Radio Test Report

FCC ID: 2A7ZM-X6MICROPHONE

Report No.	:	TBR-C-202206-0362-14
Applicant	:	JBU GLOBAL LLC
Equipment Under Test (EUT)		
EUT Name	:	ALTO X6 microphone
Model No.	:	ALTO X6 microphone
Series Model No.	:	Allegro X8 microphone
Brand Name	:	MASINGO
Sample ID	:	202206-0362-01
Receipt Date	:	2022-07-27
Test Date	:	2022-07-27 to 2022-08-25
Issue Date	:	2022-08-25
Standards	:	FCC 47 CFR Part 74 FCC 47 CFR Part 2
Test Method	:	ANSI C63.26
Conclusions	:	**PASS**

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

Witness Engineer	:	Camille Li
Engineer Supervisor	:	Ivan Su
Engineer Manager	:	Ray Lai

Camille Li
Ivan Su
Ray Lai

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in the report.

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Contents

Revision History

Report No.	Version	Description	Issued Date
TBR-C-202206-0362-14	Rev.01	Initial issue of report	2022-08-25

1. General Information about EUT

1.1 Client Information

Applicant	:	JBU GLOBAL LLC
Address	:	19416 NE 26th Ave, 114B, Miami, Florida 33180
Manufacturer	:	GUANGZHOU MIAOSHENG ELECTRONIC TECHNOLOGY Co., LTD
Address	:	1-2, second floor West Street Watermelon Ridge Dongguan village Xinya Street Huadu District, Guangzhou,China

1.2 General Description of EUT (Equipment Under Test)

EUT Name	:	ALTO X6 microphone	
Models No.	:	ALTO X6 microphone, Allegro X8 microphone	
Model Different	:	All these models are identical in the same PCB layout and electrical circuit, the only difference is that names.	
Product Description	:	Operation Frequency:	941.6MHz~945.8MHz
		Number of Channel:	15 channels
		Antenna Gain:	-9dBi PCB Antenna
		Modulation Type:	FM
Power Rating	:	DC 3.0V by AA battery*2	
Software Version	:	----	
Hardware Version	:	----	

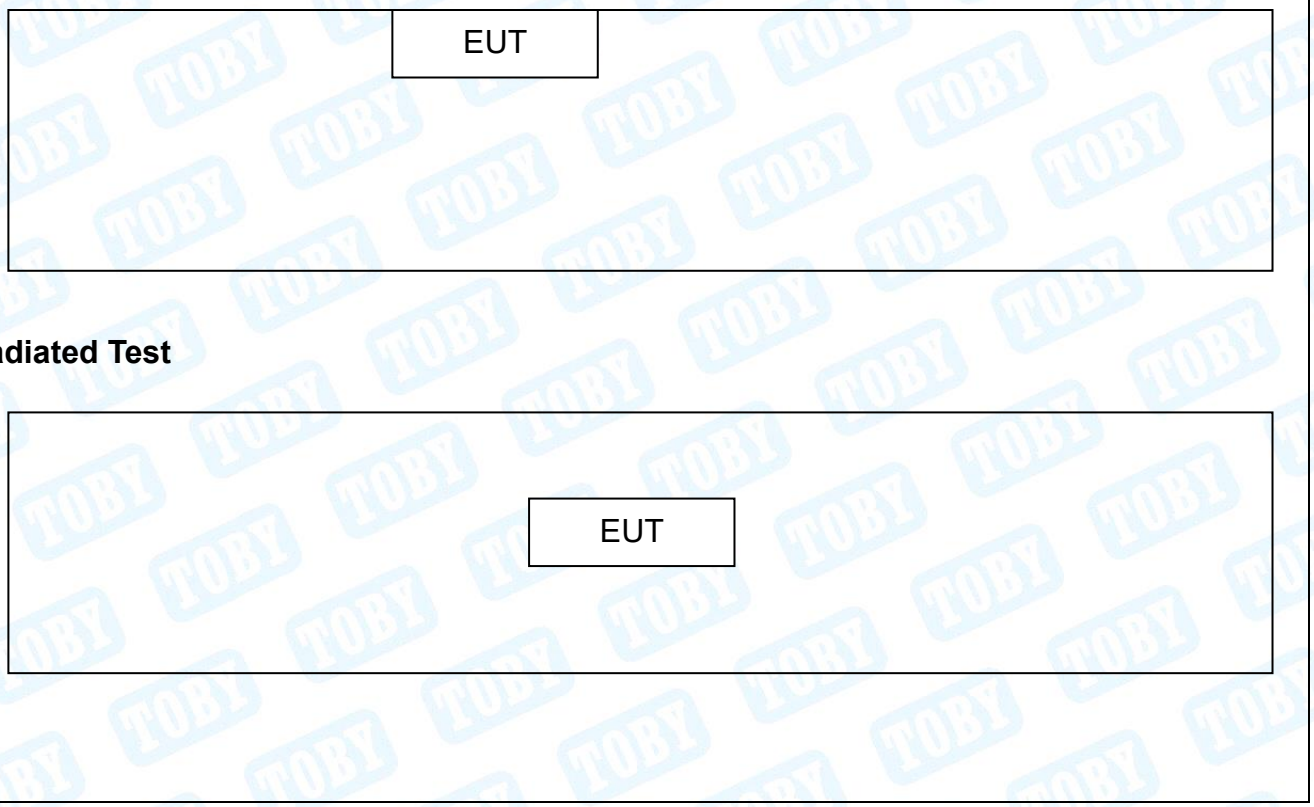
Remark:
(1)The antenna gain and adapter provided by the applicant, the verified for the RF conduction test provided by TOBY test lab.
(2)For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
(3)Antenna information provided by the applicant.

(4)Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	941.60	05	943.10	10	944.60
01	941.90	06	943.40	11	944.90
02	942.20	07	943.70	12	945.20
03	942.50	08	944.00	13	945.50
04	942.80	09	944.30	14	945.80

1.3 Block Diagram Showing the Configuration of System Tested

Conducted Test



Radiated Test

1.4 Description of Support Units

Equipment Information				
Name	**Model**	**FCC ID/VOC**	**Manufacturer**	**Used "√"**
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Cable Information				
Number	**Shielded Type**	**Ferrite Core**	**Length**	**Note**
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1.5 Description of Test Mode

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned follow was evaluated respectively.

For Radiated Test	
Final Test Mode	**Description**
Mode 1	TX Mode (Channel 00)
Mode 2	TX Mode (Channel 07)
Mode 3	TX Mode (Channel 14)

Note:

(1) For all test, we have verified the construction and function in typical operation. And all the test modes were carried out with the EUT in transmitting operation in maximum power with all kinds of data rate.

According to ANSI C63.10 standards, the measurements are performed at the highest, middle, lowest available channels, and the worst case data rate as follows:

BLE Mode: GFSK Modulation Transmitting mode.

(2) During the testing procedure, the continuously transmitting with the maximum power mode was programmed by the customer.

(3) The EUT is considered a portable unit; in normal use it was positioned on X-plane. The worst case was found positioned on X-plane. Therefore only the test data of this X-plane was used for radiated emission measurement test.

1.6 Description of Test Software Setting

During testing channel& Power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of RF setting.

Test Software Version	RFtestMode		
Frequency	941.6 MHz	943.7 MHz	945.8 MHz
UHF	DEF	DEF	DEF

1.7 Measurement Uncertainty

The reported uncertainty of measurement y±U，where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2，providing a level of confidence of approximately 95 %.

Test Item	Parameters	Expanded Uncertainty (U_{Lab})
Conducted Emission	Level Accuracy: 9kHz~150kHz 150kHz to 30MHz	±3.50 dB ±3.10 dB
Radiated Emission	Level Accuracy: 9kHz to 30 MHz	±4.60 dB
Radiated Emission	Level Accuracy: 30MHz to 1000 MHz	±4.50 dB
Radiated Emission	Level Accuracy: Above 1000MHz	±4.20 dB

1.8 Test Facility

The testing report were performed by the Shenzhen Toby Technology Co., Ltd., in their facilities located at 1/F.,Building 6, Rundongsheng Industrial Zone, Longzhu, Xixiang, Bao'an District, Shenzhen, Guangdong, China. At the time of testing, the following bodies accredited the Laboratory:

CNAS (L5813)
The Laboratory has been accredited by CNAS to ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories for the competence in the field of testing. And the Registration No.: CNAS L5813.

A2LA Certificate No.: 4750.01
The laboratory has been accredited by American Association for Laboratory Accreditation(A2LA) to ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories for the technical competence in the field of Electrical Testing. And the A2LA Certificate No.: 4750.01.FCC Accredited Test Site Number: 854351. Designation Number: CN1223.

IC Registration No.: (11950A)
The Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing. The site registration: Site# 11950A. CAB identifier: CN0056.

2. Test Summary

Standard Section FCC	Test Item	Test Sample(s)	Judgment	Remark
§74.861(d)(1), § 2.1046	Maximum Transmitter Power	202206-0362-01	PASS	N/A
§74.861(d)(4), § 2.1049	Occupied Bandwidth	202206-0362-01	PASS	N/A
§74.861(d)(4), § 2.1053	Radiated Unwanted Emissions	202206-0362-01	PASS	N/A
§74.861(d)(4), § 2.1053	Conducted Unwanted Emissions	202206-0362-01	PASS	N/A
§74.861(d)(4), § 2.1049	Emission Mask (Necessary bandwidth)	202206-0362-01	PASS	N/A
§ 2.1047	Modulation Characteristics	202206-0362-01	PASS	N/A
§74.861(e)(4), § 2.1055	Frequency Tolerance	202206-0362-01	PASS	N/A

Note: N/A is an abbreviation for Not Applicable.

3. Test Software

Test Item	Test Software	Manufacturer	Version No.
Conducted Emission	EZ-EMC	EZ	CDI-03A2
Radiation Emission	EZ-EMC	EZ	FA-03A2RE
Radiation Emission	EZ-EMC	EZ	FA-03A2RE+
RF Conducted Measurement	MTS-8310	MWRFtest	V2.0.0.0
RF Test System	JS1120	Tonscend	V2.6.88.0336

4. Test Equipment

Radiation Emission Test (A Site)					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
Spectrum Analyzer	Rohde & Schwarz	FSV40-N	102197	Jun. 23, 2022	Jun. 22, 2023
EMI Test Receiver	Rohde & Schwarz	ESPI	100010/007	Jun. 23, 2022	Jun. 22, 2023
Bilog Antenna	ETS-LINDGREN	3142E	00117537	Feb. 27, 2022	Feb.26, 2024
Horn Antenna	ETS-LINDGREN	3117	00143207	Feb. 26, 2022	Feb.25, 2024
Horn Antenna	SCHWARZBECK	BBHA 9170	1118	Feb. 26, 2022	Feb.25, 2024
Loop Antenna	SCHWARZBECK	FMZB 1519 B	1519B-059	Feb. 26, 2022	Feb.25, 2024
Pre-amplifier	SONOMA	310N	185903	Feb. 26, 2022	Feb.25, 2023
Pre-amplifier	HP	8449B	3008A00849	Feb. 26, 2022	Feb.25, 2023
HF Amplifier	Tonscend	TAP0184050	AP21C806129	Sep. 03, 2021	Sep. 02, 2022
Radiation Emission Test (B Site)					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
Spectrum Analyzer	Agilent	N9020A	MY49100060	Sep. 03, 2021	Sep. 02, 2022
Spectrum Analyzer	Rohde & Schwarz	FSV40-N	102197	Jun. 23, 2022	Jun. 22, 2023
EMI Test Receiver	Rohde & Schwarz	ESU-8	100472/008	Feb. 26, 2022	Feb.25, 2023
Bilog Antenna	SCHWARZBECK	VULB 9168	1225	Dec. 05, 2021	Dec. 04, 2023
Horn Antenna	SCHWARZBECK	BBHA 9120 D	2463	Feb. 26, 2022	Feb.25, 2024
Horn Antenna	SCHWARZBECK	BBHA 9170	1118	Jun. 26, 2022	Jun.25, 2024
Loop Antenna	SCHWARZBECK	FMZB 1519 B	1519B-059	Jun. 26, 2022	Jun.25, 2024
HF Amplifier	Tonscend	TAP9E6343	AP21C806117	Sep. 03, 2021	Sep. 02, 2022
HF Amplifier	Tonscend	TAP051845	AP21C806141	Sep. 03, 2021	Sep. 02, 2022
HF Amplifier	Tonscend	TAP0184050	AP21C806129	Sep. 03, 2021	Sep. 02, 2022
Antenna Conducted Emission					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jun. 23, 2022	Jun. 22, 2023
Spectrum Analyzer	Rohde & Schwarz	FSV40-N	102197	Jun. 23, 2022	Jun. 22, 2023
MXA Signal Analyzer	KEYSIGT	N9020B	MY60110172	Sep. 03, 2021	Sep. 02, 2022
MXA Signal Analyzer	Agilent	N9020A	MY47380425	Sep. 03, 2021	Sep. 02, 2022

5. Maximum Transmitter Power

5.1 Test Standard and Limit

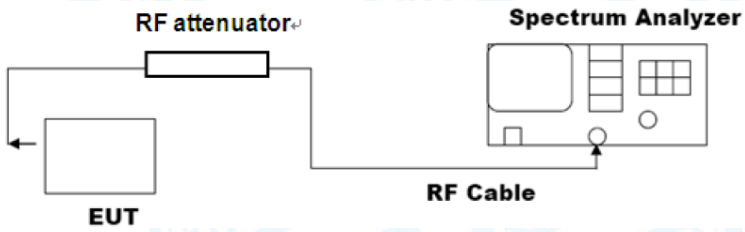
5.1.1 Test Standard

FCC §74.861(d)(1), § 2.1046

5.1.2 Test Limit

For all bands except the 1435-1525 MHz band, the maximum transmitter power which will be authorized is 1 watt. In the 1435-1525 MHz band, the maximum transmitter power which will be authorized is 250 milliwatts. Licensees may accept the manufacturer's power rating; however, it is the licensee's responsibility to observe specified power limits.

5.2 Test Setup



5.3 Test Procedure

This procedure can be used to measure the peak power in either a CW-like or noise-like narrowband RF signal. The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW >3 x RBW.

a) Set the RBW ≥ OBW.
b) Set VBW ≥3 x RBW.
c) Set span ≥2 x OBW.
d) Sweep time ≥ 10 x (number of points in sweep) x (transmission symbol period).
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the peak marker function to determine the peak amplitude level.

5.4 Deviation From Test Standard

No deviation

5.5 EUT Operating Mode

Please refer to the description of test mode.

5.6 Test Data

Please refer to the Attachment A.

6. Occupied Bandwidth

6.1 Test Standard and Limit

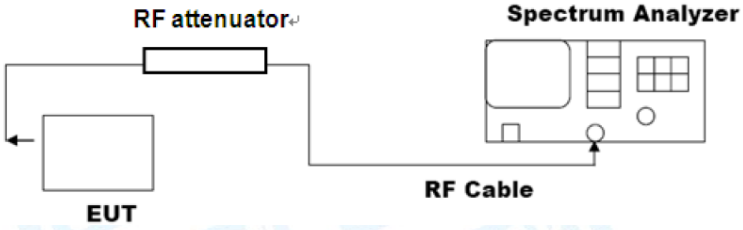
6.1.1 Test Standard

FCC §74.861(d)(4), § 2.1049

6.1.2 Test Limit

Test Item	Limit
99% occupied bandwidth	/

6.2 Test Setup



6.3 Test Procedure

The OBW is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

The following procedure shall be used for measuring (99%) power bandwidth:

a)The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (typically a span of 1.5 x OBW is sufficient).

b)The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set≥3 x RBW.

c)Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.

NOTE-Step a), step b), and step c) may require iteration to adjust within the specified tolerances.

d)Set the detection mode to peak, and the trace mode to max-hold.

e)If the instrument does not have a 99% OBW function, recover the trace data points and sum directly in linear power terms. Place the recovered amplitude data points, beginning at the lowest frequency, in a running sum until 0.5% of the total is reached. Record that frequency as the lower OBW frequency. Repeat the process until 99.5% of the total is reached and record that frequency as the upper OBW frequency. The 99% power OBW can be determined by computing the difference these two frequencies.e)

f)The OBW shall be reported and plot(s) of the measuring instrument display shall be provided with the test report. The frequency and amplitude axis and scale shall be clearly labeled. Tabular data can be reported in addition to the plot(s).

6.4 Deviation From Test Standard

No deviation

6.5 EUT Operating Mode

Please refer to the description of test mode.

6.6 Test Data

Please refer to the Attachment B.

7. Radiated and Conducted Unwanted Emissions

7.1 Test Standard and Limit

7.1.1 Test Standard

FCC §74.861(d)(4), § 2.1053

7.1.2 Test Limit

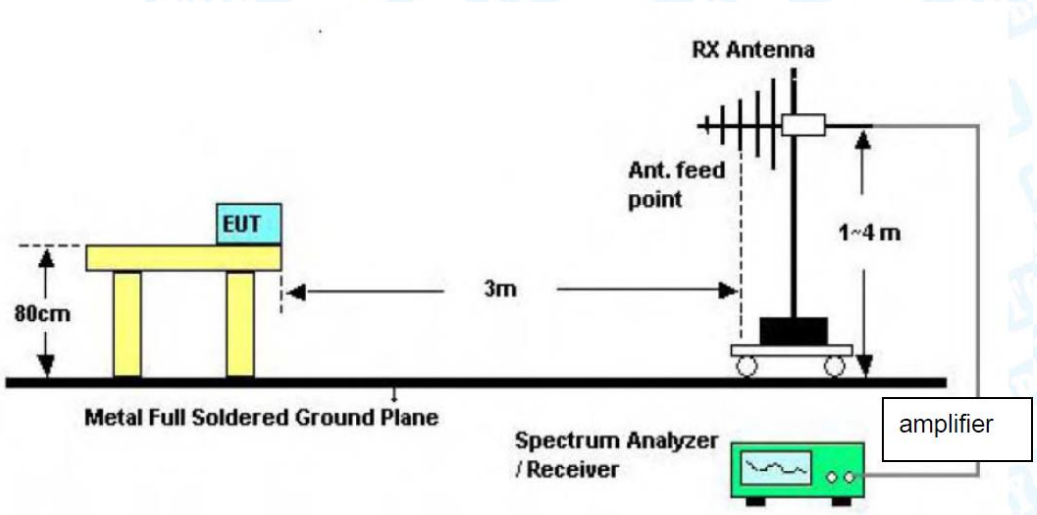
Emissions shall comply with the limits specified in section 8.4 of ETSI EN 300 422-1 v1.4.2 (2011-08).

State	Frequency		
	47 MHz to 74 MHz 87,5 MHz to 137 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other Frequencies below 1 000 MHz	Frequencies above 1 000 MHz
Operation	4 nW	250 nW	1 µW
Standby	2 nW	2 nW	20 nW

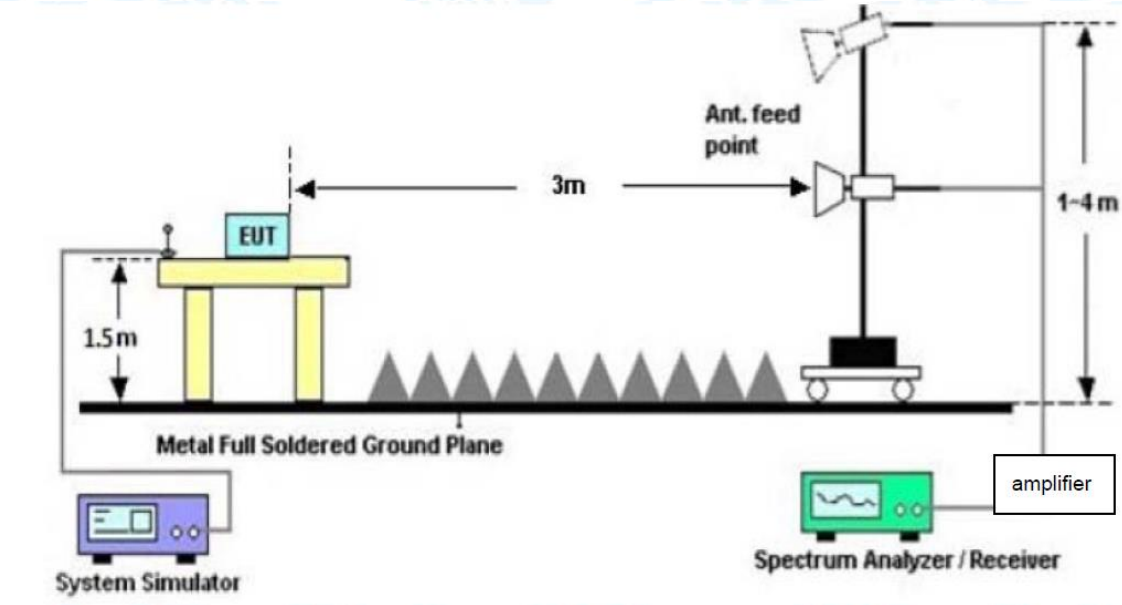
The mean power of emissions shall be attenuated below the mean output power of the transmitter
in accordance with the following schedule:
(i) On any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB;
(ii) On any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB;
(iii) On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least 43 + 10log10 (mean output power in watts) dB.
this becomes a constant specification limit of -13 dBm.

7.2 Test Setup

Radiated measurement

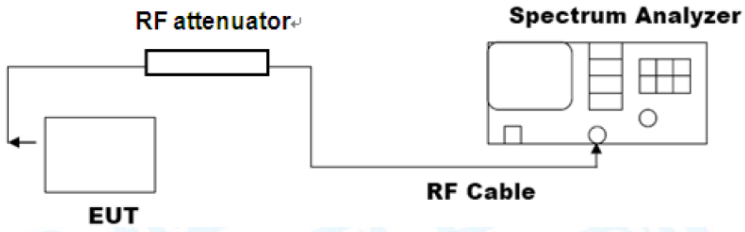


Below 1000MHz Test Setup



Above 1GHz Test Setup

Conducted measurement



7.3 Test Procedure

---Radiated measurement

●The measuring distance of 3m shall be used for measurements at frequency up to 1GHz and above 1 GHz. The EUT was placed on a rotating 0.8m high above ground, the table was rotated 360 degrees to determine the position of the highest radiation.

● Measurements at frequency above 1GHz. The EUT was placed on a rotating 1.5m high above the ground. RF absorbers covered the ground plane with a minimum area of 3.0m by 3.0m between the EUT and measurement receiver antenna. The RF absorber shall not exceed 30cm in high above the conducting floor. The table was rotated 360 degrees to determine the position of the highest radiation.

● The Test antenna shall vary between 1m and 4m, Both Horizontal and Vertical antenna are set to make measurement.

●The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.

●If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit Below 1 GHz, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed. But the Peak Value and average value both need to comply with applicable limit above 1 GHz.

●Testing frequency range 30MHz-1GHz the measuring instrument use VBW=120 kHz with Quasi-peak detection. Testing frequency range 9KHz-150Hz the measuring

instrument use VBW=200Hz with Quasi-peak detection. Testing frequency range 9KHz-30MHz the measuring instrument use VBW=9kHz with Quasi-peak detection.

●Testing frequency range above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values.

●For the actual test configuration, please see the test setup photo.

--- Conducted measurement

a) Set the spectrum analyzer start frequency to the lowest frequency generated by the EUT, without going below 9 kHz, and the stop frequency to the lower frequency covered by the measurements previously performed in 5.7.3. As an alternative, the stop frequency can be set to the value specified in 5.1.1, depending on the EUT operating range, if the resulting plot can clearly demonstrate compliance for all frequencies not addressed by the out-of-band emissions measurements performed as per 5.7.3.

b) When using an average power (rms) detector, ensure that the number of points in the sweep >2 x (span/ RBW). This may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the spectrum analyzer capabilities. This requirement does not apply to peak-detected power measurements. When average power is specified by the applicable regulation, a peak-detector can be utilized for preliminary measurements to accommodate wider frequency spans. Any emissions found in the preliminary measurement to exceed the applicable limit(s) shall be further examined using a power averaging (rms) detector with the minimum number of measurement points as defined above.a)

c) The sweep time should be set to auto-couple for performing peak-detector measurements. For measurements that use a power averaging (rms) detector, the sweep time shall be set as described for out-of-band emissions measurements in item d) of 5.7.3.

d) Identify and measure the highest spurious emission levels in each frequency range. It is not necessary to re-measure the out-of-band emissions as a part of this test. Record the frequencies and amplitudes corresponding to the measured emissions and capture the data plots.

e) Repeat step b) through step d) for the upper spurious emission frequency range if not already captured by a wide span measurement performed as per the alternative provided in step a).

f) The upper frequency for this measurement is defined in 5.1.1 as a function of the EUT operating range.

g) Compare the results with the corresponding limit in the applicable regulation. The test report shall include the data plots of the measuring instrument display and the measured data.

7.4 Deviation From Test Standard

No deviation

7.5 EUT Operating Mode

Please refer to the description of test mode.

7.6 Test Data

Please refer to the Attachment C.

8. Emission Mask(Necessary bandwidth)

8.1 Test Standard and Limit

8.1.1 Test Standard

FCC §74.861(d)(4), § 2.1049

8.1.2 Test Limit

Analog emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in section 8.3.1.2 of the European Telecommunications Institute Standard ETSI EN 300 422-1 v1.4.2 (2011-08)

Digital emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in section 8.3.2.2 (Figure 4) of the European Telecommunications Institute Standard ETSI EN 300 422-1 v1.4.2 (2011-08)

8.3.1.2 Limits

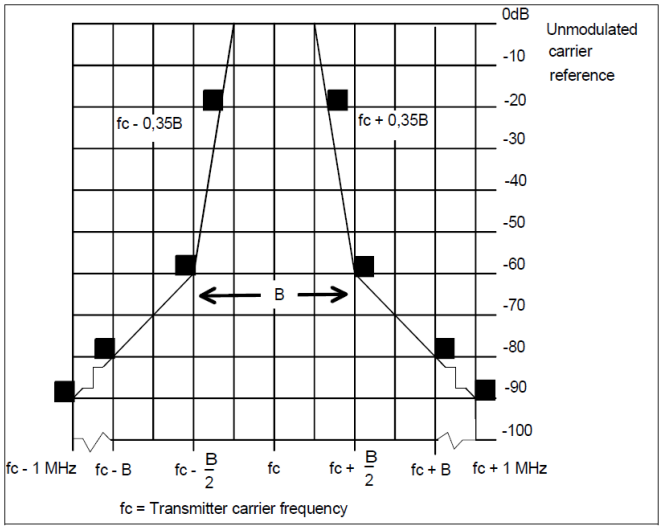


Figure 3: Spectrum mask for analogue systems in all bands

8.3.2.2 Limits

The transmitter output spectrum shall be within the mask defined in figure 4. This mask may also be used for analogue.

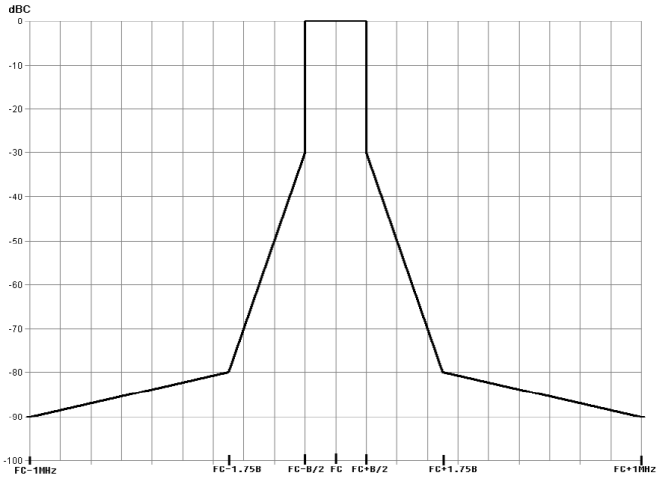


Figure 4: Spectrum mask for digital systems below 1 GHz

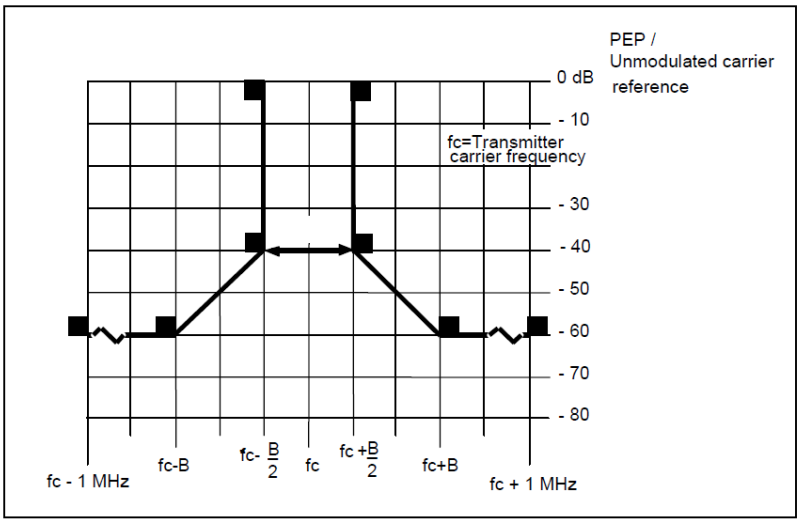
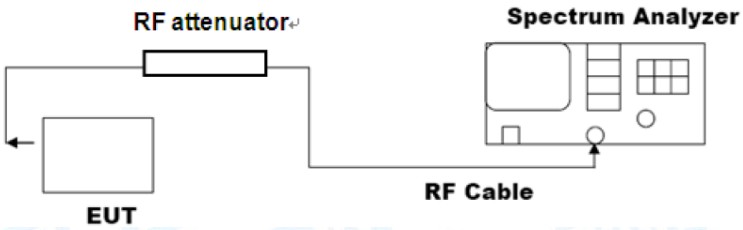


Figure 5: Spectral mask for digital systems above 1 GHz, normalized to channel bandwidth B

8.2 Test Setup



8.3 Test Procedure

---Necessary Bandwidth (BN) for Analogue Systems

The arrangement of test equipment as shown in figure B.1 shall be used. Note that the noise meter conforms to (quasi peak) without weighting filter (flat).

With the Low Frequency (LF) audio signal generator set to 500 Hz, the audio input level to the EUT shall be adjusted to 8 dB below the limiting threshold (-8 dB (lim)) as declared by the manufacturer.

The corresponding audio output level from the demodulator shall be measured and recorded.

The input impedance of the noise meter shall be sufficiently high to avoid more than 0,1 dB change in input level when the meter is switched between input and output.

The audio input level shall be increased by 20 dB, i.e. to +12 dB (lim), and the corresponding change in output level shall be measured.

It shall be checked that the audio output level has increased by ≤ 10 dB.

If this condition is not met, the initial audio input level shall be increased from -8 dB (lim) in 1 dB steps until the above condition is fulfilled, and the input level recorded in the test report. This level replaces the value derived from the manufacturer's declaration and is

defined as -8 dB (lim).

Measure the input level at the transmitter required to give +12 dB (lim).

The LF generator shall be replaced with the weighted noise source to ITU-R Recommendation BS.559-2 [1], band-limited to 15 kHz as described in IEC 60244-13 [2], and the level shall be adjusted such that the measured input to the transmitter corresponds to +12 dB (lim).

If the transmitter incorporates any ancillary coding or signalling channels (e.g. pilot-tones), these shall be enabled prior to any spectral measurements.

If the transmitter incorporates more than one audio input, e.g. stereo systems, the second and subsequent channels shall be simultaneously driven from the same noise source, attenuated to a level of -6 dB (lim).

The transmitter RF output spectrum shall be measured, using a spectrum analyser with the following settings:

- centre frequency: fc: Transmitter (Tx) nominal frequency;
- dispersion (Span): fc - 1 MHz to fc + 1 MHz;
- Resolution BandWidth (RBW): 1 kHz;
- Video BandWidth (VBW): 1 kHz;
- detector: Peak hold.

---Necessary Bandwidth (BN) for Digital Systems

Principal Spectrum Mask measuring method for digital transmitters:

- Spectrum mask below 1 GHz, see figure 4, for the spectrum mask above 1 GHz, see figure 5.

The transmitter shall be modulated with the test signals defined in clause 7.1.2. In any case the mask shall not be
exceeded.

- Step 1: Measure the "Carrier Power" with the spectrum analyzer setup:
  - Center Frequency = fc
  - Span = Zero span
  - Detector = RMS
  - Trace Mode = Average
  - RBW&VBW = 5 x B
  - Sweep time ≥ 2 s
- Step 2: Measure the "Maximum Relative Level (dBc) at Specified Carrier Offsets" with the following
spectrum analyzer setup:
  - Center Frequency = fc
  - Span ≥ 5 x B
  - Detector = RMS
  - Trace Mode = Peak Hold
  - RBW&VBW = 1 kHz
  - Sweep time ≥ 2 s

Limits: Mask shall not be exceeded.

- Step 3: Measure the "transmitter wide band noise floor":
The measurement of transmitter broad band noise floor shall be carried out according to clause 8.3.1.1.
• Start Frequency = fc + 1,75B and fc - 1 MHz below 1 GHz,
Start Frequency = fc + B and fc - 1 MHz above 1 GHz.
• Stop Frequency = fc + 1 MHz and fc - 1,75 B below 1 GHz,
Stop Frequency = fc + 1 MHz and fc -B above 1 GHz.
• Detector = RMS
• Trace Mode = Average
• RBW&VBW = 1 kHz
• Sweep time ≥ 2 s
NOTE 2: Two spectrum ranges are to be measured!
Limits: Mask shall not be exceeded.

8.4 Deviation From Test Standard

No deviation

8.5 EUT Operating Mode

Please refer to the description of test mode.

8.6 Test Data

Please refer to the Attachment D.

9. Modulation Characteristics

9.1 Test Standard and Limit

9.1.1 Test Standard

FCC § 2.1047

9.1.2 Test Limit

9.2 Test Setup

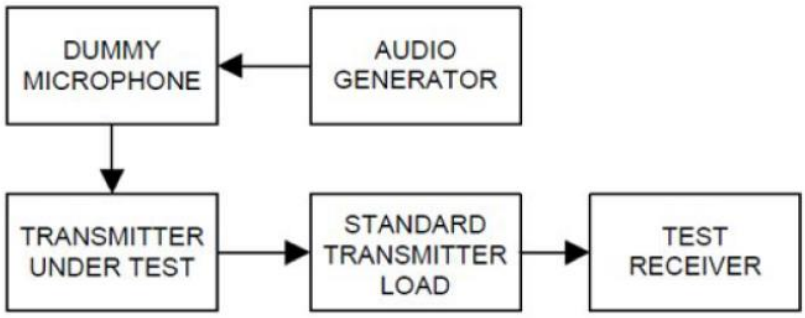


Figure 1 —Equipment set-up for modulation limiting test

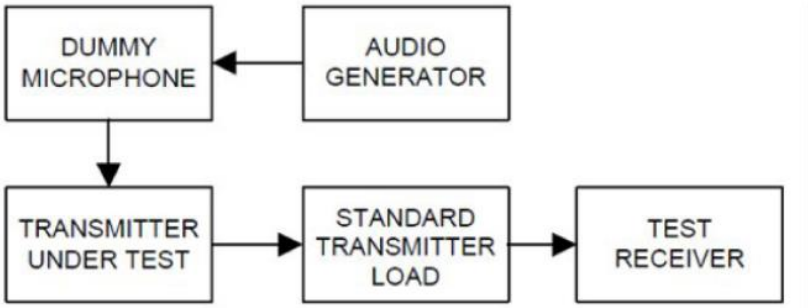


Figure 3 —Equipment set-up audio frequency response (constant input)

9.3 Test Procedure

----Modulation limiting test methodology
Modulation limiting is the ability of a transmitter circuit to limit the transmitter from producing deviations in excess of a rated system deviation.

a)Connect the equipment as illustrated in Figure 1.

b) Adjust the transmitter per the manufacturer's procedure for full rated system deviation.

c) Set the test receiver to measure peak positive deviation. Set the audio bandwidth for <0.25 Hz to 215 000 Hz. Turn the de-emphasis function off.

d) Apply a 1000 Hz modulating signal to the transmitter from the audio frequency generator, and adjust the level to obtain 60% of full rated system deviation. This is the 0 dB reference level.

e) Increase the level from the audio generator by 20 dB in 5 dB increments recording the deviation as measured from the test receiver in each step. Verify that the audio level used to make the OBW measurement is included in the sweep.

f) Repeat for step e) at 300 Hz, 2500 Hz and 3000 Hz at a minimum using the 0 dB reference level obtained in step d).

g) Set the test receiver to measure peak negative deviation and repeat step d) through step f).

h) The values recorded in step f) and step g) are the modulation limiting.

i) Plot the data set as a percentage of deviation relative to the 0 dB reference point versus input voltage.

---Audio frequency response test methodology-Constant Input

a) Connect the equipment as illustrated in Figure 3.

b) Set the test receiver to measure peak positive deviation. Set the audio bandwidth for <50 Hz to >15 000 Hz. Turn the de-emphasis function off.

c) Adjust the transmitter per the manufacturer's procedure for full rated system deviation.

d) Apply a 1000 Hz tone and adjust the audio frequency generator to produce 20% of the rated system deviation.

e) Set the test receiver to measure rms deviation and record the deviation reading as DEVREF

f) Set the audio frequency generator to the desired test frequency between 300 Hz and 3000 Hz.

g) Record the test receiver deviation reading as DEVFREQ

h) Calculate the audio frequency response at the present frequency as follows in Equation (4):

$$\text{audio frequency response} = 20\log_{10}\left(\frac{\text{DEV}_{\text{FREQ}}}{\text{DEV}_{\text{REF}}}\right)$$

i) Repeat step f) through step h) for all the desired test frequencies.

9.4 Deviation From Test Standard

No deviation

9.5 Antenna Connected Construction

Please refer to the description of test mode.

9.6 Test Data

Please refer to the Attachment E.

10. Frequency Tolerance

10.1 Test Standard and Limit

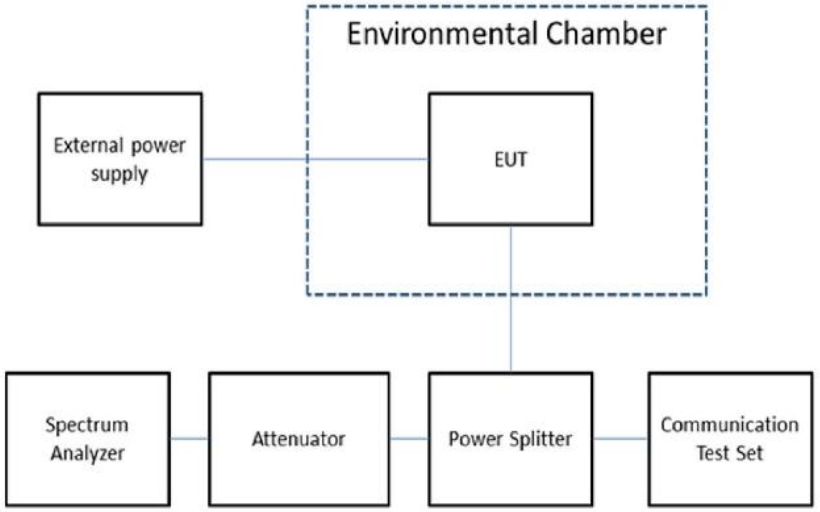
10.1.1 Test Standard

FCC §74.861(e)(4), § 2.1055

10.1.2 Test Limit

The frequency tolerance of the transmitter shall be 0.005 percent.

10.2 Test Setup



10.3 Test Procedure

Frequency stability is a measure of the frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at +20℃ and rated supply voltage.

The operating carrier frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency determining circuit element shall be made subsequent to this initial set-up. Frequency stability is tested:

a) At 10℃ intervals of temperatures between -30℃ and +50℃ at the manufacturer's rated supply voltage, and

b) At +20℃ temperature and +15% supply voltage variations. If a product is specified to operate over a range of input voltage then the -15% variation is applied to the lowermost voltage and the +15% is applied to the uppermost voltage.

During the test all necessary settings, adjustments and control of the EUT have to be performed without disturbing the test environment, i.e., without opening the environmental chamber. The frequency stabilities can be maintained to a lesser temperature range provided that the transmitter is automatically inhibited from operating outside the lesser temperature range. For handheld equipment that is only capable of operating from internal batteries and the supply voltage cannot be varied, the frequency stability tests shall be performed at the nominal battery voltage and the battery end point voltage specified by the manufacturer.

An external supply voltage can be used and set at the internal battery nominal voltage, and again at the battery operating end point voltage which shall be specified by the equipment manufacturer.
If an unmodulated carrier is not available, the mean frequency of a modulated carrier can be obtained by using a frequency counter with gating time set to an appropriately large multiple of bit periods (gating time depending on the required accuracy). Full details on the choice of values shall be included in the test report.

10.4 Deviation From Test Standard

No deviation

10.5 Antenna Connected Construction

Please refer to the description of test mode.

10.6 Test Data

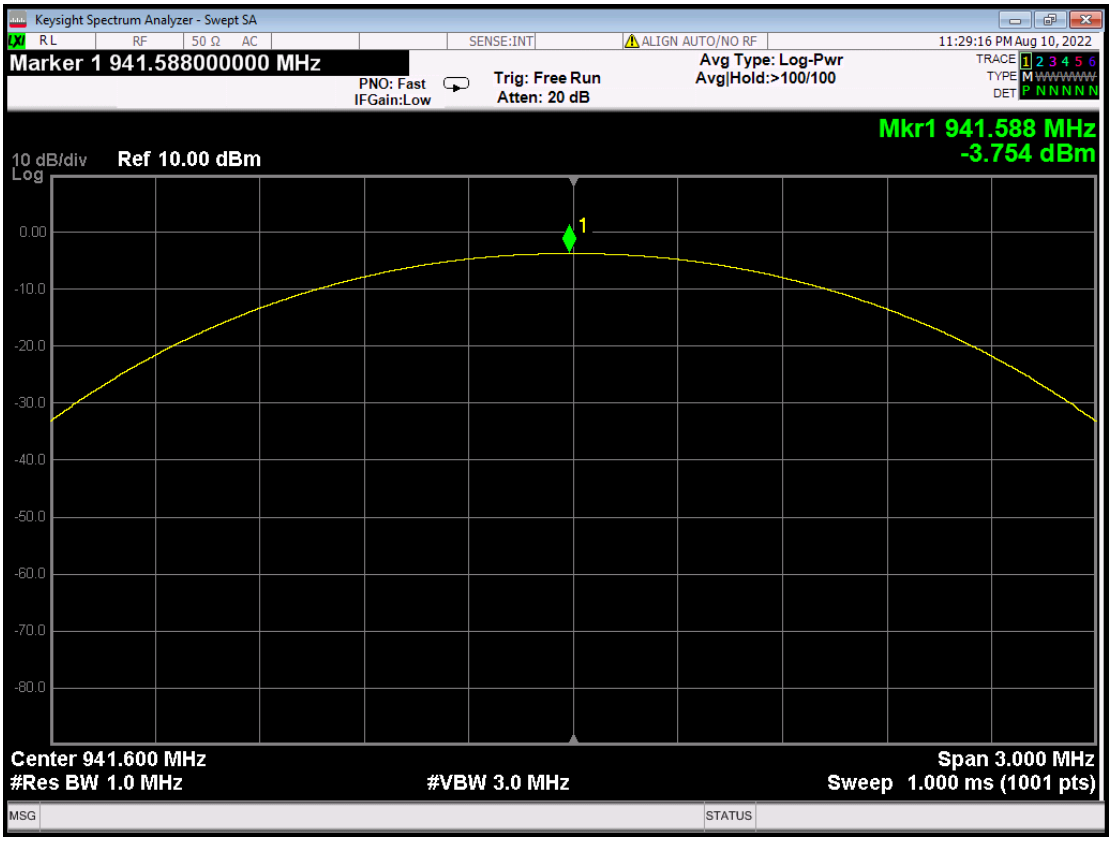
Please refer to the Attachment F.

Attachment A--Maximum Transmitter Power

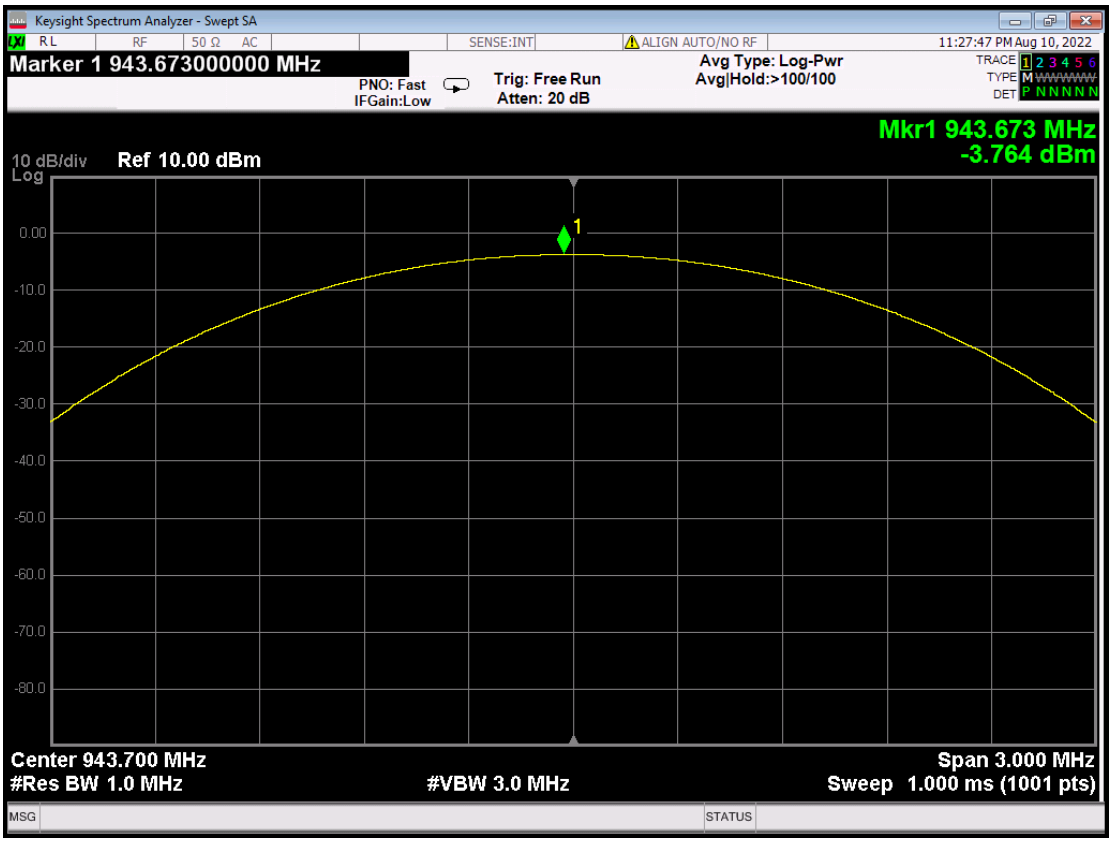
Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	DC 3V		
Test Mode:	TX Mode		

Frequency (MHz)	Test Result (dBm)	Test Result (mW)	Limit (W)	Result
941.6	-3.754	0.421	1	PASS
943.7	-3.764	0.420	1	PASS
945.8	-3.776	0.419	1	PASS

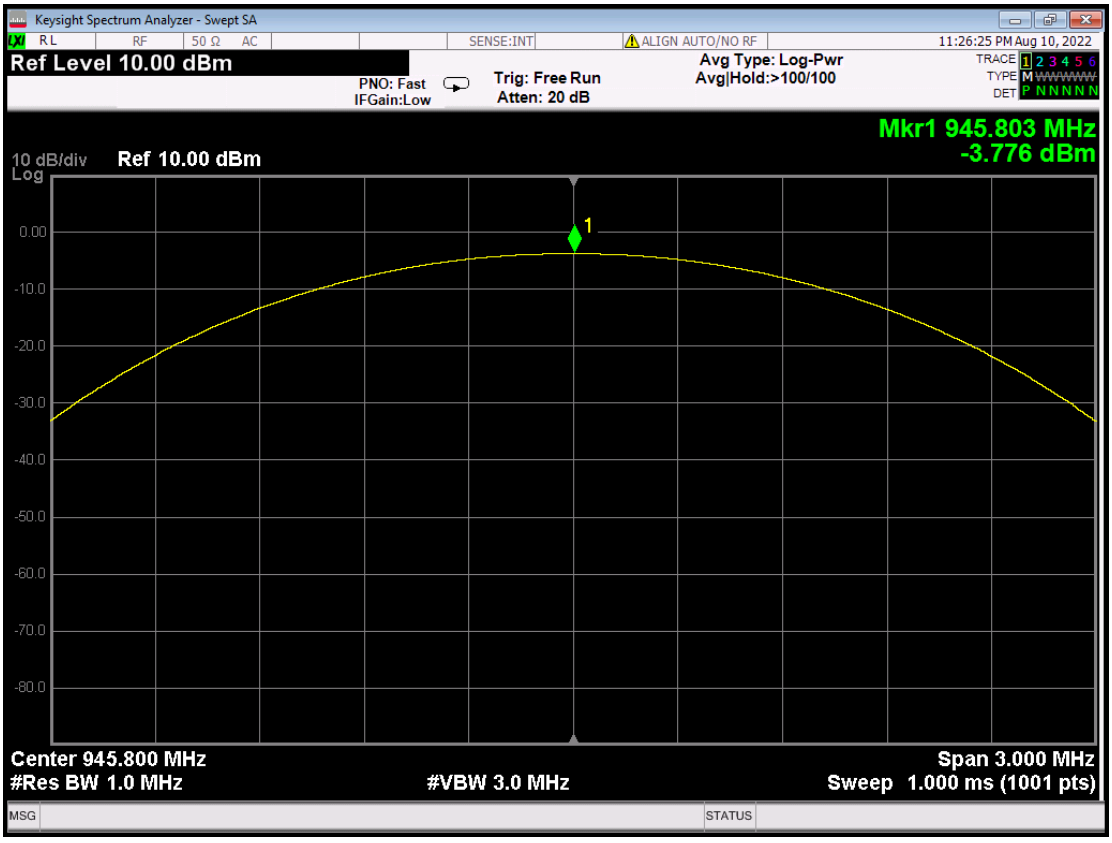
941.6 MHz



943.7 MHz



945.8 MHz

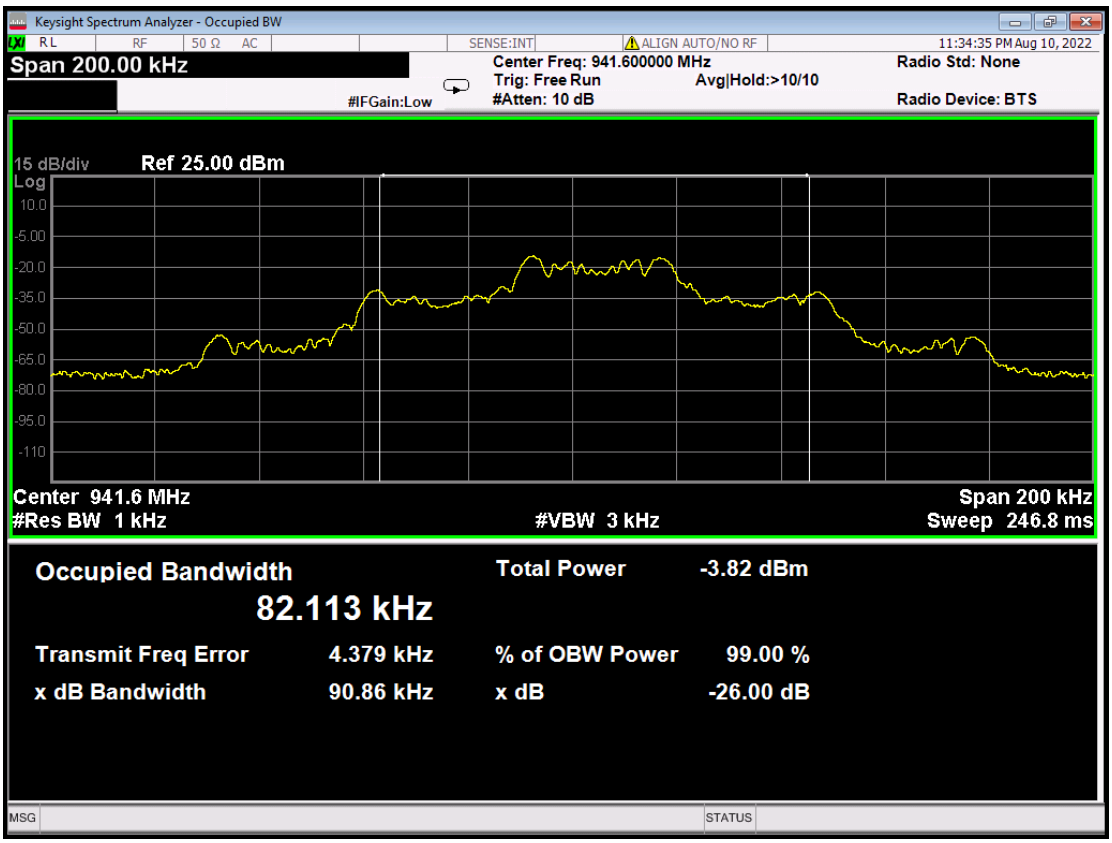


Attachment B--Occupied Bandwidth

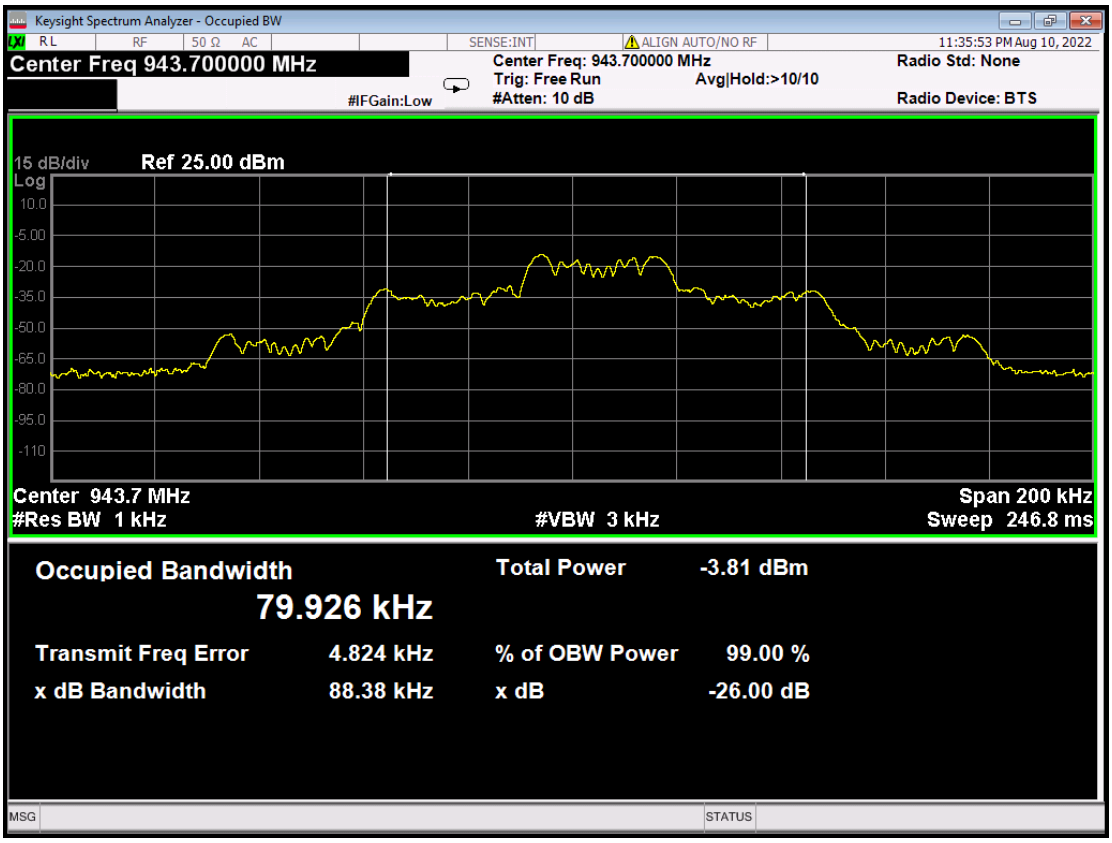
Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	DC 3V		
Test Mode:	TX Mode		

Frequency (MHz)	99% Bandwidth (kHz)	Limit (kHz)
941.6	82.113	/
943.7	79.926	
945.8	87.939	

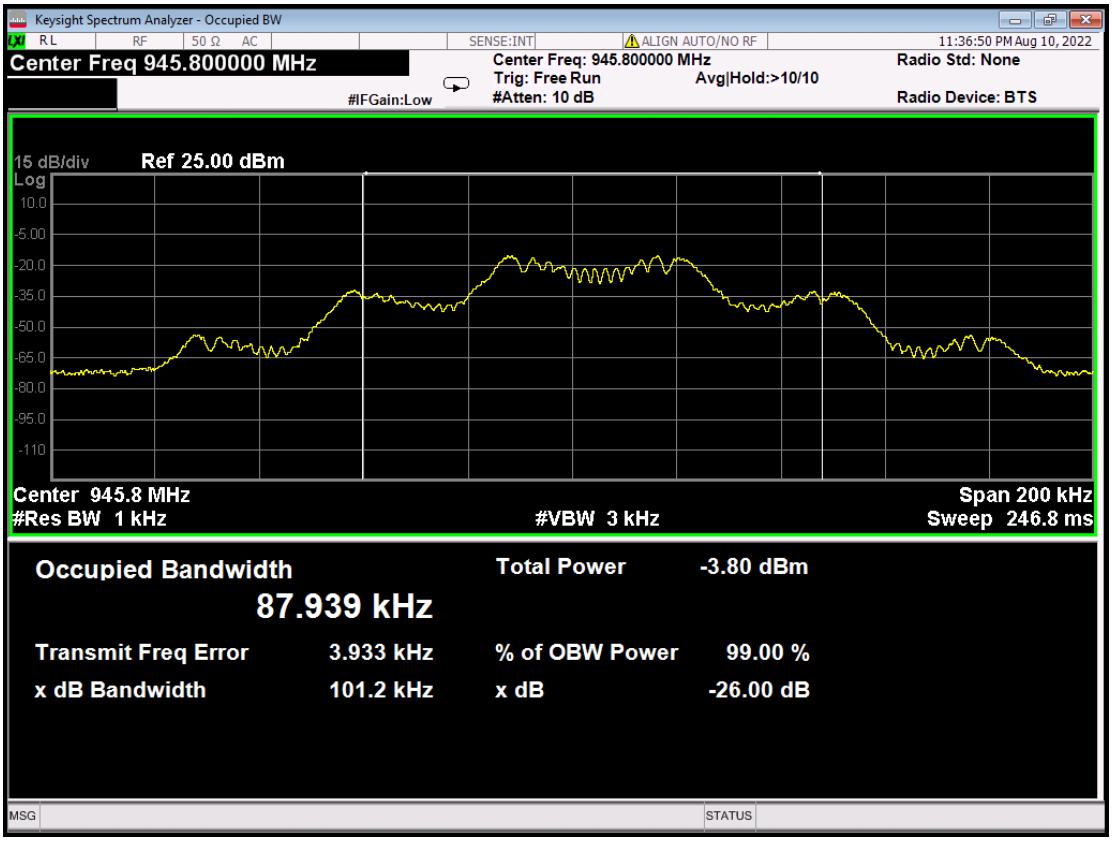
941.6 MHz



943.7 MHz



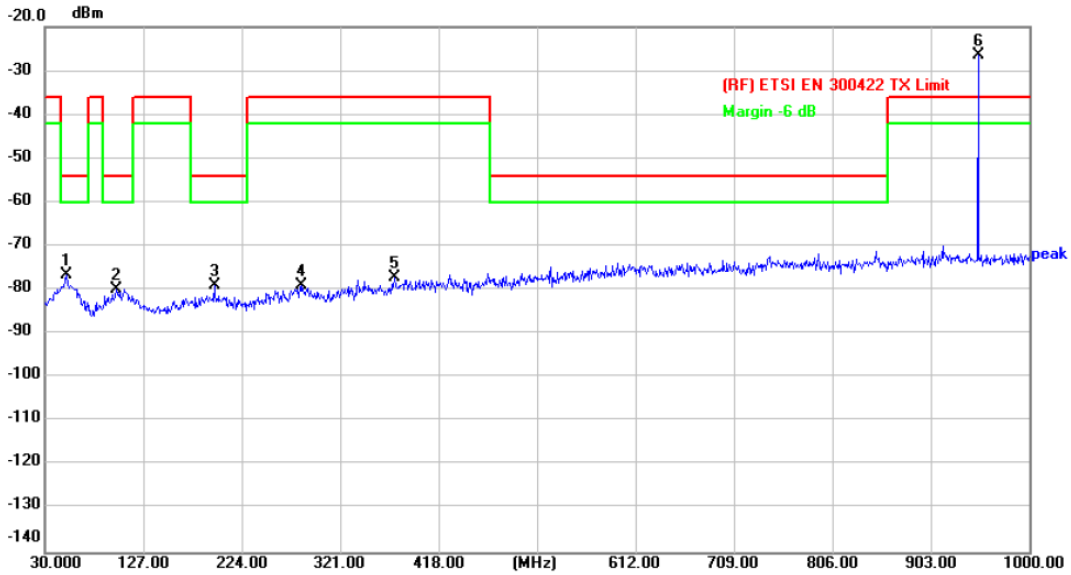
945.8 MHz



Attachment C--Unwanted Emissions Data

---Radiated Unwanted Emissions

Temperature:	23.9℃	**Relative Humidity:**	44%
Test Voltage:	DC 3V		
Ant. Pol.	Horizontal		
Test Mode:	Mode 1		
Remark:	Only worse case is reported.		

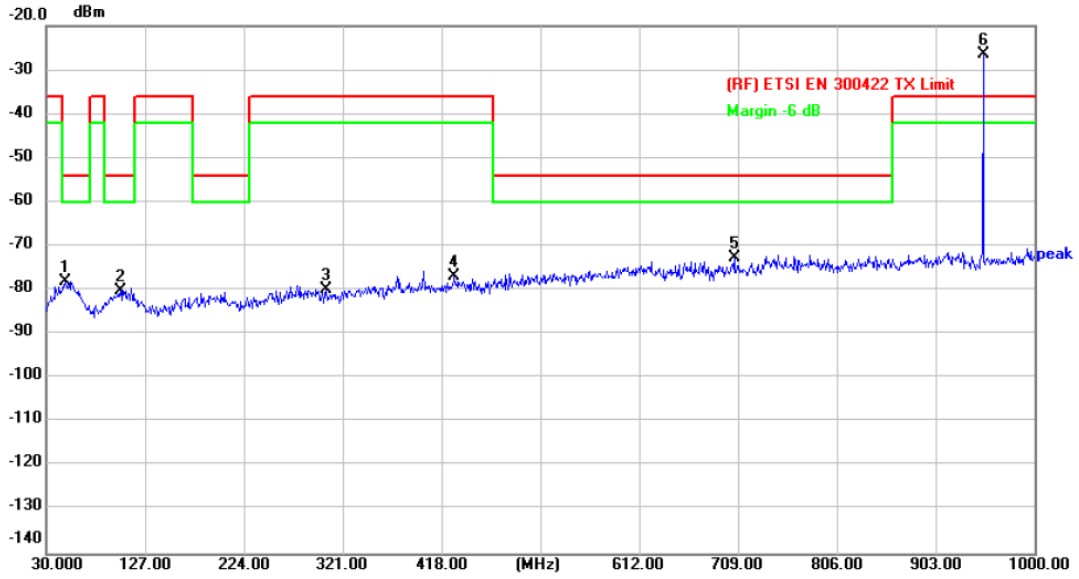


No.	Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1	51.3400	-67.90	-8.77	-76.67	-54.00	-22.67	peak
2	100.8100	-69.61	-10.28	-79.89	-54.00	-25.89	peak
3	196.8400	-68.73	-10.25	-78.98	-54.00	-24.98	peak
4	282.2000	-69.95	-9.08	-79.03	-36.00	-43.03	peak
5	374.3500	-69.55	-7.70	-77.25	-36.00	-41.25	peak
6 *	949.5600	-26.26	-0.30	-26.56	Fundamental Frequency		peak

*:Maximum data x:Over limit !:over margin

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = QuasiPeak (dBμV/m)-Limit QPK(dBμV/m)

Temperature:	23.9℃	Relative Humidity:	44%
Test Voltage:	DC 3V		
Ant. Pol.	Vertical		
Test Mode:	Mode 1		
Remark:	Only worse case is reported.		



No.	Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1	48.4300	-69.10	-8.86	-77.96	-54.00	-23.96	peak
2	102.7500	-69.91	-10.28	-80.19	-54.00	-26.19	peak
3	304.5100	-70.43	-9.51	-79.94	-36.00	-43.94	peak
4	430.6100	-70.32	-6.49	-76.81	-36.00	-40.81	peak
5	705.1200	-70.15	-2.56	-72.71	-54.00	-18.71	peak
6 *	949.5600	-26.27	-0.30	-26.57	Fundamental Frequency		peak

*:Maximum data x:Over limit !:over margin

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = QuasiPeak (dBμV/m)-Limit QPK(dBμV/m)

Above 1GHz

Temperature:	23.2℃	Relative Humidity:	41%
Test Voltage:	DC 3V		
Ant. Pol.	Horizontal		
Test Mode:	TX 941.6 MHz		

No.	Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1 *	2827.000	-41.89	6.55	-35.34	-30.00	-5.34	peak
2	3772.000	-47.18	9.61	-37.57	-30.00	-7.57	peak

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)
4. The tests evaluated1-26.5GHz,The testing has been conformed to the 10th harmonic of the highest fundamental frequency.
5. No report for the emission which more than 20dB below the prescribed limit.

Temperature:	23.2℃	Relative Humidity:	41%
Test Voltage:	DC 3V		
Ant. Pol.	Vertical		
Test Mode:	TX 941.6 MHz		

No.	Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1 *	2827.000	-42.03	6.55	-35.48	-30.00	-5.48	peak
2	3772.000	-48.04	9.61	-38.43	-30.00	-8.43	peak

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)
4. The tests evaluated1-26.5GHz,The testing has been conformed to the 10th harmonic of the highest fundamental frequency.
5. No report for the emission which more than 20dB below the prescribed limit.

Temperature:	23.2℃	Relative Humidity:	41%
Test Voltage:	DC 3V		
Ant. Pol.	Horizontal		
Test Mode:	TX 943.7 MHz		

No.	Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1	4717.000	-55.53	12.32	-43.21	-30.00	-13.21	peak
2 *	5662.000	-56.59	13.42	-43.17	-30.00	-13.17	peak

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)
4. The tests evaluated1-26.5GHz,The testing has been conformed to the 10th harmonic of the highest fundamental frequency.
5. No report for the emission which more than 20dB below the prescribed limit.

Temperature:	23.2℃	Relative Humidity:	41%
Test Voltage:	DC 3V		
Ant. Pol.	Vertical		
Test Mode:	TX 943.7 MHz		

No.	Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1 *	3772.000	-47.59	9.61	-37.98	-30.00	-7.98	peak
2	4717.000	-55.28	12.32	-42.96	-30.00	-12.96	peak

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)
4. The tests evaluated1-26.5GHz,The testing has been conformed to the 10th harmonic of the highest fundamental frequency.
5. No report for the emission which more than 20dB below the prescribed limit.

Temperature:	23.2℃	Relative Humidity:	41%
Test Voltage:	DC 3V		
Ant. Pol.	Horizontal		
Test Mode:	TX 945.8 MHz		

No.	Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1	4303.000	-56.54	11.15	-45.39	-30.00	-15.39	peak
2 *	5275.000	-57.57	13.25	-44.32	-30.00	-14.32	peak

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)
4. The tests evaluated1-26.5GHz,The testing has been conformed to the 10th harmonic of the highest fundamental frequency.
5. No report for the emission which more than 20dB below the prescribed limit.

Temperature:	23.2℃	Relative Humidity:	41%
Test Voltage:	DC 3V		
Ant. Pol.	Vertical		
Test Mode:	TX 945.8 MHz		

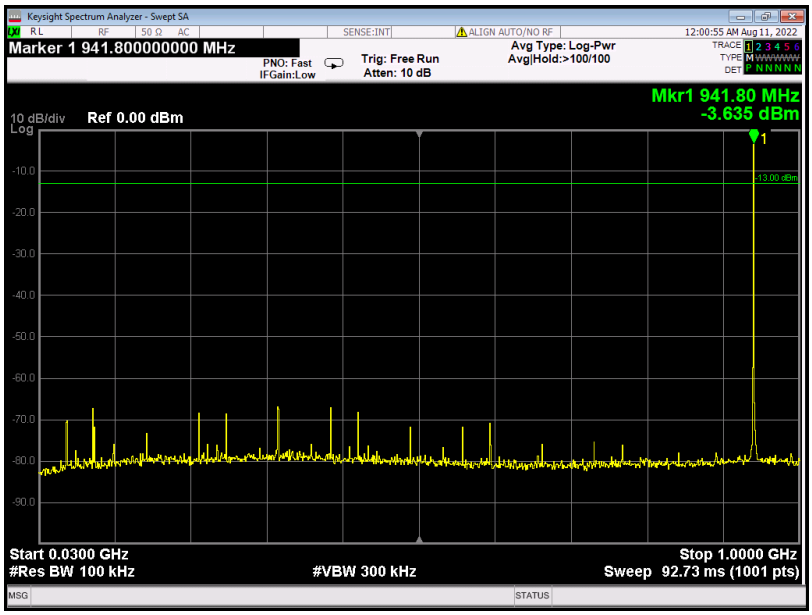
No.	Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1	5167.000	-56.98	13.13	-43.85	-30.00	-13.85	peak
2 *	5941.000	-57.73	14.29	-43.44	-30.00	-13.44	peak

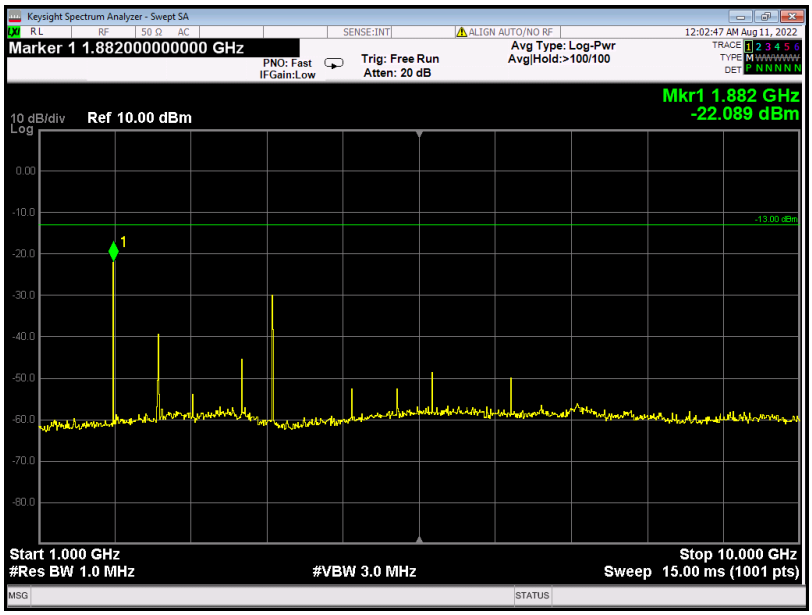
Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. Peak/AVG (dBμV/m)= Corr. (dB/m)+ Read Level (dBμV)
3. Margin (dB) = Peak/AVG (dBμV/m)-Limit PK/AVG(dBμV/m)
4. The tests evaluated1-26.5GHz,The testing has been conformed to the 10th harmonic of the highest fundamental frequency.
5. No report for the emission which more than 20dB below the prescribed limit.

--- Conducted Unwanted Emissions

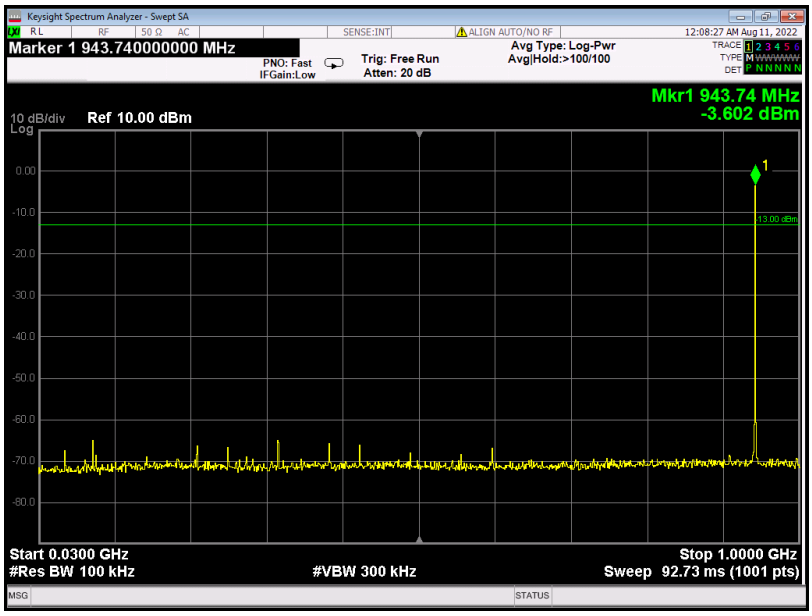
Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	DC 3V		
Test Mode:	TX Mode		

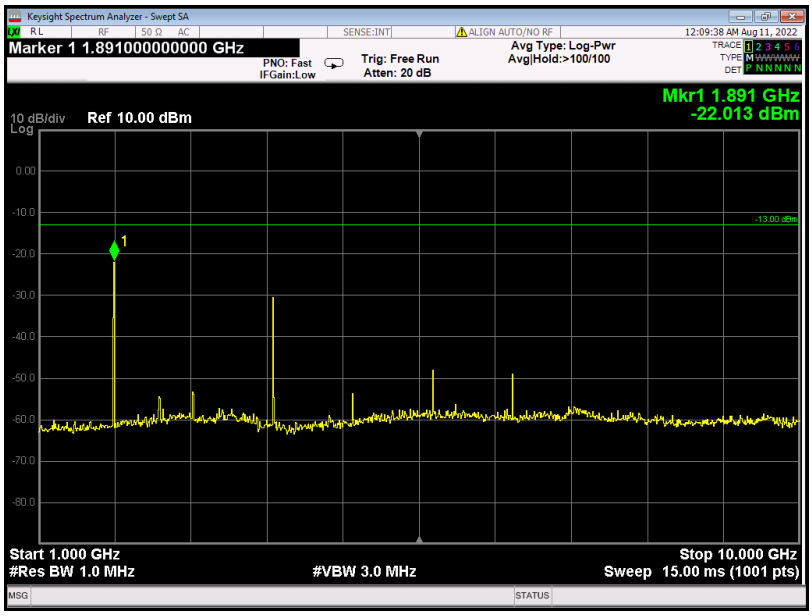
941.6 MHz



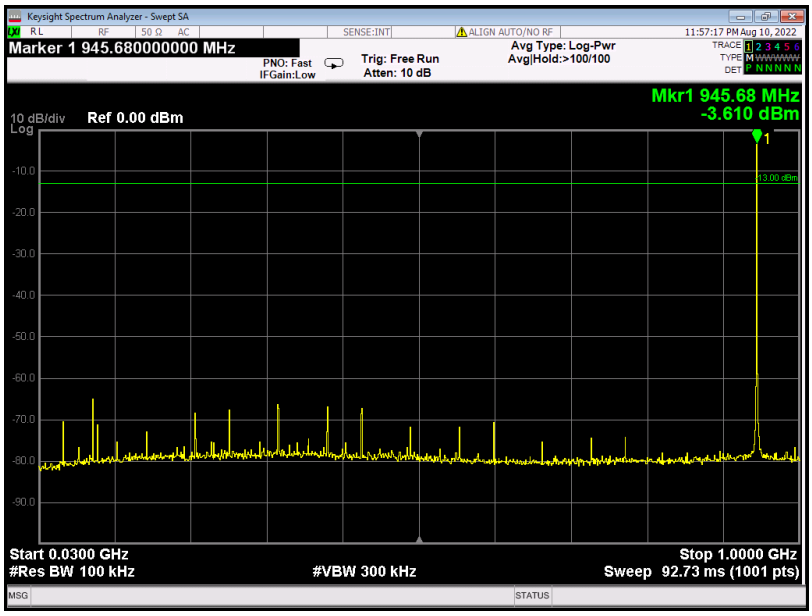


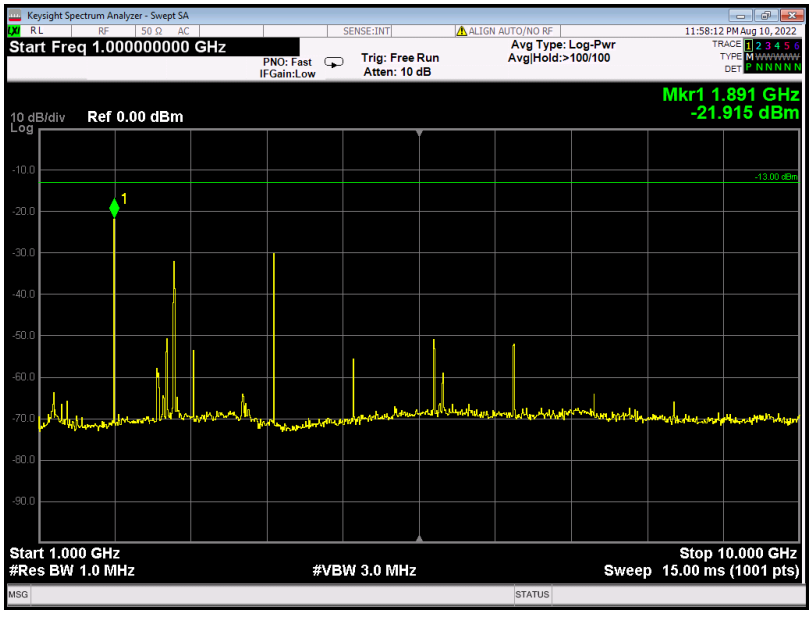
943.7 MHz


Keysight Spectrum Analyzer - Swept SA
Marker 1 943.740000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:08:27 AM Aug 11, 2022
Mkr1 943.74 MHz
-3.602 dBm
10 dB/div
Log
Ref 10.00 dBm
-13.00 dBm
Start 0.0300 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 1.0000 GHz
Sweep 92.73 ms (1001 pts)


Keysight Spectrum Analyzer - Swept SA
Marker 1 1.891000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:09:38 AM Aug 11, 2022
Mkr1 1.891 GHz
-22.013 dBm
10 dB/div
Log
Ref 10.00 dBm
-13.00 dBm
Start 1.000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 10.000 GHz
Sweep 15.00 ms (1001 pts)

945.8 MHz

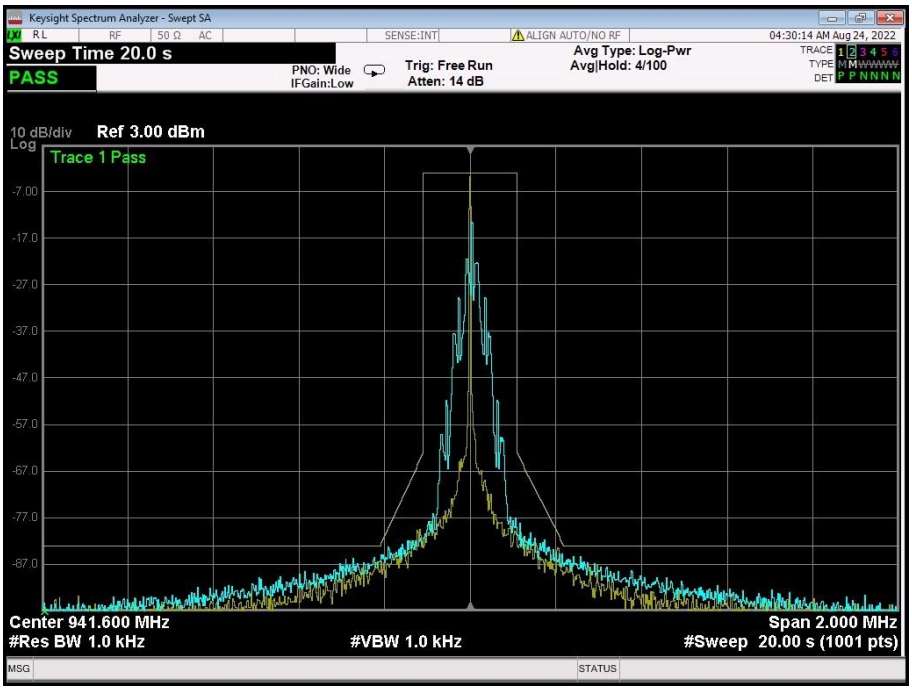

Keysight Spectrum Analyzer - Swept SA
Marker 1 945.680000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:57:17 PM Aug 10, 2022
Mkr1 945.68 MHz
-3.610 dBm
10 dB/div
Log
Ref 0.00 dBm
-13.00 dBm
Start 0.0300 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 1.0000 GHz
Sweep 92.73 ms (1001 pts)


Keysight Spectrum Analyzer - Swept SA
Start Freq 1.000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:58:12 PM Aug 10, 2022
Mkr1 1.891 GHz
-21.915 dBm
10 dB/div
Log
Ref 0.00 dBm
-13.00 dBm
Start 1.000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 10.000 GHz
Sweep 15.00 ms (1001 pts)

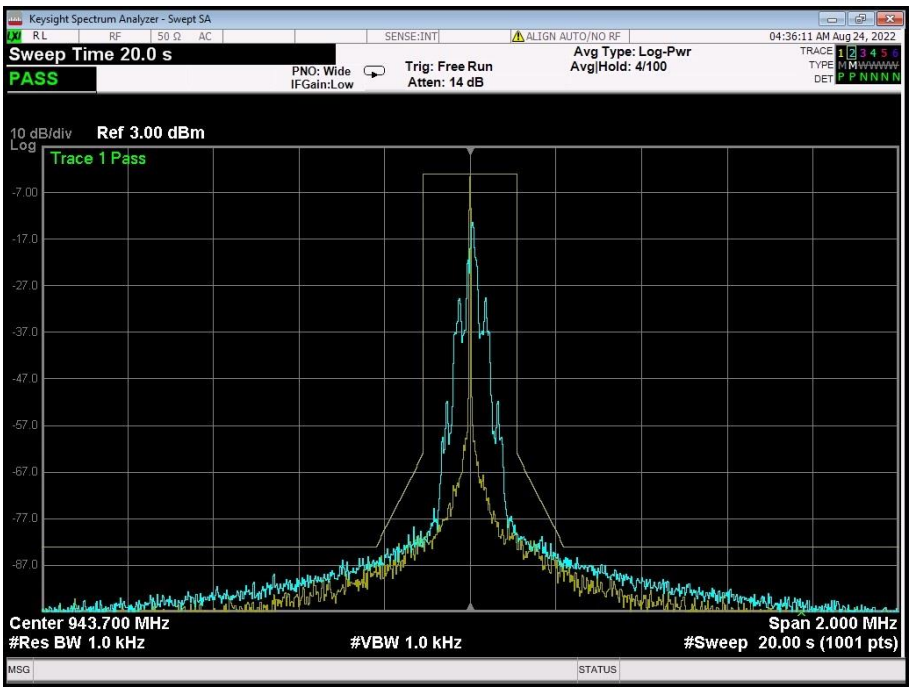
Attachment D-- Emission Mask (Necessary bandwidth)

Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	DC 3V		
Test Mode:	TX Mode		

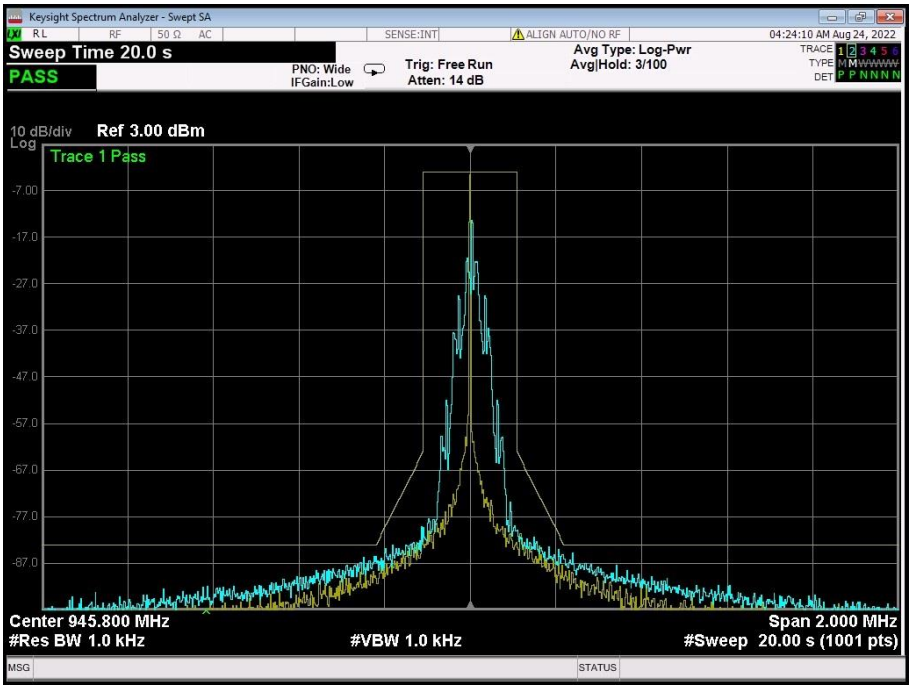
941.6 MHz



943.7 MHz



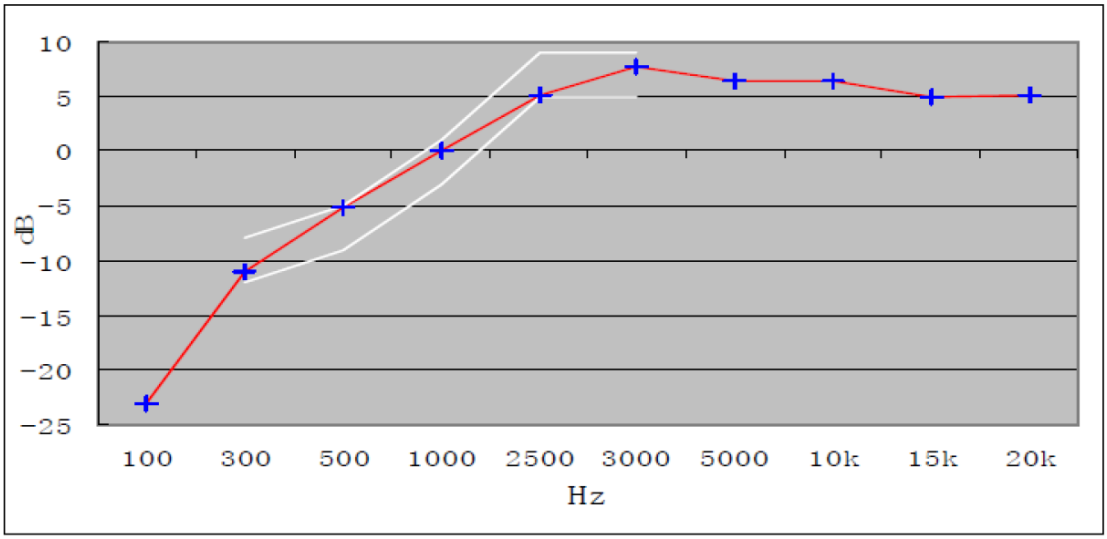
945.8 MHz


Keysight Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO/NO RF
04:24:10 AM Aug 24, 2022
Sweep Time 20.0 s
PASS
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 14 dB
Avg Type: Log-Pwr
Avg|Hold: 3/100
TRACE 1 2 3 4 5
TYPE M WWWWW
DET P P N N N
10 dB/div
Log
Ref 3.00 dBm
Trace 1 Pass
-7.00
-17.0
-27.0
-37.0
-47.0
-57.0
-67.0
-77.0
-87.0
Center 945.800 MHz
#Res BW 1.0 kHz
#VBW 1.0 kHz
Span 2.000 MHz
#Sweep 20.00 s (1001 pts)
MSG
STATUS

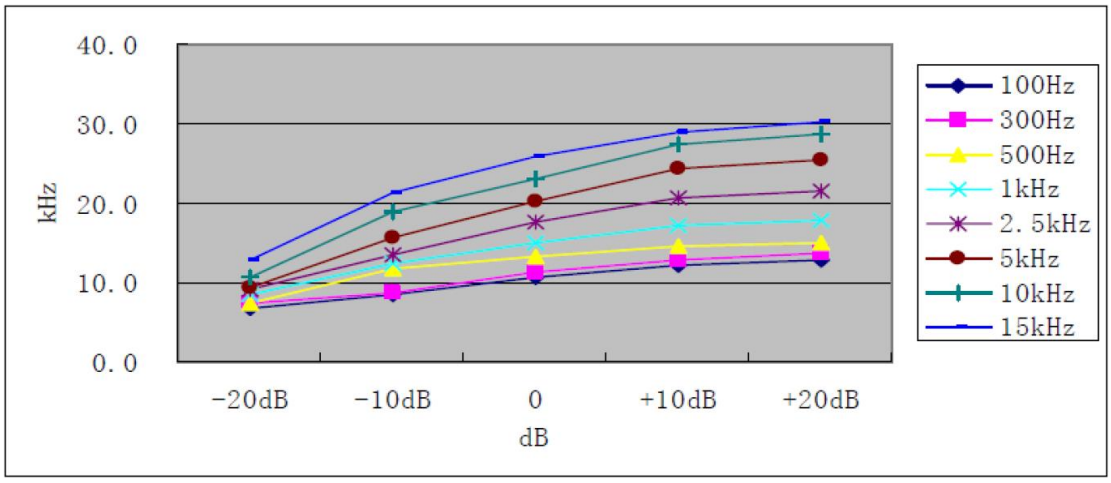
Attachment E--Modulation Characteristics

Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	DC 3V		
Test Mode:	TX Mode		

Modulation limiting test



Audio frequency response test



Attachment F--Frequency Tolerance

Test Frequency:	943.7MHz				
Supply Voltage	☐AC ☒DC				
Temperature (℃)	Test Voltage (V)	Frequency (MHz)	Deviation (kHz)	Limit (kHz)	Result
-30	3.7	943.673	0.027	±47.185	Pass
-20	3.7	943.673	0.027	±47.185	Pass
-10	3.7	943.673	0.027	±47.185	Pass
0	3.7	943.673	0.027	±47.185	Pass
10	3.7	943.673	0.027	±47.185	Pass
20	*3.7*	943.673	0.027	±47.185	Pass
20	*4.2*	943.673	0.027	±47.185	Pass
20	*3.3*	943.673	0.027	±47.185	Pass
30	3.7	943.673	0.027	±47.185	Pass
40	3.7	943.673	0.027	±47.185	Pass
50	3.7	943.673	0.027	±47.185	Pass
Note: The frequency tolerance of the transmitter shall be 0.005 percent. So the limit=951*0.005%(MHz)=0.047185MHz=47.185KHz					

-----END OF REPORT------