagram

Connection Diagram			
 The diagram shows a test setup. At the top, a box labeled '2' is connected to a box labeled '1' by a line labeled 'A'. A dashed line connects box '2' to a box labeled 'EUT'. Below 'EUT' is a box labeled '3'. These three boxes are enclosed in a larger rectangular frame.			
Product	Manufacturer		Model No.
1	Notebook (for RF Test)	Lenovo	E495
2	IR Dongle	Shure	PT21071
3	Premium Modular Shotgun Microphone	Shure	VP89M
Cable Type	Cable Description		
A	USB Cable	Shielded, 1.8m	

2.3. Test Software

The test utility software used during testing was “teraterm”, and the version was V4.85, all test commands were provided by the manufacturer.

2.4. Applied Standards

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

- FCC Part 15.236
- KDB 206256 D01v02r01
- ANSI C63.10-2013
- ETSI EN 300 422 - 1 V 1.4.2

2.5. Test Environment Condition

Ambient Temperature	15 ~ 35°C
Relative Humidity	20 ~ 75%RH

3. Measuring Instrument

Instrument	Manufacturer	Model No.	Asset No.	Cali. Interval	Cali. Due Date	Test Site
TRILOG Antenna	Schwarzbeck	VULB 9162	MRTSUE06022	1 year	2023-05-20	WZ-AC2
EMI Test Receiver	Agilent	N9038A	MRTSUE06125	1 year	2023-06-04	WZ-AC2
Thermohygrometer	Mingle	ETH529	MRTSUE06170	1 year	2023-11-27	WZ-AC2
Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06171	1 year	2023-10-13	WZ-AC2
Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2023-05-08	WZ-AC2
Anechoic Chamber	RIKEN	WZ-AC2	MRTSUE06213	1 year	2023-04-21	WZ-AC2
Thermohygrometer	testo	608-H1	MRTSUE11038	1 year	2023-11-01	WZ-AC2
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2023-09-29	WZ-AC2
Two-Line V-Network	R&S	ENV216	MRTSUE06002	1 year	2023-06-04	WZ-SR2
Shielding Room	MIX-BEP	WZ-SR2	MRTSUE06215	5 years	2026-12-20	WZ-SR2
Thermohygrometer	testo	608-H1	MRTSUE06404	1 year	2023-06-06	WZ-SR2
EMI Test Receiver	R&S	ESR3	MRTSUE06909	1 year	2023-10-27	WZ-SR2
USB Power Sensor	Keysight	U2021XA	MRTSUE06446	1 year	2023-06-04	WZ-SR5
Thermohygrometer	testo	608-H1	MRTSUE06402	1 year	2023-06-06	WZ-SR5
Shielding Room	HUAMING	WZ-SR5	MRTSUE06442	N/A	N/A	WZ-SR5
Signal Analyzer	Keysight	N9010B	MRTSUE06457	1 year	2023-06-04	WZ-SR5
Temperature Chamber	BAOYT	BYH-150CL	MRTSUE06051	1 year	2023-10-08	WZ-TR3
Thermohygrometer	testo	608-H1	MRTSUE06401	1 year	2023-06-06	WZ-TR3
Signal Analyzer	Keysight	N9010B	MRTSUE07027	1 year	2023-11-25	WZ-TR3
Attenuator	MVE	MVE2213	MRTSUE11071	1 year	2023-06-09	WZ
Attenuator	MVE	MVE2213	MRTSUE11072	1 year	2023-06-09	WZ

Software	Version	Function
EMI Software	V3.0.0	EMI Test Software
Controller_MF 7802	1.02	RE Antenna & Turntable
BenchVue Power Meter	2018.1	Power

4. Decision Rules and Measurement Uncertainty

4.1. 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.)

4.2. Measurement Uncertainty

Where relevant, the following test 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 $k = 2$.

AC Conducted Emission Measurement	
The maximum measurement uncertainty is evaluated as:	
9kHz~150kHz: 3.58dB	
150kHz~30MHz: 3.20dB	
Radiated Emission Measurement	
The maximum measurement uncertainty is evaluated as:	
Coaxial:	9kHz~30MHz: 2.59dB
Coplanar:	9kHz~30MHz: 2.60dB
Horizontal:	30MHz~200MHz: 3.85dB
	200MHz~1GHz: 4.36dB
	1GHz~40GHz: 4.98dB
Vertical:	30MHz~200MHz: 4.06dB
	200MHz~1GHz: 5.28dB
	1GHz~40GHz: 4.91dB
Spurious Emissions, Conducted	
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$):	
2.3dB	
Output Power	
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$):	
1.5dB	
Occupied Bandwidth	
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$):	
3.2%	

5. Test Result

5.1. Summary

FCC Part Section(s)	Test Description	Test Condition	Test Result
15.236(f)(2)	Occupied Bandwidth	Conducted	Pass
15.236(f)(3)	Frequency Tolerance		Pass
15.236(g)	Necessary Bandwidth		Pass
15.236(d)(1)	RF Output Power		Pass
15.236(g)	Radiated Spurious Emission	Radiated	Pass
15.207	AC Conducted Emissions 150kHz - 30MHz	Line Conducted	Pass

Notes:

- 1) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
- 2) All modes of operation and data rates were investigated. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst case emissions.
- 3) For STD mode, besides test item of necessary bandwidth was assessed three power level, any others test items were only assessed max power level.

5.2. 99% Occupied Bandwidth Measurement

5.2.1. Test Limit

The operating bandwidth shall not exceed 200 kHz.

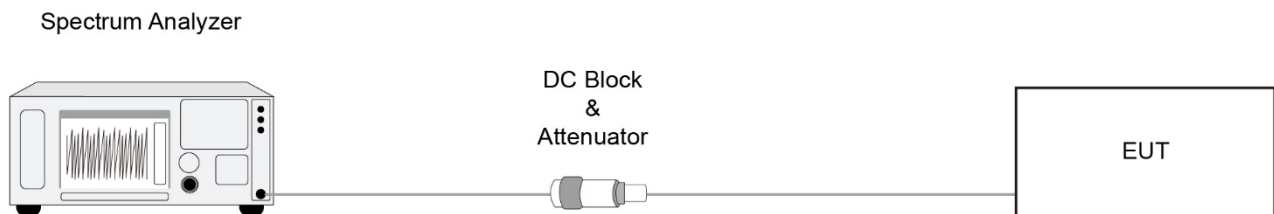
5.2.2. Test Procedure

ANSI C63.10-2013 - Section 6.9.3

5.2.3. Test Setting

1. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
2. Set RBW $\geq$ 1% to 5% of the OBW
3. VBW = Approximately three times RBW
4. Detector = Peak
5. Trace mode = Max hold
6. Sweep = Auto couple
7. Allow the trace to stabilize
8. Use the 99% power bandwidth function of the instrument and report the measured bandwidth.

5.2.4. Test Setup



5.2.5. Test Result

Refer to Appendix A.1.

5.3. Frequency Tolerance Measurement

5.3.1. Test Limit

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.005\%$ of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. Battery operated equipment shall be tested using a new battery.

5.3.2. Test Procedure

ANSI C63.10-2013 - Section 6.8

5.3.3. Test Setting

The EUT was programmed to transmit with an unmodulated carrier.

Frequency Stability Under Temperature Variations:

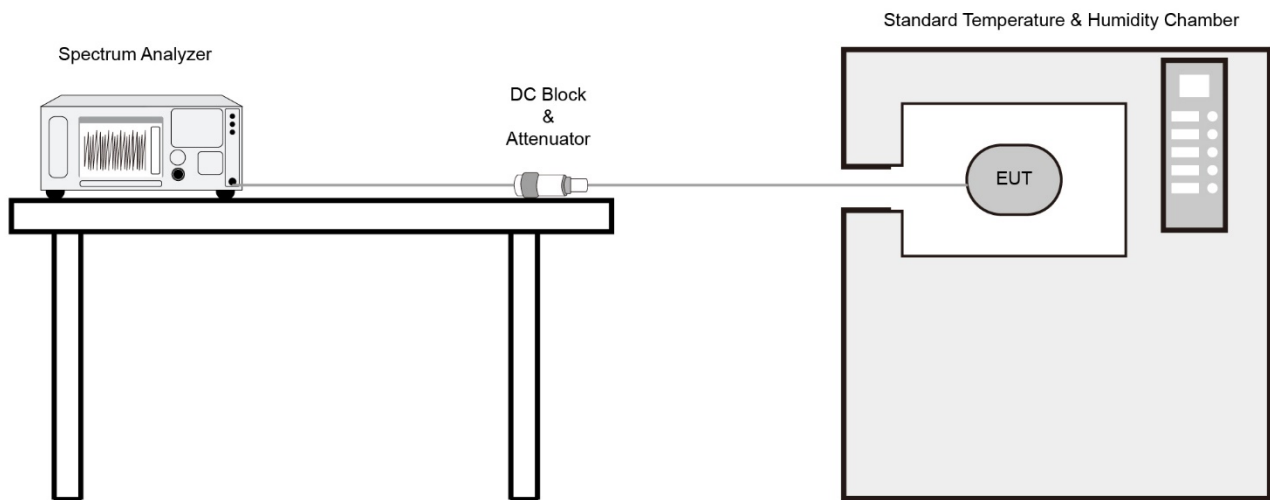
The equipment under test was connected to an external DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. While maintaining a constant temperature inside the environmental chamber, turn the EUT on and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total are made. Repeat step measure with 10°C decreased per stage until the lowest temperature reached.

Frequency Stability Under Voltage Variations:

Set chamber temperature to 20°C. Use a variable DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.

Reduce the input voltage to specify extreme voltage variation ($\pm 15\%$) and endpoint, record the maximum frequency change.

5.3.4. Test Setup



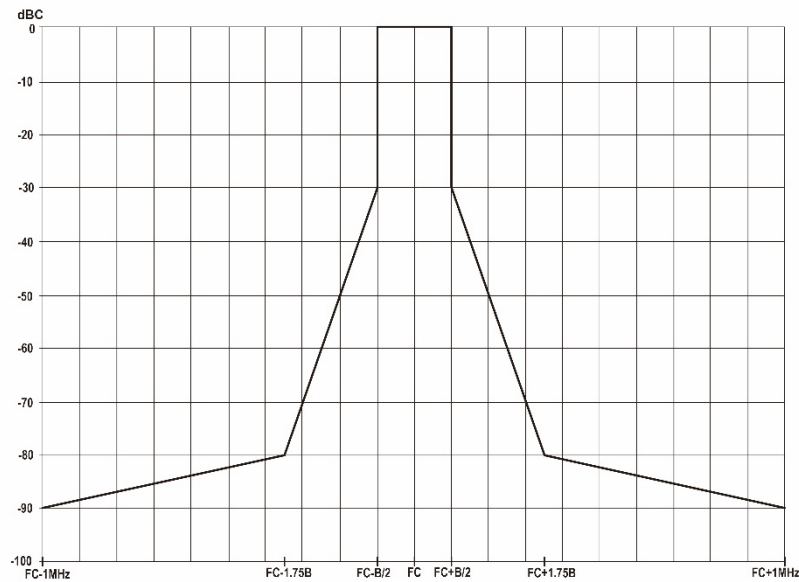
5.3.5. Test Result

Refer to Appendix A.2.

5.4. Necessary Bandwidth Measurement

5.4.1. Test Limit

According to EN 300 422-1 V1.4.2 clause 8.3.2.2, the transmitter output spectrum shall be within the mask defined as below figure.



5.4.2. Test Procedure

ETSI EN 300 422-1 V1.4.2 clause 8.3.2.1.

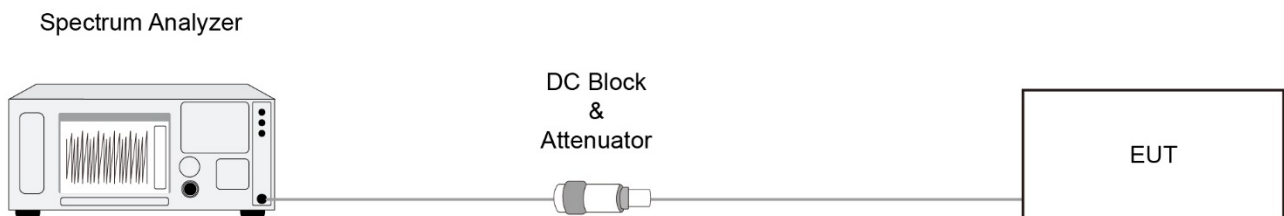
5.4.3. Test Setting

The EUT was powered up and the transmit frequency & power output of the EUT were selected.

The spectrum analyzer center frequency is set to the nominal EUT channel center frequency.

Only bottom and top channel is required, at an output power level of 2mW & 10mW & 35mW.

5.4.4. Test Setup



5.4.5. Test Result

Refer to Appendix A.3.

5.5. Output Power Measurement

5.5.1. Test Limit

In the bands allocated and assigned for broadcast television and in the 600 MHz service band: 50 mW EIRP.

In the 600 MHz guard band and the 600 MHz duplex gap: 20 mW EIRP.

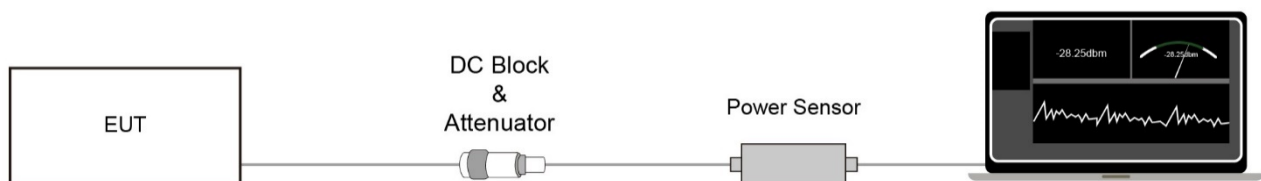
5.5.2. Test Procedure

ANSI C63.10 - 2013 - Section 11.9.2.3.2

5.5.3. Test Setting

Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter.

5.5.4. Test Setup



5.5.5. Test Result

Refer to Appendix A.4.

5.6. Radiated Spurious Emission Measurement

5.6.1. Test Limit

According to FCC Part 15.236(g), emissions outside of this band shall comply with the limits specified in section 8.4 of ETSI EN 300 422-1 V1.4.2.

State	Frequency		
	47MHz to 74MHz, 87.5MHz to 137MHz 174MHz to 230MHz, 470MHz to 862MHz	Other Frequencies below 1000MHz	Frequencies above 1000MHz
Operation	4nW	250nW	1uW
Standby	2nW	2nW	20nW

5.6.2. Test Procedure

ETSI EN 300 422-1 V1.4.2 clause 8.4.2.

5.6.3. Test Setting

Table 1 - RBW as a function of frequency

Frequency	RBW
25 ~ 30 MHz	9 kHz
30 ~ 1000 MHz	100 kHz
1000 ~ 6000 MHz	1 MHz

Emissions shall be investigated up to the 10th harmonic of the fundamental.

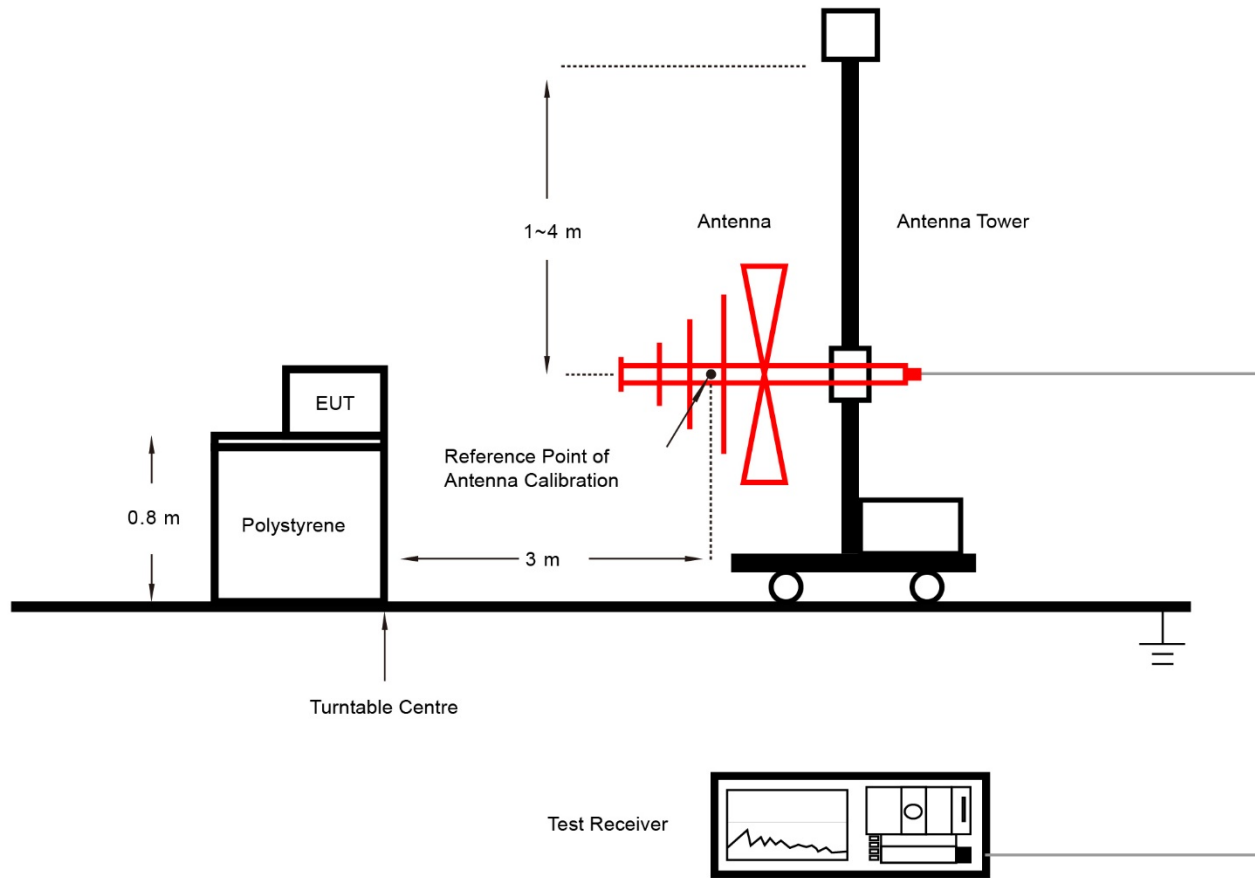
All the emissions shall be demonstrated using a QP detector below 1 GHz and an RMS Average detector above 1 GHz.

All significant broadband and narrowband signals found in the preliminary sweeps were measured using a peak detector at a test distance of 3 meters.

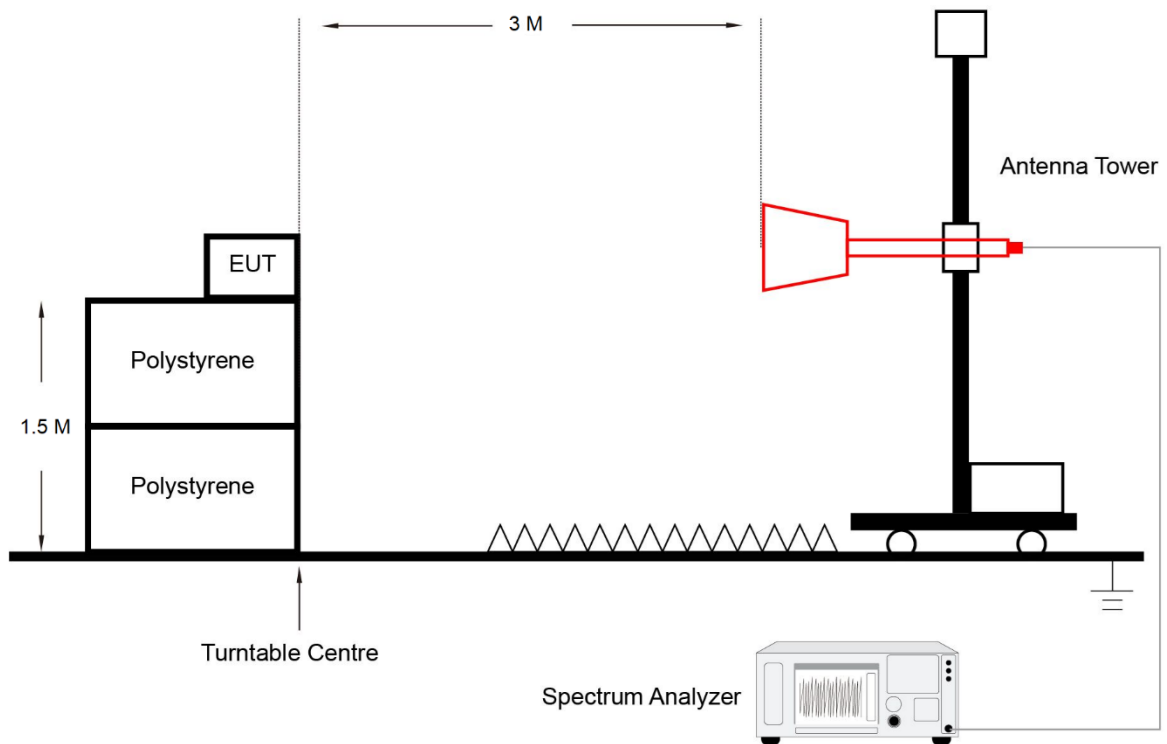
at each frequency at which a component is detected, the sample shall be rotated to obtain maximum response and the effective radiated power of that component determined by a substitution measurement.

5.6.4. Test Setup

Below 1GHz Test Setup:



Above 1GHz Test Setup:



5.6.5. Test Result

Refer to Appendix A.5.

5.7. AC Conducted Emissions Measurement

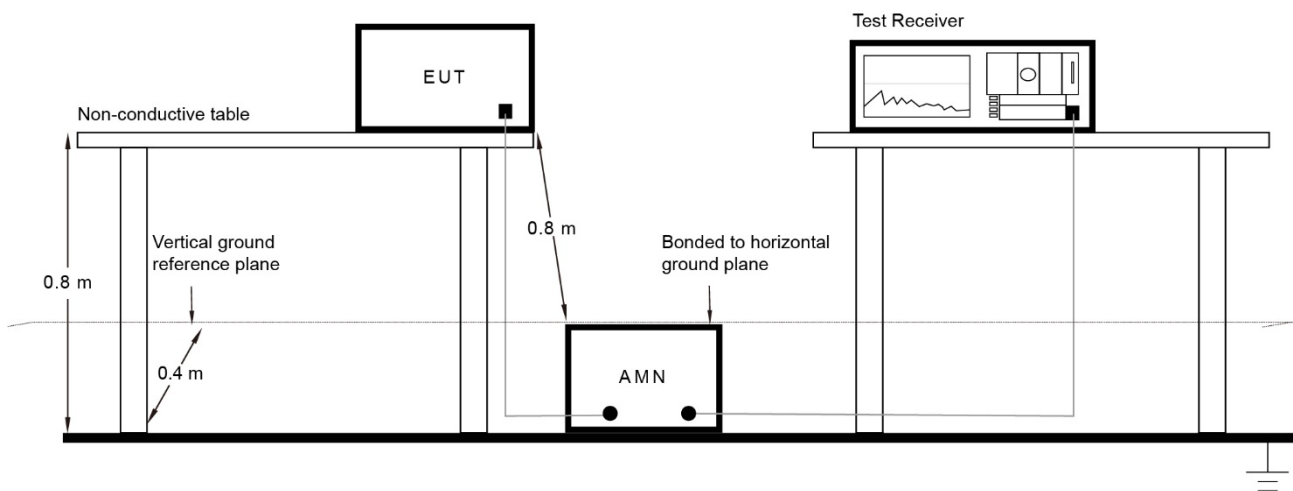
5.7.1. Test Limit

FCC Part 15 Subpart C Paragraph 15.207 Limits		
Frequency (MHz)	QP (dB μ V)	Average (dB μ V)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

5.7.2. Test Setup



5.7.3. Test Result

Refer to Appendix A.6.

Appendix A – Test Result

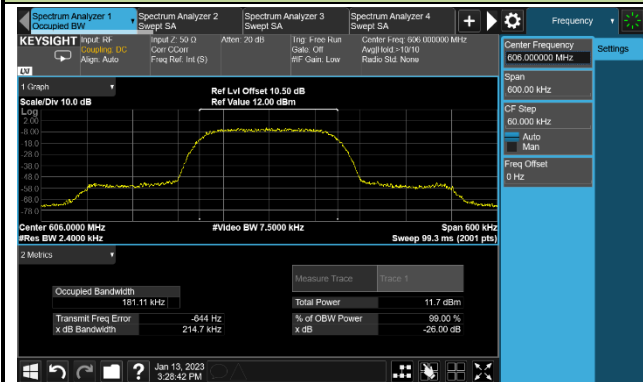
A.1 99% Occupied Bandwidth Test Result

Test Site	WZ-SR5	Test Engineer	Dandy Li
Test Date	2023-01-13 ~ 2023-01-15		

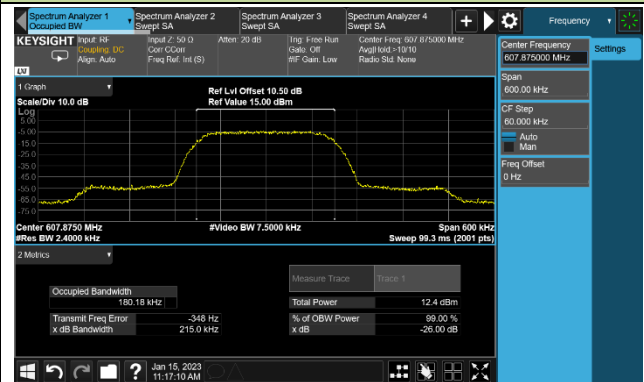
Mode	Frequency (MHz)	99% Bandwidth (kHz)	Limit (kHz)	Result
STD (35mW)	606.000	181.110	< 200	Pass
	607.875	180.180	< 200	Pass
STD (10mW)	614.125	180.880	< 200	Pass
	615.875	180.560	< 200	Pass
STD (10mW)	657.125	180.100	< 200	Pass
	662.875	180.140	< 200	Pass
HD (2mW)	606.000	97.451	< 200	Pass
	607.875	97.483	< 200	Pass
	614.125	97.678	< 200	Pass
	615.875	97.046	< 200	Pass
	657.125	98.099	< 200	Pass
	662.875	97.558	< 200	Pass

STD Mode - 99% Occupied Bandwidth

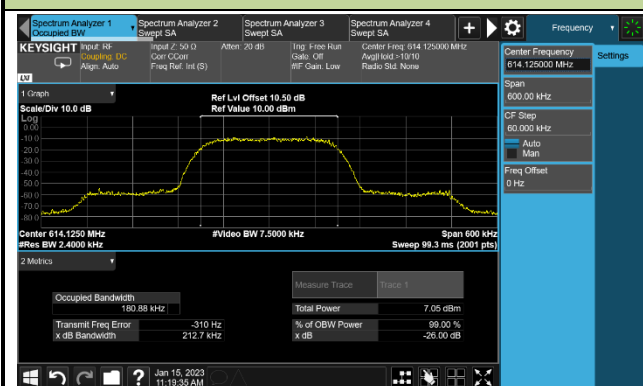
606.000MHz



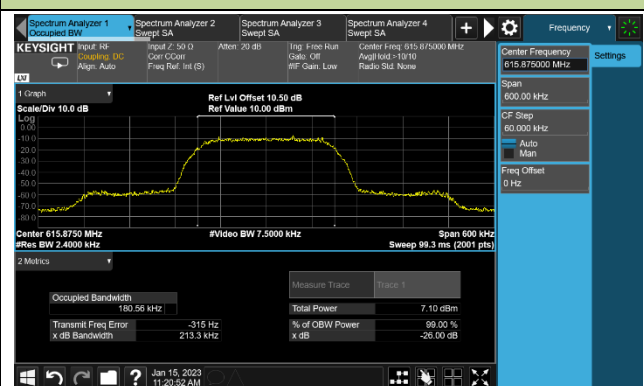
607.875MHz



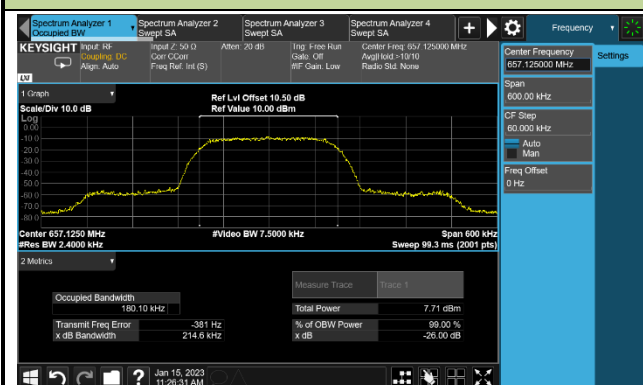
614.125MHz



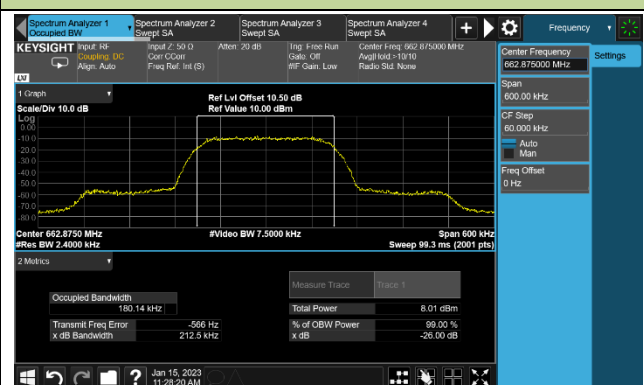
615.875MHz



657.125MHz

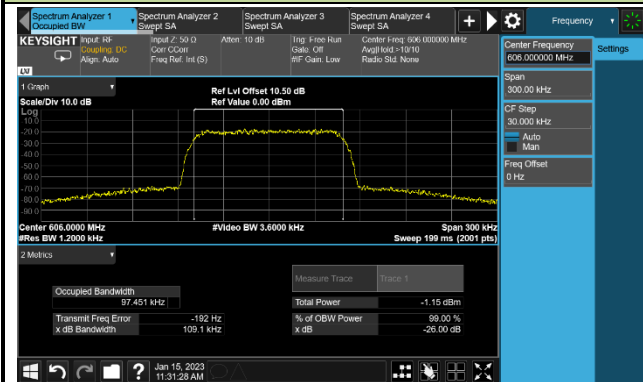


662.875MHz

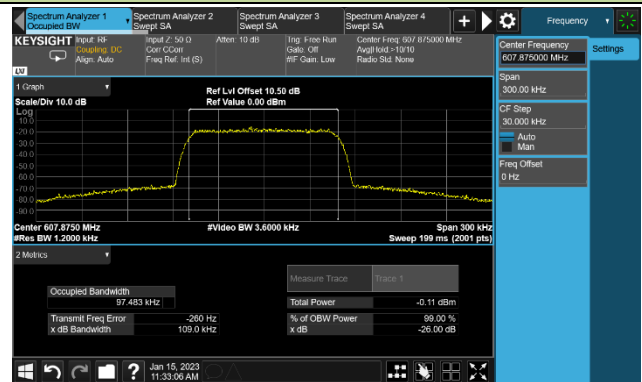


HD Mode - 99% Occupied Bandwidth

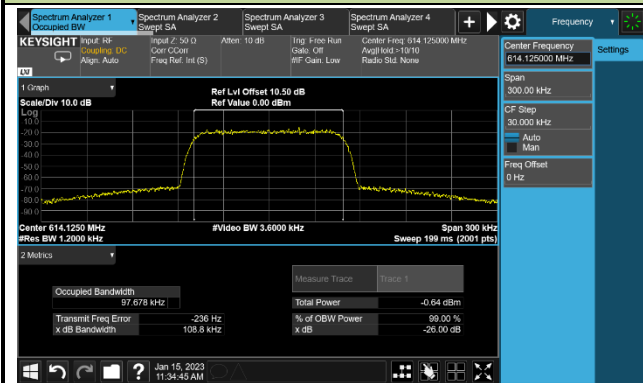
606.000MHz



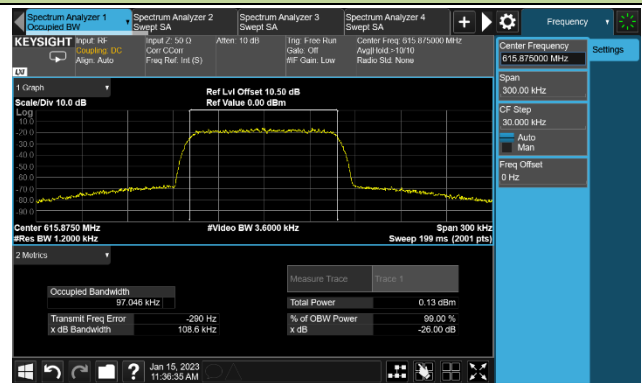
607.875MHz



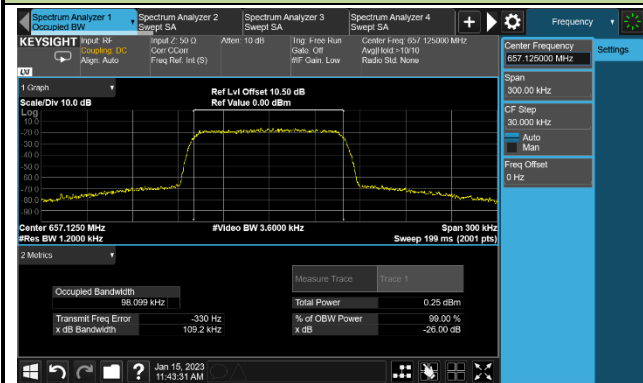
614.125MHz



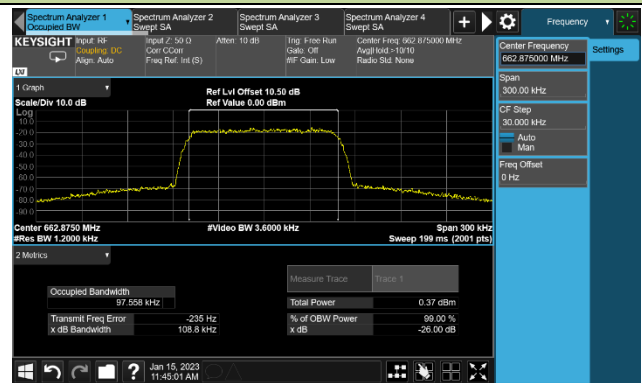
615.875MHz



657.125MHz



662.875MHz



A.2 Frequency Tolerance Test Result

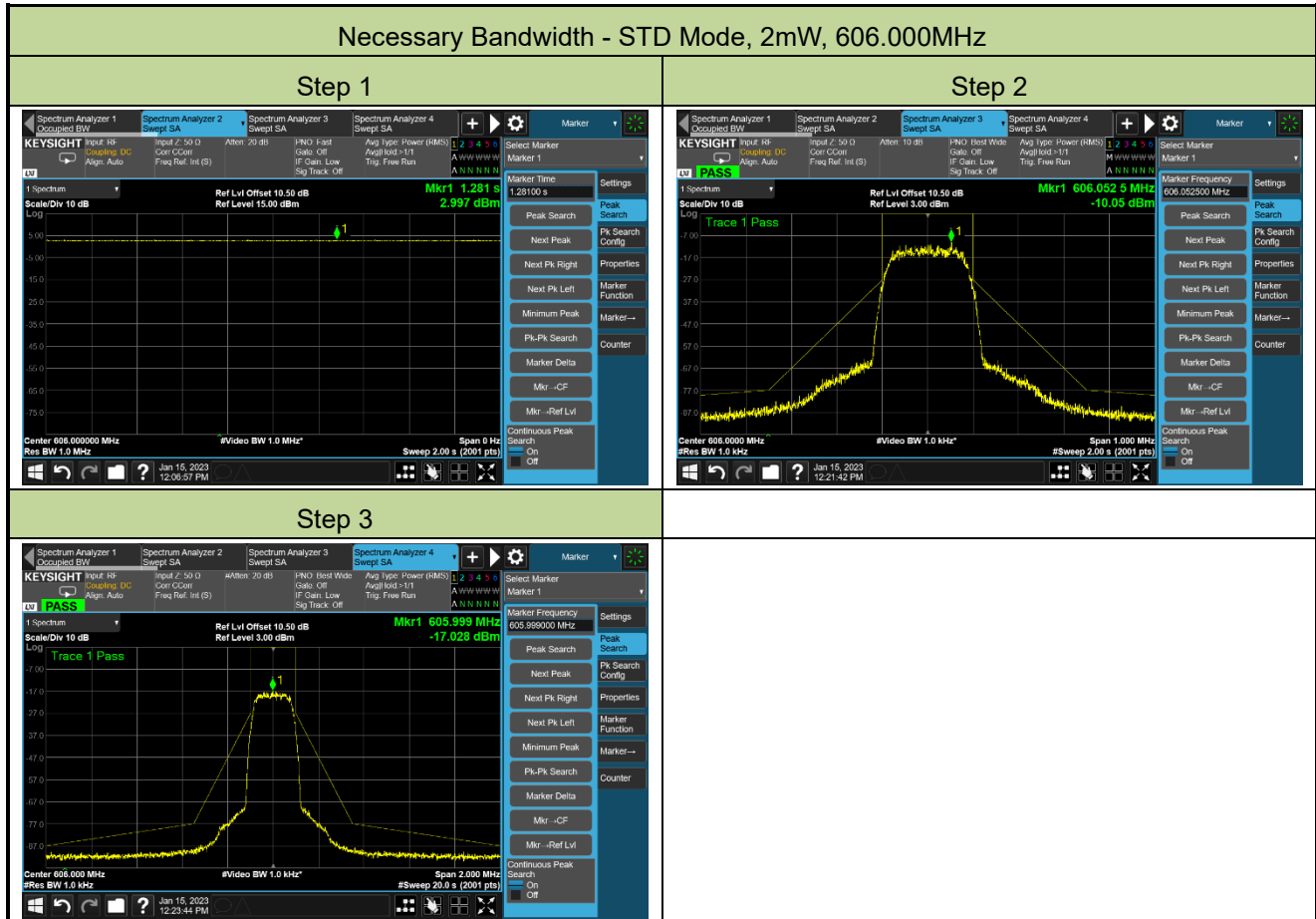
Test Site	WZ-TR3	Test Engineer	Dandy Li
Test Date	2023-02-06	Test Mode	606.000MHz

Voltage (%)	Power (VDC)	Temp (°C)	Frequency Tolerance (ppm)			
			0 minutes	2 minutes	5 minutes	10 minutes
100	3.7	- 10	-1.12	-1.20	-1.21	-1.22
		0	-0.75	-0.79	-0.79	-0.81
		+ 10	-0.33	-0.34	-0.34	-0.33
		+ 20	-0.26	-0.26	-0.25	-0.24
		+ 30	-0.40	-0.39	-0.38	-0.37
		+ 40	-0.40	-0.39	-0.37	-0.35
		+ 50	-0.41	-0.43	-0.44	-0.43
115	4.2	+ 20	-0.26	-0.25	-0.25	-0.49
85	3.1	+ 20	-0.26	-0.26	-0.25	-0.23

Note: Frequency Tolerance (ppm) = {[Measured Frequency (Hz) - Declared Frequency (Hz)] / Declared Frequency (Hz)} *10⁶.

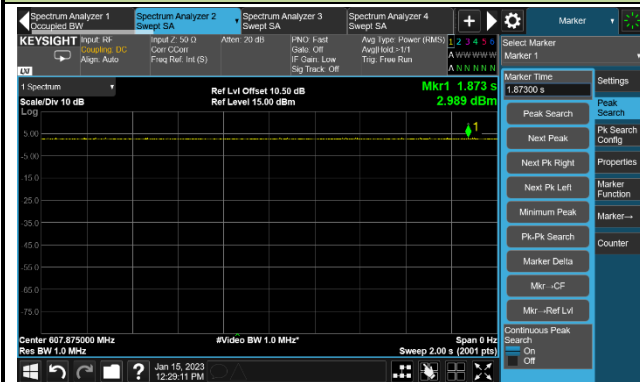
A.3 Necessary Bandwidth Test Result

Test Site	WZ-TR3	Test Engineer	Dandy Li
Test Date	2023-01-15		

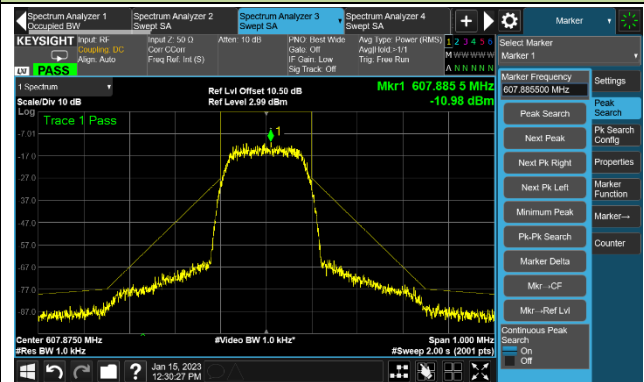


Necessary Bandwidth - STD Mode, 2mW, 607.875MHz

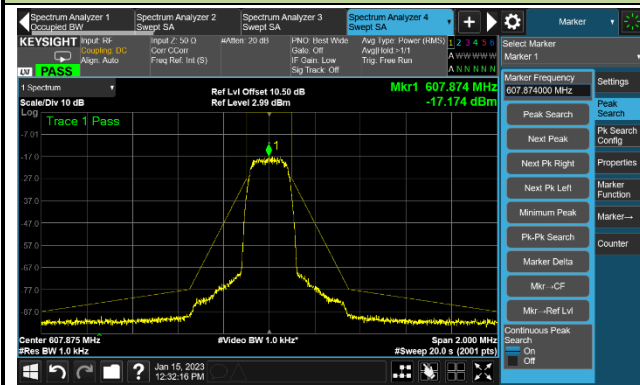
Step 1



Step 2

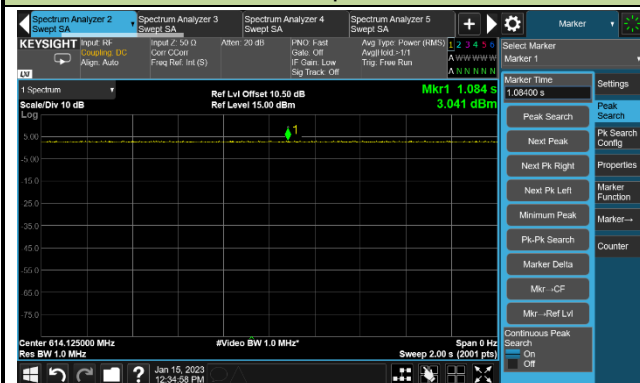


Step 3

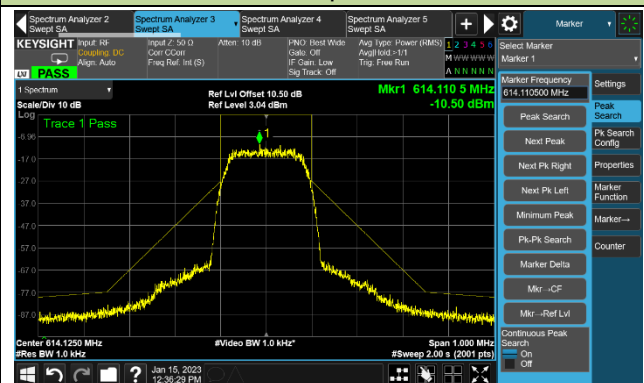


Necessary Bandwidth - STD Mode, 2mW, 614.125MHz

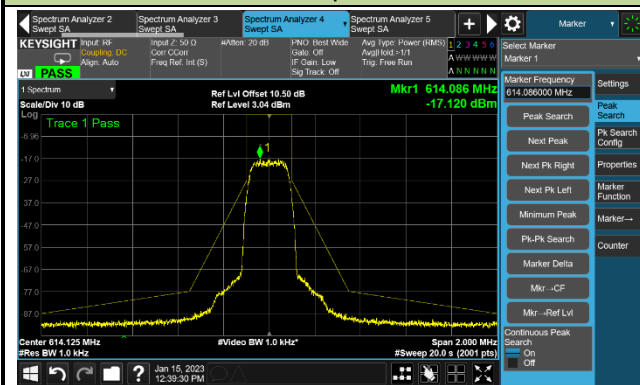
Step 1



Step 2

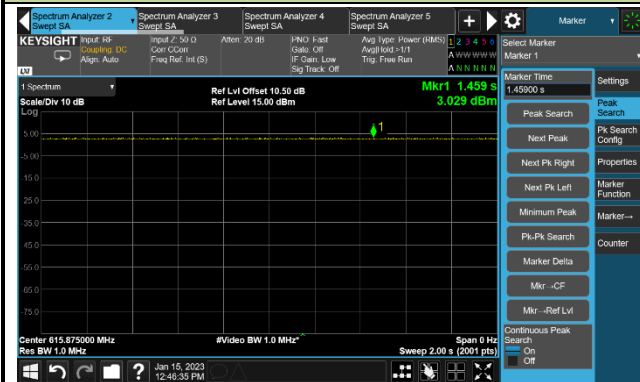


Step 3

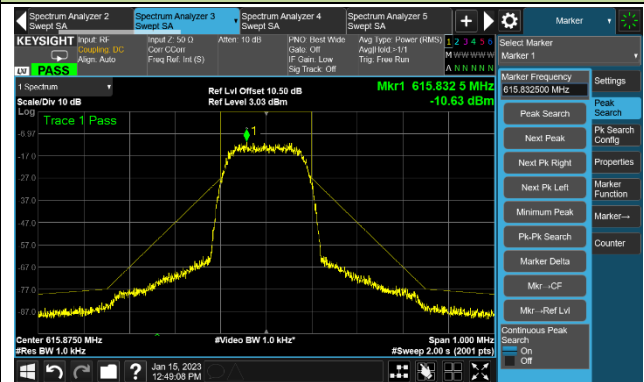


Necessary Bandwidth - STD Mode, 2mW, 615.875MHz

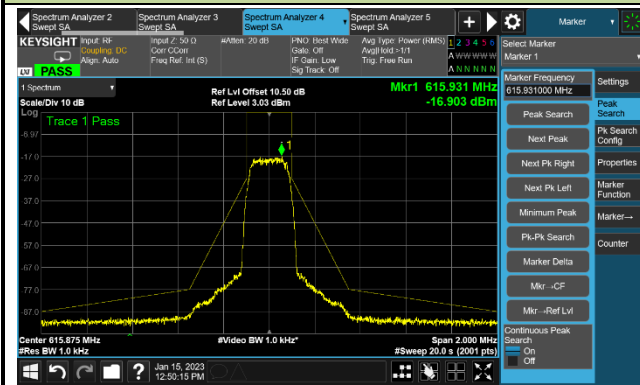
Step 1



Step 2

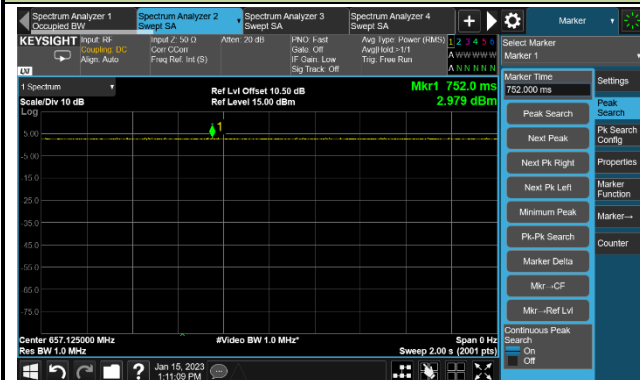


Step 3

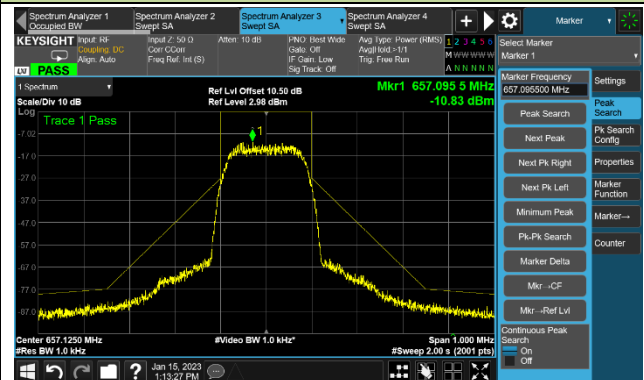


Necessary Bandwidth - STD Mode, 2mW, 657.125MHz

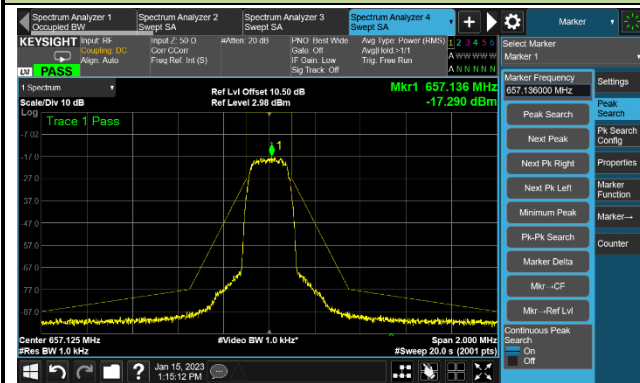
Step 1



Step 2

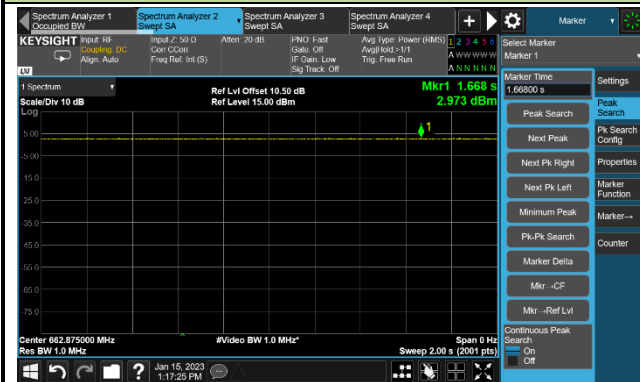


Step 3

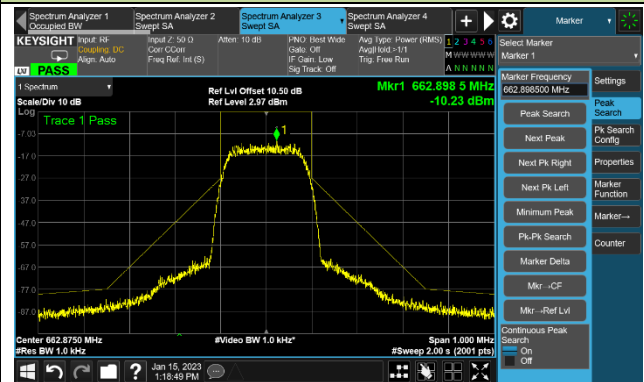


Necessary Bandwidth - STD Mode, 2mW, 662.875MHz

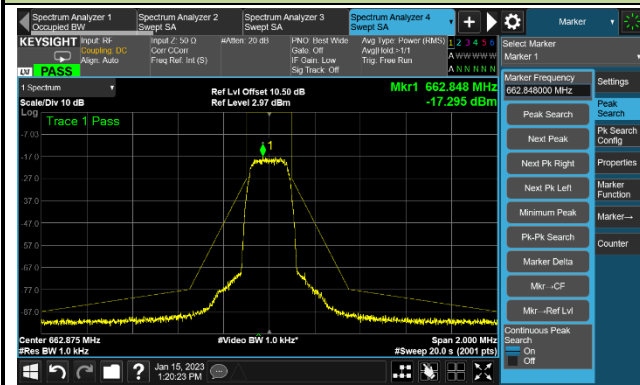
Step 1



Step 2

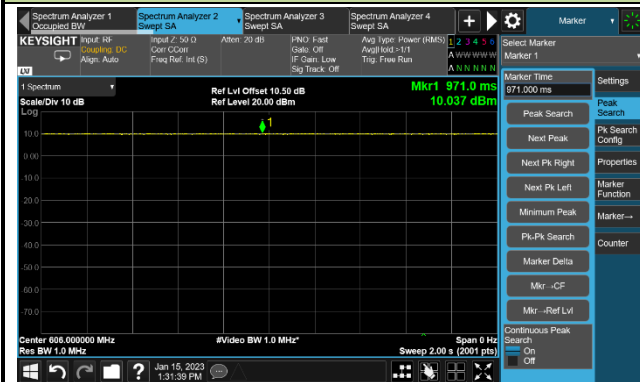


Step 3

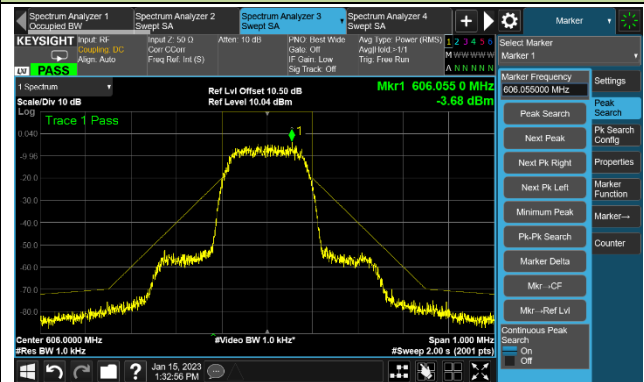


Necessary Bandwidth - STD Mode, 10mW, 606.000MHz

Step 1



Step 2



Step 3

