

**Shenzhen Global Test Service Co.,Ltd.**

No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road,  
Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

**FCC PART 15 SUBPART C TEST REPORT****FCC CFR 47 PART 74****Report Reference No.** : GTS20200306005-1-6**FCC ID.** : 2AVV4-001

Compiled by

( position+printed name+signature) : File administrators Peter Xiao

Supervised by

( position+printed name+signature) : Test Engineer Moon Tan

Approved by

( position+printed name+signature) : Manager Simon Hu

Date of issue : Mar. 27, 2020

**Representative Laboratory Name** : **Shenzhen Global Test Service Co.,Ltd.****Address** : No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong**Applicant's name** : **Shenzhen Yilaisi Electronic Technology Co., Ltd.****Address** : 2nd Floor, 2 Building, forth industrial estate, Shanghenglang, Longhua district, Shenzhen, Guangdong, China**Test specification** :

Standard : FCC CFR 47 PART 74

TRF Originator : Shenzhen Global Test Service Co.,Ltd.

Master TRF : Dated 2014-12

**Shenzhen Global Test Service Co.,Ltd. All rights reserved.**

This publication may be reproduced in whole or in part for non-commercial purposes as long as the Shenzhen Global Test Service Co.,Ltd. is acknowledged as copyright owner and source of the material. Shenzhen Global Test Service Co.,Ltd. takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.

**Test item description** : **UHF Wireless Microphone System**

Trade Mark : N/A

Manufacturer : Shenzhen Yilaisi Electronic Technology Co., Ltd.

Model/Type reference : ALLAP-W1

Listed Models : UWM-2, WM1, WM2, WM3, UWM1, UWM2, UWM3, UWM4, UWM5, UWM6, UWM7, UWM8, UWM9, UWM1Pro, UWM2Pro, UWM3Pro, UWM4Pro, UWM5Pro, UWM6Pro

Modulation Type : FM

Operation Frequency : From 538.0-557.6MHz and 566.4-586.0MHz

Hardware Version : V1.5

Software Version : V1.3

Rating : DC 3.0V to 2\*AA or  
DC 5.0V /0.2A to AdapterResult : **PASS**

**TEST REPORT**

|                                                    |                                |
|----------------------------------------------------|--------------------------------|
| <b>Test Report No. :</b> <b>GTS20200306005-1-6</b> | Mar. 27, 2020<br>Date of issue |
|----------------------------------------------------|--------------------------------|

Equipment under Test : UHF Wireless Microphone System

Model /Type : ALLAP-W1

Listed Models : UWM-2, WM1, WM2, WM3, UWM1, UWM2, UWM3, UWM4, UWM5, UWM6, UWM7, UWM8, UWM9, UWM1Pro, UWM2Pro, UWM3Pro, UWM4Pro, UWM5Pro, UWM6Pro

**Applicant** : **Shenzhen Yilaisi Electronic Technology Co., Ltd.**

Address : 2nd Floor, 2 Building, forth industrial estate, Shanghenglang, Longhua district, Shenzhen, Guangdong, China

**Manufacturer** : **Shenzhen Yilaisi Electronic Technology Co., Ltd.**

Address : 2nd Floor, 2 Building, forth industrial estate, Shanghenglang, Longhua district, Shenzhen, Guangdong, China

|                     |             |
|---------------------|-------------|
| <b>Test Result:</b> | <b>PASS</b> |
|---------------------|-------------|

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

## Contents

|                                                                  |           |
|------------------------------------------------------------------|-----------|
| <b>1. TEST STANDARDS .....</b>                                   | <b>4</b>  |
| <b>2. SUMMARY .....</b>                                          | <b>5</b>  |
| 2.1. General Remarks .....                                       | 5         |
| 2.2. Product Description .....                                   | 5         |
| 2.3. Equipment Under Test .....                                  | 5         |
| 2.4. Short description of the Equipment under Test (EUT) .....   | 5         |
| 2.5. EUT operation mode .....                                    | 6         |
| 2.6. Block Diagram of Test Setup .....                           | 6         |
| 2.7. Related Submittal(s) / Grant (s) .....                      | 6         |
| 2.8. Special Accessories .....                                   | 6         |
| 2.9. Modifications .....                                         | 6         |
| <b>3. TEST ENVIRONMENT .....</b>                                 | <b>7</b>  |
| 3.1. Address of the test laboratory .....                        | 7         |
| 3.2. Test Facility .....                                         | 7         |
| 3.3. Environmental conditions .....                              | 7         |
| 3.4. Statement of the measurement uncertainty .....              | 7         |
| 3.5. Summary of measurement results .....                        | 8         |
| 3.6. Equipments Used during the Test.....                        | 9         |
| <b>4. TEST CONDITIONS AND RESULTS .....</b>                      | <b>10</b> |
| 4.1. AC Power Conducted Emission .....                           | 10        |
| 4.2. Transmitter unwanted emissions(radiated or conducted) ..... | 12        |
| 4.3. Maximum Peak Output Power .....                             | 20        |
| 4.4. Occupied bandwidth and Emission Mask .....                  | 24        |
| 4.5. Frequency Stability .....                                   | 27        |
| 4.6. Modulation Characteristics.....                             | 34        |
| 4.7. Necessary bandwidth (BN) for analogue systems .....         | 36        |
| <b>5. TEST SETUP PHOTOS OF THE EUT .....</b>                     | <b>41</b> |
| <b>6. EXTERNAL AND INTERNAL PHOTOS OF THE EUT .....</b>          | <b>43</b> |
| 6.1. External photos of the EUT .....                            | 43        |
| 6.2. Internal photos of the EUT .....                            | 46        |

## **1. TEST STANDARDS**

The tests were performed according to following standards:

[FCC Rules Part 74](#): Experimental radio, auxiliary, special broadcast and other program distributional services.

[ANSI C63.4-2014](#): American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

[KDB 935210 D05](#): KDB Publication 935210 D05 Measurements guidance for industrial and non-consumer signal booster, repeater, and amplifier devices

## 2. SUMMARY

### 2.1. General Remarks

|                                |   |               |
|--------------------------------|---|---------------|
| Date of receipt of test sample | : | Mar. 10, 2020 |
|                                |   |               |
| Testing commenced on           | : | Mar. 10, 2020 |
|                                |   |               |
| Testing concluded on           | : | Mar. 27, 2020 |

### 2.2. Product Description

|                                             |                                                                                                                                  |
|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Product Name                                | UHF Wireless Microphone System                                                                                                   |
| Trade Mark                                  | N/A                                                                                                                              |
| Model/Type reference                        | ALLAP-W1                                                                                                                         |
| List Models                                 | UWM-2, WM1, WM2, WM3, UWM1, UWM2, UWM3, UWM4, UWM5, UWM6, UWM7, UWM8, UWM9, UWM1Pro, UWM2Pro, UWM3Pro, UWM4Pro, UWM5Pro, UWM6Pro |
| Model Declaration                           | PCB board, structure and internal of these model(s) are the same, So no additional models were tested.                           |
| Power supply:                               | DC 3.0V to 2*AA or<br>DC 5.0V /0.2A to Adapter                                                                                   |
| UHF Wireless Microphone System(Transmitter) |                                                                                                                                  |
| Frequency Range                             | 538.0-557.6MHz and 566.4-586.0MHz                                                                                                |
| Channel No.                                 | 50 Channels form 538.0-557.6MHz<br>50 Channels form 566.4-586.0MHz                                                               |
| Modulation Type                             | FM                                                                                                                               |
| Rated Power                                 | 15mW/10mW                                                                                                                        |
| Antenna Description                         | External Antenna; 0dBi(Max.)                                                                                                     |

### 2.3. Equipment Under Test

#### Power supply system utilised

|                      |   |                                                                   |                                   |
|----------------------|---|-------------------------------------------------------------------|-----------------------------------|
| Power supply voltage | : | <input type="radio"/> 230V / 50 Hz                                | <input type="radio"/> 120V / 60Hz |
|                      |   | <input type="radio"/> 12 V DC                                     | <input type="radio"/> 24 V DC     |
|                      |   | <input checked="" type="radio"/> Other (specified in blank below) |                                   |

DC 3.0V from battery

### 2.4. Short description of the Equipment under Test (EUT)

This is a UHF Wireless Microphone System.

For more details, refer to the user's manual of the EUT.

## 2.5. EUT operation mode

The EUT has been tested under typical operating condition.

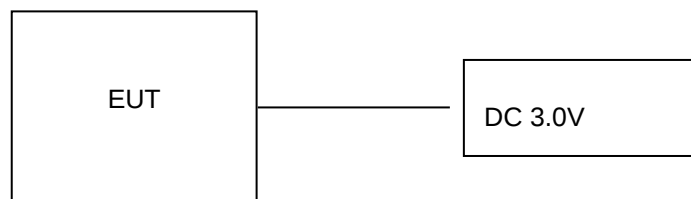
\*\*\*Note: Only recorded the worst case in this report.

Channel List & Frequency:

| Channel A |                |         |                |
|-----------|----------------|---------|----------------|
| Channel   | Frequency(MHz) | Channel | Frequency(MHz) |
| 01        | 538.0          | 26      | 548.0          |
| 02        | 538.4          | 27      | 548.4          |
| 03        | 538.8          | 28      | 548.8          |
| --        | --             | --      | --             |
| --        | --             | --      | --             |
| --        | --             | --      | --             |
| 24        | 547.2          | 49      | 557.2          |
| 25        | 547.6          | 50      | 557.6          |

| Channel B |                |         |                |
|-----------|----------------|---------|----------------|
| Channel   | Frequency(MHz) | Channel | Frequency(MHz) |
| 01        | 566.4          | 26      | 576.4          |
| 02        | 566.8          | 27      | 576.8          |
| 03        | 567.2          | 28      | 577.2          |
| --        | --             | --      | --             |
| --        | --             | --      | --             |
| --        | --             | --      | --             |
| 24        | 575.6          | 49      | 585.6          |
| 25        | 576.0          | 50      | 586.0          |

## 2.6. Block Diagram of Test Setup



## 2.7. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: 2AVV4-001** filing to comply with Section 861 of the FCC Part 74.

## 2.8. Special Accessories

| Manufacturer | Description | Model        | Serial Number | Certificate |
|--------------|-------------|--------------|---------------|-------------|
| SKF          | Adapter     | MR-0501000EU | --            | SDOC        |

The adapter is provided by the laboratory.

## 2.9. Modifications

No modifications were implemented to meet testing criteria.

### 3. TEST ENVIRONMENT

#### 3.1. Address of the test laboratory

**Shenzhen Global Test Service Co.,Ltd.**

No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

#### 3.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

CNAS (No. CNAS L8169)

Shenzhen Global Test Service Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2019 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA (Certificate No. 4758.01)

Shenzhen Global Test Service Co., Ltd. has been assessed by the American Association for Laboratory Accreditation (A2LA). Certificate No. 4758.01.

#### 3.3. Environmental conditions

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

|                       |              |
|-----------------------|--------------|
| Temperature:          | 15-35 ° C    |
|                       |              |
| Humidity:             | 30-60 %      |
|                       |              |
| Atmospheric pressure: | 950-1050mbar |

#### 3.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen Global Test Service Co.,Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen GTS laboratory is reported:

| Test                  | Range      | Measurement Uncertainty | Notes |
|-----------------------|------------|-------------------------|-------|
| Radiated Emission     | 30~1000MHz | 4.10 dB                 | (1)   |
| Radiated Emission     | 1~18GHz    | 4.32 dB                 | (1)   |
| Radiated Emission     | 18-40GHz   | 5.54 dB                 | (1)   |
| Conducted Disturbance | 0.15~30MHz | 3.12 dB                 | (1)   |

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

### 3.5. Summary of measurement results

| Applied Standard: FCC Part 74                |                                                       |           |
|----------------------------------------------|-------------------------------------------------------|-----------|
| FCC Rules                                    | Description of Test                                   | Result    |
| FCC Part 74.861(e)(1)(ii)<br>FCC Part 2.1046 | Maximum Conducted Output Power                        | Compliant |
| FCC Part 74.861 (e)(5)<br>FCC Part 2.1049    | Occupied Bandwidth                                    | Compliant |
| FCC Part 74.861 (e)(4)<br>FCC Part 2.1055    | Frequency error                                       | Compliant |
| FCC Part 74.861(e)(6)<br>FCC Part 2.1053     | Transmitter unwanted emissions(radiated or conducted) | Compliant |
| FCC Part 2.1049<br>FCC Part 2.1047           | Modulation characteristic                             | Compliant |
| FCC Part 74.861 (e)(7)<br>FCC Part 2.1049    | Necessary bandwidth (BN) for analogue systems         | Compliant |
| §15.107(a)<br>§15.207                        | Conducted Emission                                    | Compliant |

Remark:

1. The measurement uncertainty is not included in the test result.
2. NA = Not Applicable; NP = Not Performed
3. We tested all test mode and recorded worst case in report

### 3.6. Equipments Used during the Test

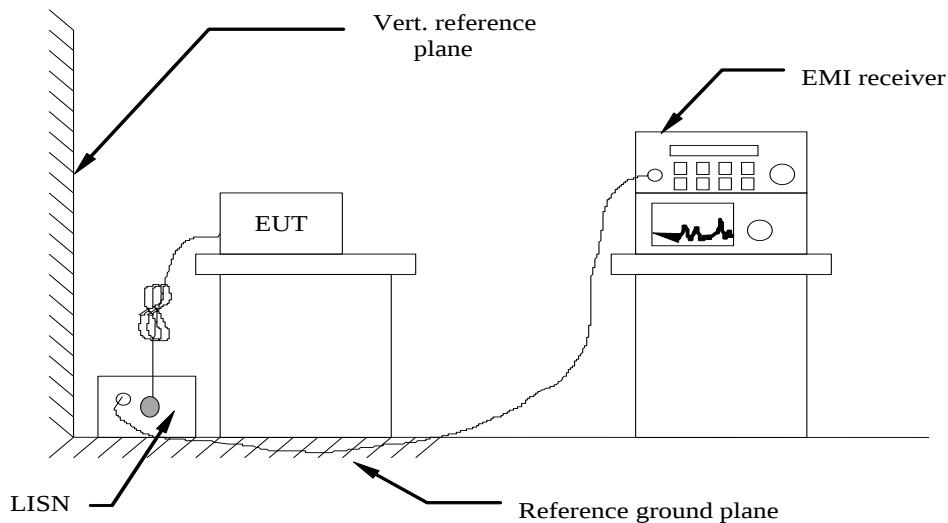
| Test Equipment             | Manufacturer                      | Model No.             | Serial No.      | Calibration Date | Calibration Due Date |
|----------------------------|-----------------------------------|-----------------------|-----------------|------------------|----------------------|
| LISN                       | R&S                               | ENV216                | 3560.6550.08    | 2019/09/20       | 2020/09/19           |
| LISN                       | R&S                               | ESH2-Z5               | 893606/008      | 2019/09/20       | 2020/09/19           |
| EMI Test Receiver          | R&S                               | ESPI3                 | 101841-cd       | 2019/09/20       | 2020/09/19           |
| EMI Test Receiver          | R&S                               | ESCI7                 | 101102          | 2019/09/20       | 2020/09/19           |
| Spectrum Analyzer          | Agilent                           | N9020A                | MY48010425      | 2019/09/20       | 2020/09/19           |
| Spectrum Analyzer          | R&S                               | FSV40                 | 100019          | 2019/09/20       | 2020/09/19           |
| Vector Signal generator    | Agilent                           | N5181A                | MY49060502      | 2019/09/20       | 2020/09/19           |
| Signal generator           | Agilent                           | E4421B                | 3610AO1069      | 2019/09/20       | 2020/09/19           |
| Climate Chamber            | ESPEC                             | EL-10KA               | A20120523       | 2019/09/20       | 2020/09/19           |
| Controller                 | EM Electronics                    | Controller EM 1000    | N/A             | N/A              | N/A                  |
| Horn Antenna               | Schwarzbeck                       | BBHA 9120D            | 01622           | 2019/09/23       | 2020/09/22           |
| Active Loop Antenna        | Beijing Da Ze Technology Co.,Ltd. | ZN30900C              | 15006           | 2019/10/12       | 2020/10/11           |
| Bilog Antenna              | Schwarzbeck                       | VULB9163              | 000976          | 2019/05/26       | 2020/05/25           |
| Broadband Horn Antenna     | SCHWARZBECK                       | BBHA 9170             | 791             | 2019/09/20       | 2020/09/19           |
| Amplifier                  | Schwarzbeck                       | BBV 9743              | #202            | 2019/09/20       | 2020/09/19           |
| Amplifier                  | Schwarzbeck                       | BBV9179               | 9719-025        | 2019/09/20       | 2020/09/19           |
| Amplifier                  | EMCI                              | EMC051845B            | 980355          | 2019/09/20       | 2020/09/19           |
| Temperature/Humidity Meter | Gangxing                          | CTH-608               | 02              | 2019/09/20       | 2020/09/19           |
| High-Pass Filter           | K&L                               | 9SH10-2700/X12750-O/O | KL142031        | 2019/09/20       | 2020/09/19           |
| High-Pass Filter           | K&L                               | 41H10-1375/U12750-O/O | KL142032        | 2019/09/20       | 2020/09/19           |
| RF Cable(below 1GHz)       | HUBER+SUHNER                      | RG214                 | RE01            | 2019/09/20       | 2020/09/19           |
| RF Cable(above 1GHz)       | HUBER+SUHNER                      | RG214                 | RE02            | 2019/09/20       | 2020/09/19           |
| Data acquisition card      | Agilent                           | U2531A                | TW53323507      | 2019/09/20       | 2020/09/19           |
| Power Sensor               | Agilent                           | U2021XA               | MY5365004       | 2019/09/20       | 2020/09/19           |
| Test Control Unit          | Tonscend                          | JS0806-1              | 178060067       | 2019/06/20       | 2020/06/19           |
| Automated filter bank      | Tonscend                          | JS0806-F              | 19F8060177      | 2019/06/20       | 2020/06/19           |
| EMI Test Software          | Tonscend                          | JS1120-1              | Ver 2.6.8.0518  | /                | /                    |
| EMI Test Software          | Tonscend                          | JS1120-3              | Ver 2.5.77.0418 | /                | /                    |
| EMI Test Software          | Tonscend                          | JS32-CE               | Ver 2.5         | /                | /                    |
| EMI Test Software          | Tonscend                          | JS32-RE               | Ver 2.5.1.8     | /                | /                    |

Note: The Cal.Interval was one year.

## 4. TEST CONDITIONS AND RESULTS

### 4.1. AC Power Conducted Emission

#### TEST CONFIGURATION



#### TEST PROCEDURE

- 1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.4-2014.
- 2 Support equipment, if needed, was placed as per ANSI C63.4-2014.
- 3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.4-2014.
- 4 The EUT received DC 5V power, the adapter received AC120V/60Hz or AC 240V/50Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
- 5 All support equipments received AC power from a second LISN, if any.
- 6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
- 8 During the above scans, the emissions were maximized by cable manipulation.

#### AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following :

| Frequency range (MHz) | Limit (dBuV) |           |
|-----------------------|--------------|-----------|
|                       | 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 RESULTS

Remark: We measured Conducted Emission at FM mode in AC 120V/60Hz and AC 240V/50Hz, the worst case was recorded .

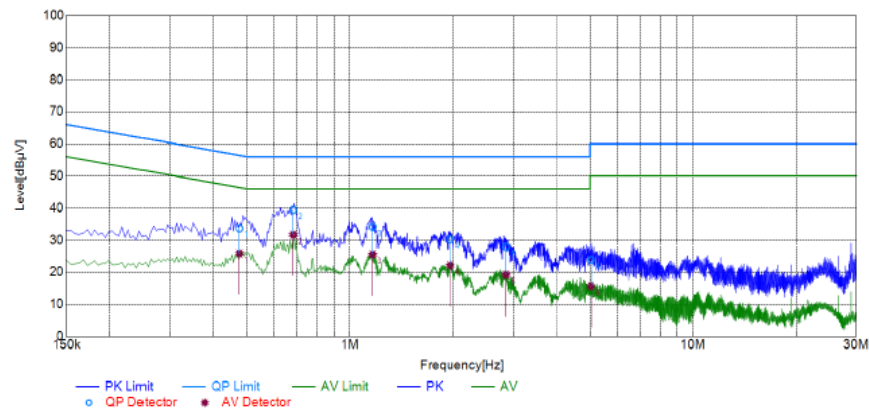
Power supply:

AC 120V/60Hz

Polarization

L

Test Graph



Final Data List

| NO. | Frequency<br>[MHz] | QP<br>Reading<br>[dBμV] | AVG.<br>Reading<br>[dBμV] | Factor<br>[dB] | QP<br>Result<br>[dBμV] | AVG.<br>Result<br>[dBμV] | QP<br>Limit<br>[dBμV] | AVG.<br>Limit<br>[dBμV] | QP<br>Margin<br>[dB] | AVG.<br>Margin<br>[dB] | Line | Remark |
|-----|--------------------|-------------------------|---------------------------|----------------|------------------------|--------------------------|-----------------------|-------------------------|----------------------|------------------------|------|--------|
| 1   | 0.4758             | 23.40                   | 15.62                     | 10.24          | 33.64                  | 25.86                    | 56.41                 | 46.41                   | 22.77                | 20.55                  | L1   | PASS   |
| 2   | 0.6822             | 29.19                   | 21.43                     | 10.22          | 39.41                  | 31.65                    | 56.00                 | 46.00                   | 16.59                | 14.35                  | L1   | PASS   |
| 3   | 1.1615             | 23.90                   | 15.38                     | 10.21          | 34.11                  | 25.59                    | 56.00                 | 46.00                   | 21.89                | 20.41                  | L1   | PASS   |
| 4   | 1.9558             | 19.94                   | 11.88                     | 10.27          | 30.21                  | 22.15                    | 56.00                 | 46.00                   | 25.79                | 23.85                  | L1   | PASS   |
| 5   | 2.8472             | 17.61                   | 8.87                      | 10.33          | 27.94                  | 19.20                    | 56.00                 | 46.00                   | 28.06                | 26.80                  | L1   | PASS   |
| 6   | 5.0425             | 13.52                   | 5.34                      | 10.34          | 23.86                  | 15.68                    | 60.00                 | 50.00                   | 36.14                | 34.32                  | L1   | PASS   |

Note: 1. Result (dBμV) = Reading (dBμV) + Factor (dB).

2. Factor (dB) = Cable loss (dB) + LISN Factor (dB).

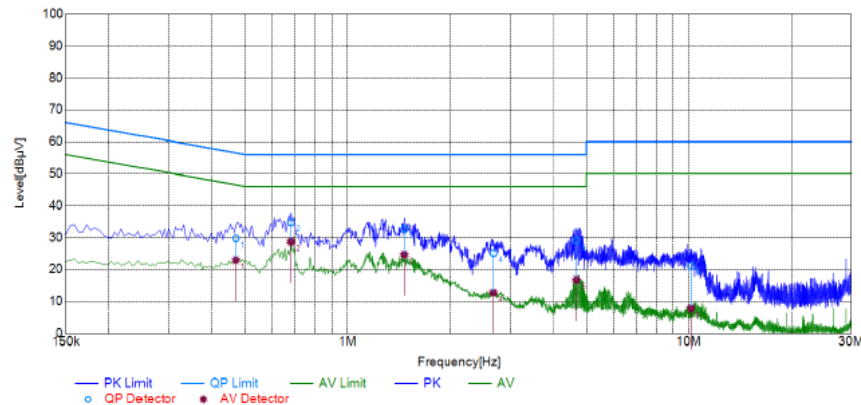
Power supply:

AC 120V/60Hz

Polarization

N

Test Graph



Final Data List

| NO. | Frequency<br>[MHz] | QP<br>Reading<br>[dBμV] | AVG.<br>Reading<br>[dBμV] | Factor<br>[dB] | QP<br>Result<br>[dBμV] | AVG.<br>Result<br>[dBμV] | QP<br>Limit<br>[dBμV] | AVG.<br>Limit<br>[dBμV] | QP<br>Margin<br>[dB] | AVG.<br>Margin<br>[dB] | Line | Remark |
|-----|--------------------|-------------------------|---------------------------|----------------|------------------------|--------------------------|-----------------------|-------------------------|----------------------|------------------------|------|--------|
| 1   | 0.4691             | 19.46                   | 12.70                     | 10.24          | 29.70                  | 22.94                    | 56.53                 | 46.53                   | 26.83                | 23.59                  | N    | PASS   |
| 2   | 0.6806             | 24.57                   | 18.52                     | 10.22          | 34.79                  | 28.74                    | 56.00                 | 46.00                   | 21.21                | 17.26                  | N    | PASS   |
| 3   | 1.4609             | 22.41                   | 14.45                     | 10.23          | 32.64                  | 24.68                    | 56.00                 | 46.00                   | 23.36                | 21.32                  | N    | PASS   |
| 4   | 2.6748             | 14.81                   | 2.44                      | 10.31          | 25.12                  | 12.75                    | 56.00                 | 46.00                   | 30.88                | 33.25                  | N    | PASS   |
| 5   | 4.6808             | 18.74                   | 6.49                      | 10.35          | 29.09                  | 16.84                    | 56.00                 | 46.00                   | 26.91                | 29.16                  | N    | PASS   |
| 6   | 10.1354            | 10.43                   | -2.74                     | 10.60          | 21.03                  | 7.86                     | 60.00                 | 50.00                   | 38.97                | 42.14                  | N    | PASS   |

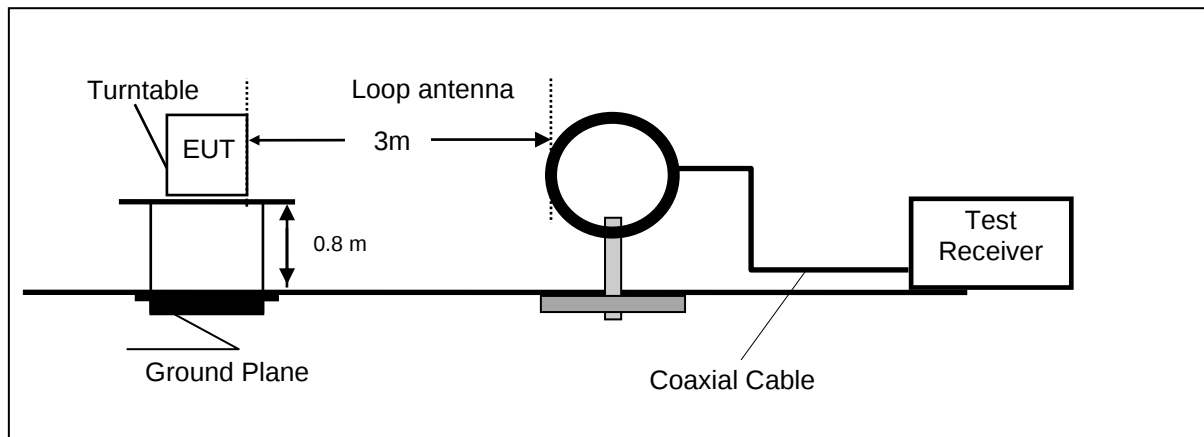
Note: 1. Result (dBμV) = Reading (dBμV) + Factor (dB).

2. Factor (dB) = Cable loss (dB) + LISN Factor (dB).

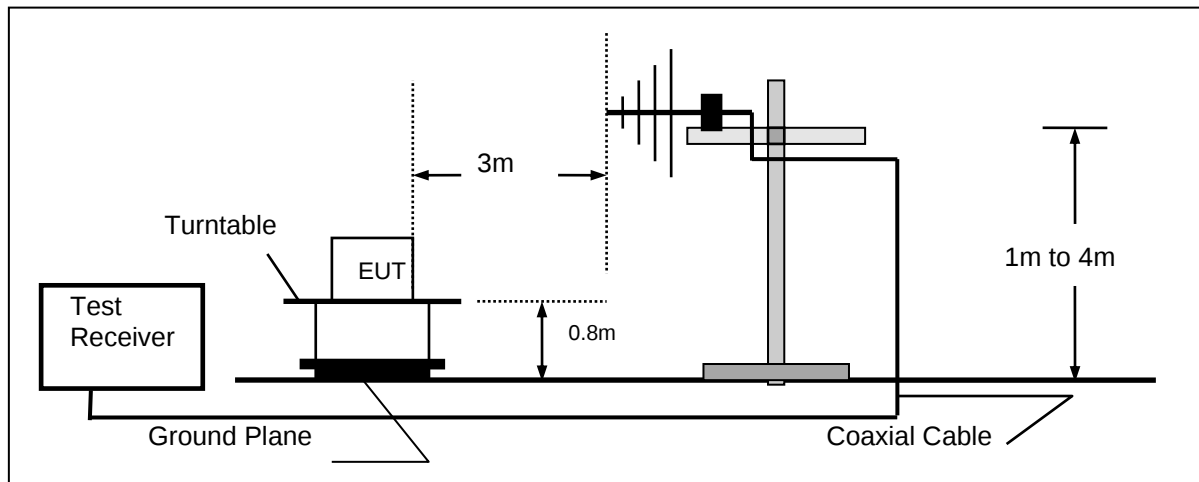
## 4.2. Transmitter unwanted emissions(radiated or conducted)

### TEST CONFIGURATION

Frequency range 9 KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



**TEST PROCEDURE**

1. EUT was placed on a 1.50 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.50 m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.
2. A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
3. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=1MHz, VBW=3MHz, And the maximum value of the receiver should be recorded as ( $P_r$ ).
4. The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power ( $P_{Mea}$ ) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded ( $P_r$ ). The power of signal source ( $P_{Mea}$ ) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
5. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss ( $P_{cl}$ ), the Substitution Antenna Gain ( $G_a$ ) and the Amplifier Gain ( $P_{Ag}$ ) should be recorded after test.  
The measurement results are obtained as described below:  
$$\text{Power(EIRP)} = P_{Mea} - P_{Ag} - P_{cl} + G_a$$
6. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
7. ERP can be calculated from EIRP by subtracting the gain of the dipole,  $ERP = EIRP - 2.15\text{dBi}$ .
8. In order to make sure test results more clearly, we set frequency range and sweep time for difference frequency range as follows table:

**RADIATION LIMIT**

| FCC & IC (according to ETSI EN 300 422-1 V2.1.2 (2017-01)) |                                                                                     |                                 |                               |
|------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------|-------------------------------|
| State                                                      | Max. spurious level                                                                 |                                 |                               |
|                                                            | 47 MHz to 74 MHz<br>87.5 MHz to 118 MHz<br>174 MHz to 230 MHz<br>470 MHz to 862 MHz | Other frequencies<br>≤ 1000 MHz | All frequencies<br>> 1000 MHz |
| Operating                                                  | 4.0 nW                                                                              | 250 nW                          | 1.00 μW                       |
| Standby                                                    | 2.0 nW                                                                              | 2.0 nW                          | 20.0 nW                       |

| FCC & IC                                                                                                                                            |                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| The mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:           |                                                                  |
| 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                                                            |
| On any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth          | 35 dB                                                            |
| On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least                                | $43 + 10\log_{10}(\text{mean output power in watts}) \text{ dB}$ |

**TEST RESULTS**

Remark: We measured Radiated Emission at FM mode from 30MHz to 25GHz and recorded worst case at High power mode.

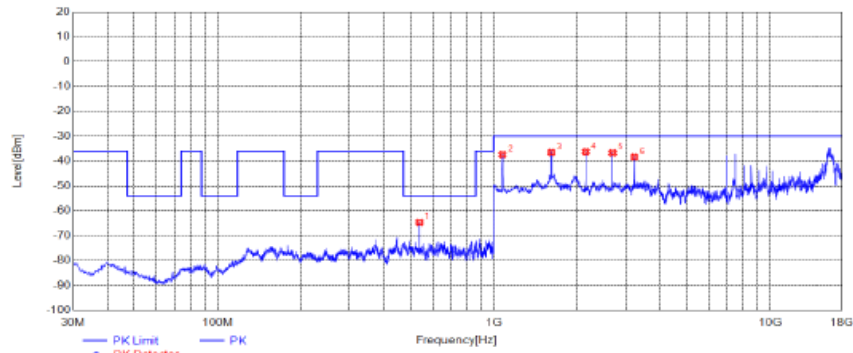
**Radiated Emissions:**

For 30MHz-18GHz

Channel 0 / 538.0 MHz

Horizontal

Test Graph



Suspected List

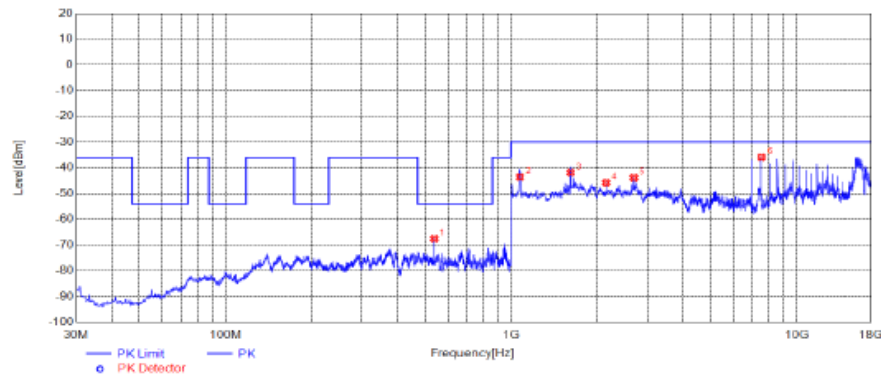
| NO. | Frequency [MHz] | Factor [dB] | Margin [dB] | Height [cm] | Angle [°] | Detector | Polarity   | Remark |
|-----|-----------------|-------------|-------------|-------------|-----------|----------|------------|--------|
| 1   | 537.9936        | -100.48     | 10.62       | 150         | 170       | PK       | Horizontal | PASS   |
| 2   | 10748150        | -100.55     | 7.40        | 150         | 170       | PK       | Horizontal | PASS   |
| 3   | 16155231        | -95.26      | 6.49        | 150         | 32        | PK       | Horizontal | PASS   |
| 4   | 21528306        | -98.69      | 6.23        | 150         | 163       | PK       | Horizontal | PASS   |
| 5   | 2690.1380       | -97.71      | 6.67        | 150         | 301       | PK       | Horizontal | PASS   |
| 6   | 3227.4455       | -94.80      | 8.37        | 150         | 107       | PK       | Horizontal | PASS   |

Note:1. Result (dBμV/m) = Reading(dBμV/m) + Factor (dB) .

2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

Vertical

Test Graph



Suspected List

| NO. | Frequency [MHz] | Factor [dB] | Margin [dB] | Height [cm] | Angle [°] | Detector | Polarity | Remark |
|-----|-----------------|-------------|-------------|-------------|-----------|----------|----------|--------|
| 1   | 537.9936        | -100.89     | 13.54       | 150         | 21        | PK       | Vertical | PASS   |
| 2   | 10748150        | -100.05     | 13.58       | 150         | 2         | PK       | Vertical | PASS   |
| 3   | 16155231        | -97.85      | 11.84       | 150         | 2         | PK       | Vertical | PASS   |
| 4   | 21528306        | -97.37      | 15.77       | 150         | 25        | PK       | Vertical | PASS   |
| 5   | 2690.1380       | -94.61      | 13.85       | 150         | 21        | PK       | Vertical | PASS   |
| 6   | 7532.7065       | -89.54      | 5.83        | 150         | 271       | PK       | Vertical | PASS   |

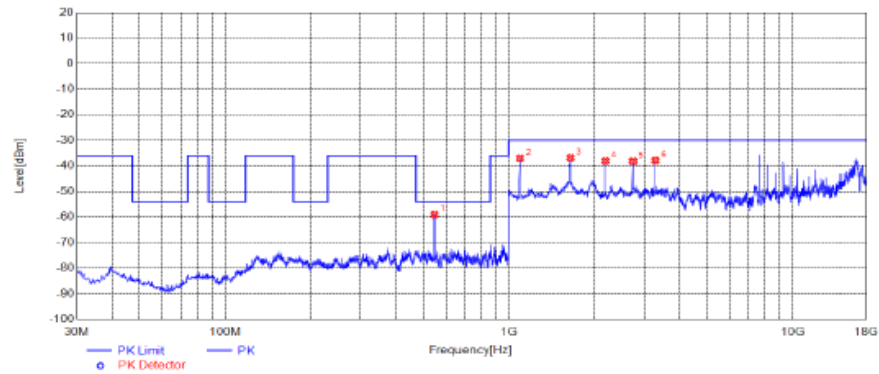
Note:1. Result (dBμV/m) = Reading(dBμV/m) + Factor (dB) .

2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

## Channel 0 / 547.6 MHz

## Horizontal

Test Graph



Suspected List

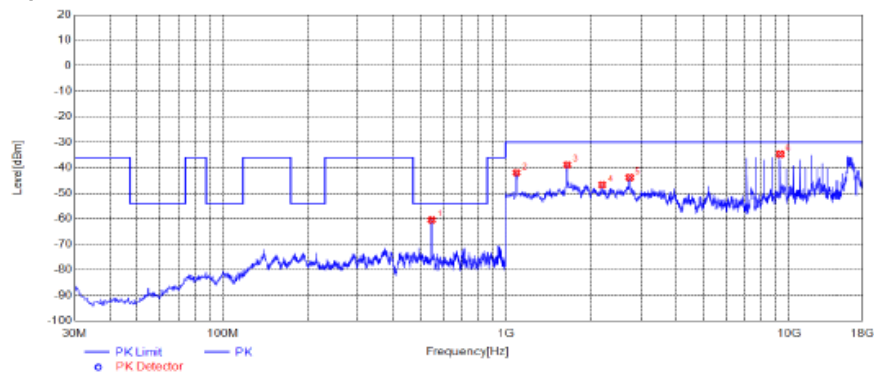
| NO. | Frequency [MHz] | Factor [dB] | Margin [dB] | Height [cm] | Angle [°] | Detector | Polarity   | Remark |
|-----|-----------------|-------------|-------------|-------------|-----------|----------|------------|--------|
| 1   | 547.5015        | -99.46      | 5.01        | 150         | 187       | PK       | Horizontal | PASS   |
| 2   | 1095.2190       | -100.12     | 7.00        | 150         | 199       | PK       | Horizontal | PASS   |
| 3   | 1649.5299       | -94.84      | 6.83        | 150         | 302       | PK       | Horizontal | PASS   |
| 4   | 2190.2380       | -98.63      | 8.05        | 150         | 152       | PK       | Horizontal | PASS   |
| 5   | 2737.7476       | -95.62      | 8.18        | 150         | 306       | PK       | Horizontal | PASS   |
| 6   | 3285.2571       | -94.32      | 7.87        | 150         | 96        | PK       | Horizontal | PASS   |

Note: 1. Result (dBμV/m) = Reading (dBμV/m) + Factor (dB) .

2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

## Vertical

Test Graph



Suspected List

| NO. | Frequency [MHz] | Factor [dB] | Margin [dB] | Height [cm] | Angle [°] | Detector | Polarity | Remark |
|-----|-----------------|-------------|-------------|-------------|-----------|----------|----------|--------|
| 1   | 547.6955        | -99.39      | 6.48        | 150         | 202       | PK       | Vertical | PASS   |
| 2   | 1091.8184       | -99.96      | 11.94       | 150         | 132       | PK       | Vertical | PASS   |
| 3   | 1649.5299       | -95.84      | 8.83        | 150         | 191       | PK       | Vertical | PASS   |
| 4   | 2190.2380       | -96.73      | 16.68       | 150         | 350       | PK       | Vertical | PASS   |
| 5   | 2737.7476       | -93.67      | 13.82       | 150         | 33        | PK       | Vertical | PASS   |
| 6   | 9307.8616       | -90.62      | 4.68        | 150         | 211       | PK       | Vertical | PASS   |

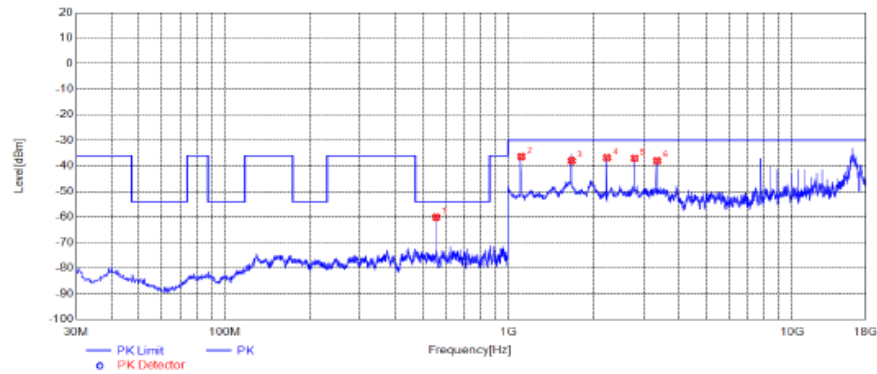
Note: 1. Result (dBμV/m) = Reading (dBμV/m) + Factor (dB) .

2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

## Channel 0 / 557.6 MHz

## Horizontal

Test Graph



Suspected List

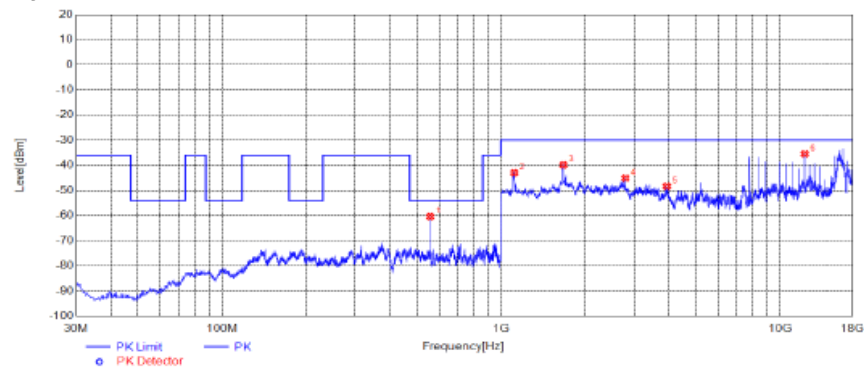
| NO. | Frequency [MHz] | Factor [dB] | Margin [dB] | Height [cm] | Angle [°] | Detector | Polarity   | Remark |
|-----|-----------------|-------------|-------------|-------------|-----------|----------|------------|--------|
| 1   | 557.5915        | -99.31      | 6.08        | 150         | 206       | PK       | Horizontal | PASS   |
| 2   | 1112.2224       | -100.22     | 6.32        | 150         | 33        | PK       | Horizontal | PASS   |
| 3   | 1673.3347       | -96.00      | 7.98        | 150         | 2         | PK       | Horizontal | PASS   |
| 4   | 2231.0462       | -99.11      | 6.78        | 150         | 166       | PK       | Horizontal | PASS   |
| 5   | 2788.7578       | -95.48      | 7.02        | 150         | 281       | PK       | Horizontal | PASS   |
| 6   | 3346.4693       | -94.17      | 8.03        | 150         | 80        | PK       | Horizontal | PASS   |

Note: 1. Result (dBμV/m) = Reading (dBμV/m) + Factor (dB) .

2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

## Vertical

Test Graph



Suspected List

| NO. | Frequency [MHz] | Factor [dB] | Margin [dB] | Height [cm] | Angle [°] | Detector | Polarity | Remark |
|-----|-----------------|-------------|-------------|-------------|-----------|----------|----------|--------|
| 1   | 557.5915        | -98.48      | 6.40        | 150         | 162       | PK       | Vertical | PASS   |
| 2   | 1115.6231       | -99.74      | 12.91       | 150         | 2         | PK       | Vertical | PASS   |
| 3   | 1673.3347       | -95.75      | 9.80        | 150         | 2         | PK       | Vertical | PASS   |
| 4   | 2792.1584       | -95.29      | 15.08       | 150         | 215       | PK       | Vertical | PASS   |
| 5   | 3934.7870       | -92.21      | 18.32       | 150         | 85        | PK       | Vertical | PASS   |
| 6   | 12266.4533      | -91.10      | 5.43        | 150         | 223       | PK       | Vertical | PASS   |

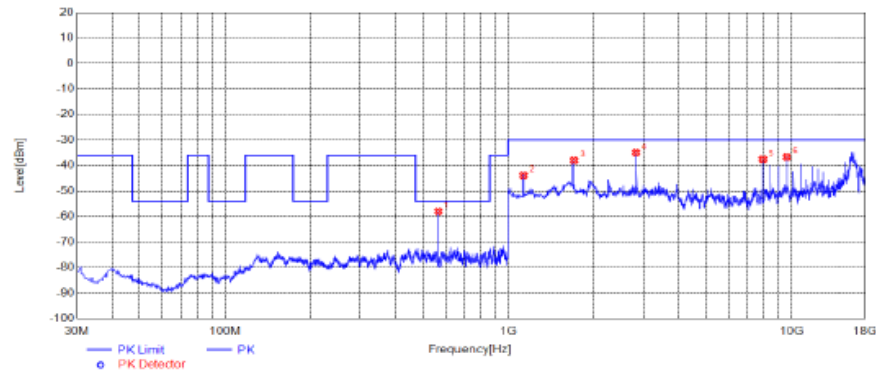
Note: 1. Result (dBμV/m) = Reading (dBμV/m) + Factor (dB) .

2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

## Channel 0 / 566.4 MHz

## Horizontal

Test Graph



Suspected List

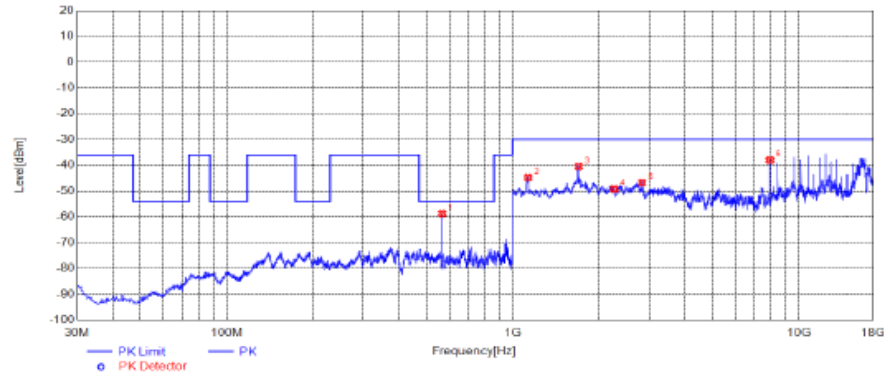
| NO. | Frequency [MHz] | Factor [dB] | Margin [dB] | Height [cm] | Angle [°] | Detector | Polarity   | Remark |
|-----|-----------------|-------------|-------------|-------------|-----------|----------|------------|--------|
| 1   | 566.5173        | -101.16     | 3.97        | 150         | 194       | PK       | Horizontal | PASS   |
| 2   | 1132.6265       | -100.56     | 13.90       | 150         | 203       | PK       | Horizontal | PASS   |
| 3   | 1707.3415       | -97.51      | 7.98        | 150         | 294       | PK       | Horizontal | PASS   |
| 4   | 2826.1652       | -95.60      | 4.95        | 150         | 310       | PK       | Horizontal | PASS   |
| 5   | 7930.5861       | -93.44      | 7.58        | 150         | 282       | PK       | Horizontal | PASS   |
| 6   | 9627.5255       | -91.14      | 6.65        | 150         | 298       | PK       | Horizontal | PASS   |

Note:1. Result (dBμV/m) = Reading(dBμV/m) + Factor (dB) .

2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

## Vertical

Test Graph



Suspected List

| NO. | Frequency [MHz] | Factor [dB] | Margin [dB] | Height [cm] | Angle [°] | Detector | Polarity | Remark |
|-----|-----------------|-------------|-------------|-------------|-----------|----------|----------|--------|
| 1   | 566.3233        | -102.40     | 4.71        | 150         | 159       | PK       | Vertical | PASS   |
| 2   | 1132.6265       | -99.54      | 14.77       | 150         | 2         | PK       | Vertical | PASS   |
| 3   | 1700.5401       | -95.67      | 10.47       | 150         | 2         | PK       | Vertical | PASS   |
| 4   | 2265.0530       | -97.02      | 19.16       | 150         | 140       | PK       | Vertical | PASS   |
| 5   | 2832.9666       | -95.57      | 16.72       | 150         | 2         | PK       | Vertical | PASS   |
| 6   | 7930.5861       | -93.97      | 7.98        | 150         | 195       | PK       | Vertical | PASS   |

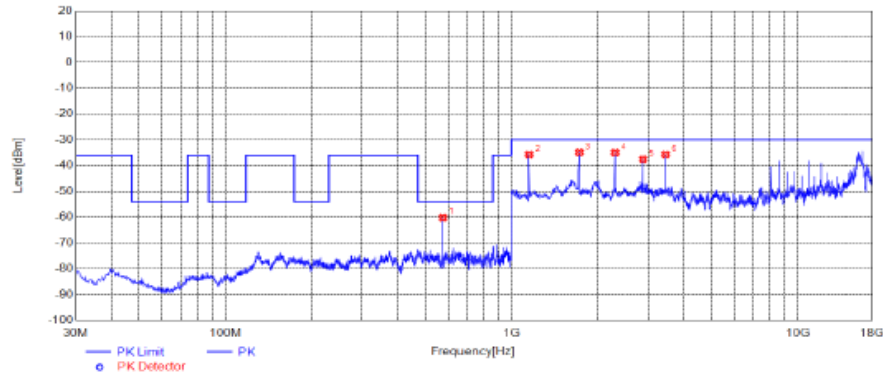
Note:1. Result (dBμV/m) = Reading(dBμV/m) + Factor (dB) .

2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

## Channel 0 / 576.0 MHz

## Horizontal

Test Graph



Suspected List

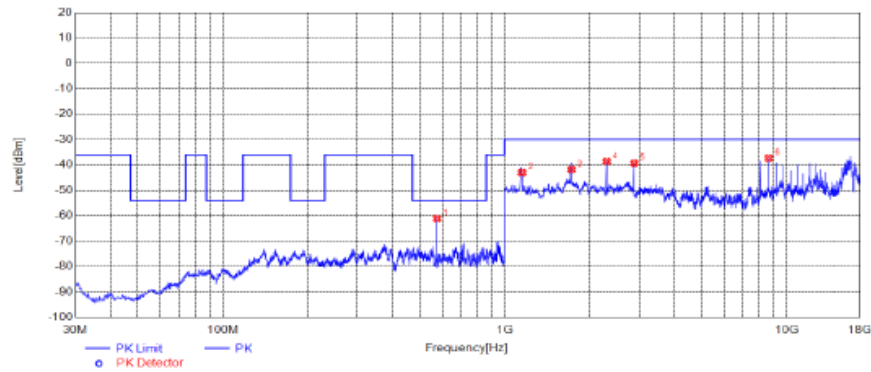
| NO. | Frequency [MHz] | Factor [dB] | Margin [dB] | Height [cm] | Angle [°] | Detector | Polarity   | Remark |
|-----|-----------------|-------------|-------------|-------------|-----------|----------|------------|--------|
| 1   | 576.0252        | -100.66     | 6.21        | 150         | 75        | PK       | Horizontal | PASS   |
| 2   | 1153.0306       | -100.69     | 5.69        | 150         | 40        | PK       | Horizontal | PASS   |
| 3   | 1727.7455       | -98.01      | 4.89        | 150         | 32        | PK       | Horizontal | PASS   |
| 4   | 2302.4605       | -95.83      | 4.98        | 150         | 60        | PK       | Horizontal | PASS   |
| 5   | 2880.5761       | -96.49      | 7.57        | 150         | 40        | PK       | Horizontal | PASS   |
| 6   | 3455.2911       | -94.12      | 5.69        | 150         | 88        | PK       | Horizontal | PASS   |

Note:1. Result (dBμV/m) = Reading(dBμV/m) + Factor (dB) .

2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

## Vertical

Test Graph



Suspected List

| NO. | Frequency [MHz] | Factor [dB] | Margin [dB] | Height [cm] | Angle [°] | Detector | Polarity | Remark |
|-----|-----------------|-------------|-------------|-------------|-----------|----------|----------|--------|
| 1   | 576.0252        | -99.05      | 7.10        | 150         | 45        | PK       | Vertical | PASS   |
| 2   | 1153.0306       | -99.32      | 12.98       | 150         | 2         | PK       | Vertical | PASS   |
| 3   | 1727.7455       | -95.66      | 11.80       | 150         | 2         | PK       | Vertical | PASS   |
| 4   | 2302.4605       | -98.41      | 8.60        | 150         | 155       | PK       | Vertical | PASS   |
| 5   | 2880.5761       | -96.61      | 9.25        | 150         | 2         | PK       | Vertical | PASS   |
| 6   | 8641.3283       | -91.85      | 7.36        | 150         | 214       | PK       | Vertical | PASS   |

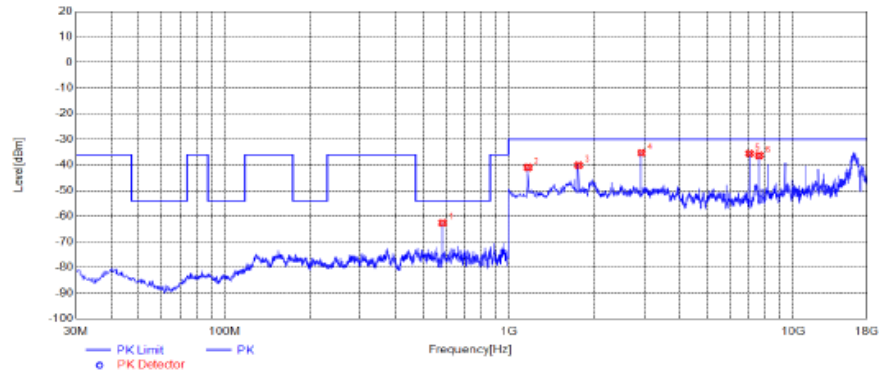
Note:1. Result (dBμV/m) = Reading(dBμV/m) + Factor (dB) .

2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

## Channel 0 / 586.0 MHz

## Horizontal

Test Graph



Suspected List

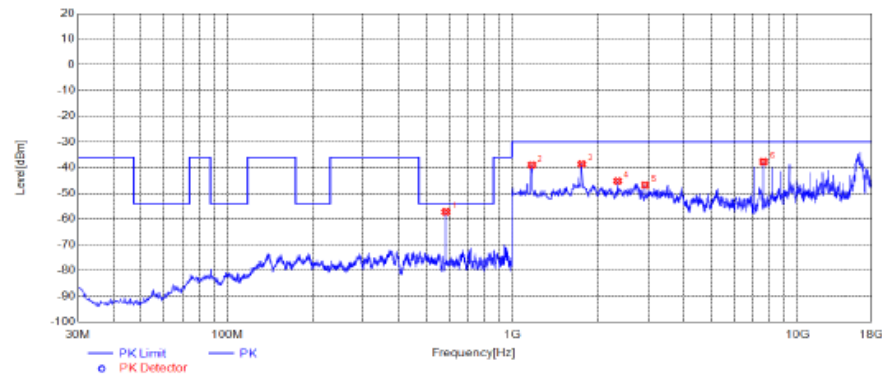
| NO. | Frequency [MHz] | Factor [dB] | Margin [dB] | Height [cm] | Angle [°] | Detector | Polarity   | Remark |
|-----|-----------------|-------------|-------------|-------------|-----------|----------|------------|--------|
| 1   | 585.9212        | -99.28      | 8.61        | 150         | 245       | PK       | Horizontal | PASS   |
| 2   | 1170.0340       | -99.78      | 10.98       | 150         | 231       | PK       | Horizontal | PASS   |
| 3   | 1761.7524       | -98.36      | 10.07       | 150         | 160       | PK       | Horizontal | PASS   |
| 4   | 2931.5863       | -96.96      | 5.27        | 150         | 56        | PK       | Horizontal | PASS   |
| 5   | 7032.8066       | -93.68      | 5.52        | 150         | 337       | PK       | Horizontal | PASS   |
| 6   | 7617.7235       | -94.20      | 6.25        | 150         | 298       | PK       | Horizontal | PASS   |

Note: 1. Result (dBμV/m) = Reading (dBμV/m) + Factor (dB) .

2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

## Vertical

Test Graph



Suspected List

| NO. | Frequency [MHz] | Factor [dB] | Margin [dB] | Height [cm] | Angle [°] | Detector | Polarity | Remark |
|-----|-----------------|-------------|-------------|-------------|-----------|----------|----------|--------|
| 1   | 585.9212        | -100.71     | 3.21        | 150         | 358       | PK       | Vertical | PASS   |
| 2   | 1173.4347       | -99.24      | 8.95        | 150         | 2         | PK       | Vertical | PASS   |
| 3   | 1754.9510       | -95.64      | 8.57        | 150         | 255       | PK       | Vertical | PASS   |
| 4   | 2343.2687       | -96.06      | 15.19       | 150         | 203       | PK       | Vertical | PASS   |
| 5   | 2924.7850       | -97.10      | 16.76       | 150         | 17        | PK       | Vertical | PASS   |
| 6   | 7617.7235       | -94.89      | 7.72        | 150         | 168       | PK       | Vertical | PASS   |

Note: 1. Result (dBμV/m) = Reading (dBμV/m) + Factor (dB) .

2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

### 4.3. Maximum Peak Output Power

#### Measurement description

Two traces are captured to show the difference between input- and output signals and to measure the effective output power of the device. Trace 1 shows the measurement results of the output signal and trace 2 shows the measurement results of the input signal. Marker D2 in the plots shows the difference between the input and the output signal

#### Measurement

| Measurement parameter |                                                                                                                                                                                                                                                                                   |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Detector:             | Peak (worst case) / Average (RMS)                                                                                                                                                                                                                                                 |
| Sweep time:           | Auto / 20s                                                                                                                                                                                                                                                                        |
| Resolution bandwidth: | > emission bandwidth                                                                                                                                                                                                                                                              |
| Video bandwidth:      | > resolution bandwidth                                                                                                                                                                                                                                                            |
| Span:                 | > 2 times emissions bandwidth                                                                                                                                                                                                                                                     |
| Trace mode:           | Max. hold                                                                                                                                                                                                                                                                         |
| EUT configuration:    | <p>Peak: Unmodulated carrier</p> <p>RMS:<br/>Modulate the transmitter with a 2.5 kHz tone at a level 16 dB higher than that required to produce a frequency deviation of <math>\pm 75</math> kHz, or to produce 50% of the manufacturer's rated deviation, whichever is less.</p> |

#### Limits

| FCC&IC             |                                     |
|--------------------|-------------------------------------|
| 470 MHz to 608 MHz | 250 mW (average) / 24 dBm (average) |

#### Test result

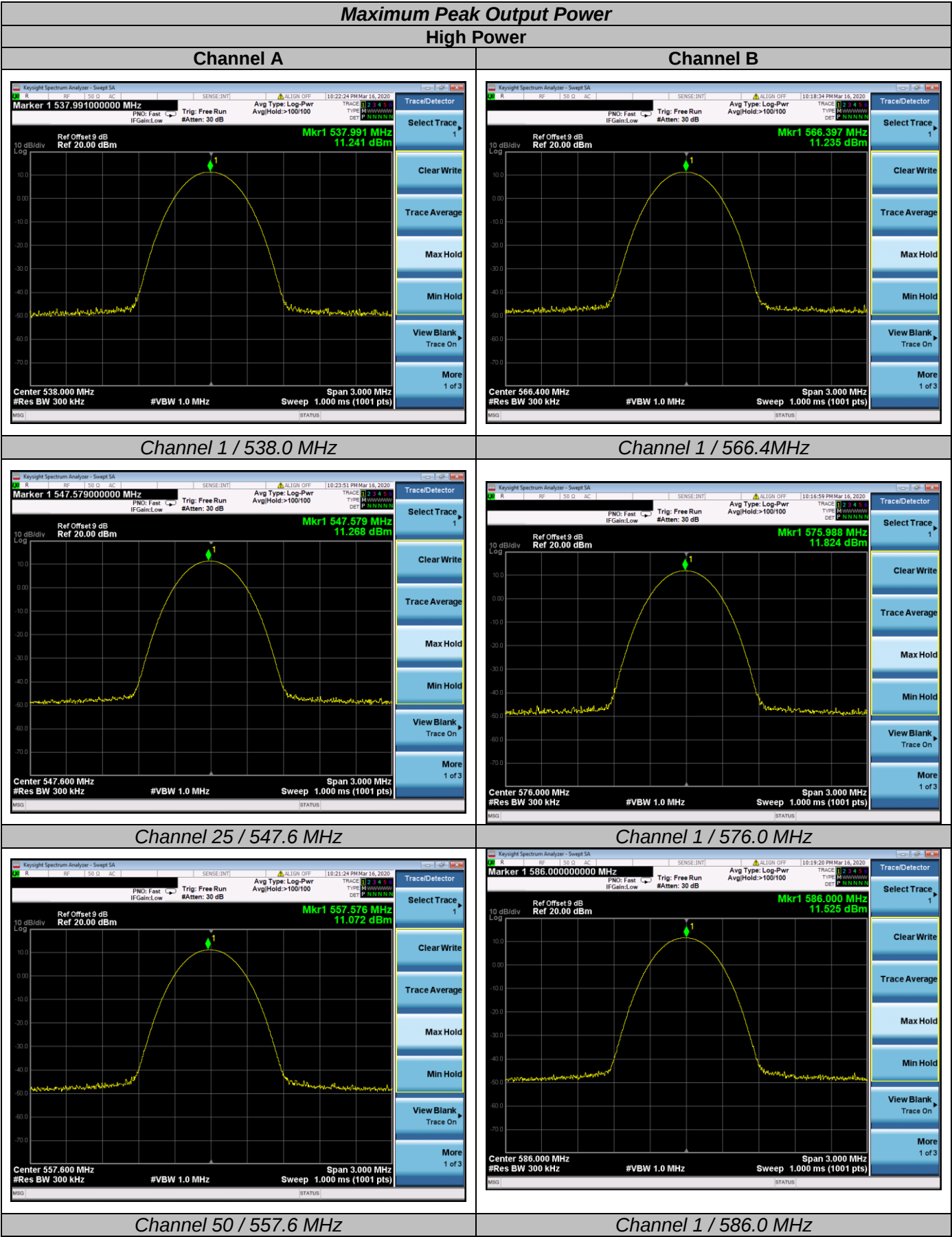
The EUT was programmed to be in continuously transmitting mode.

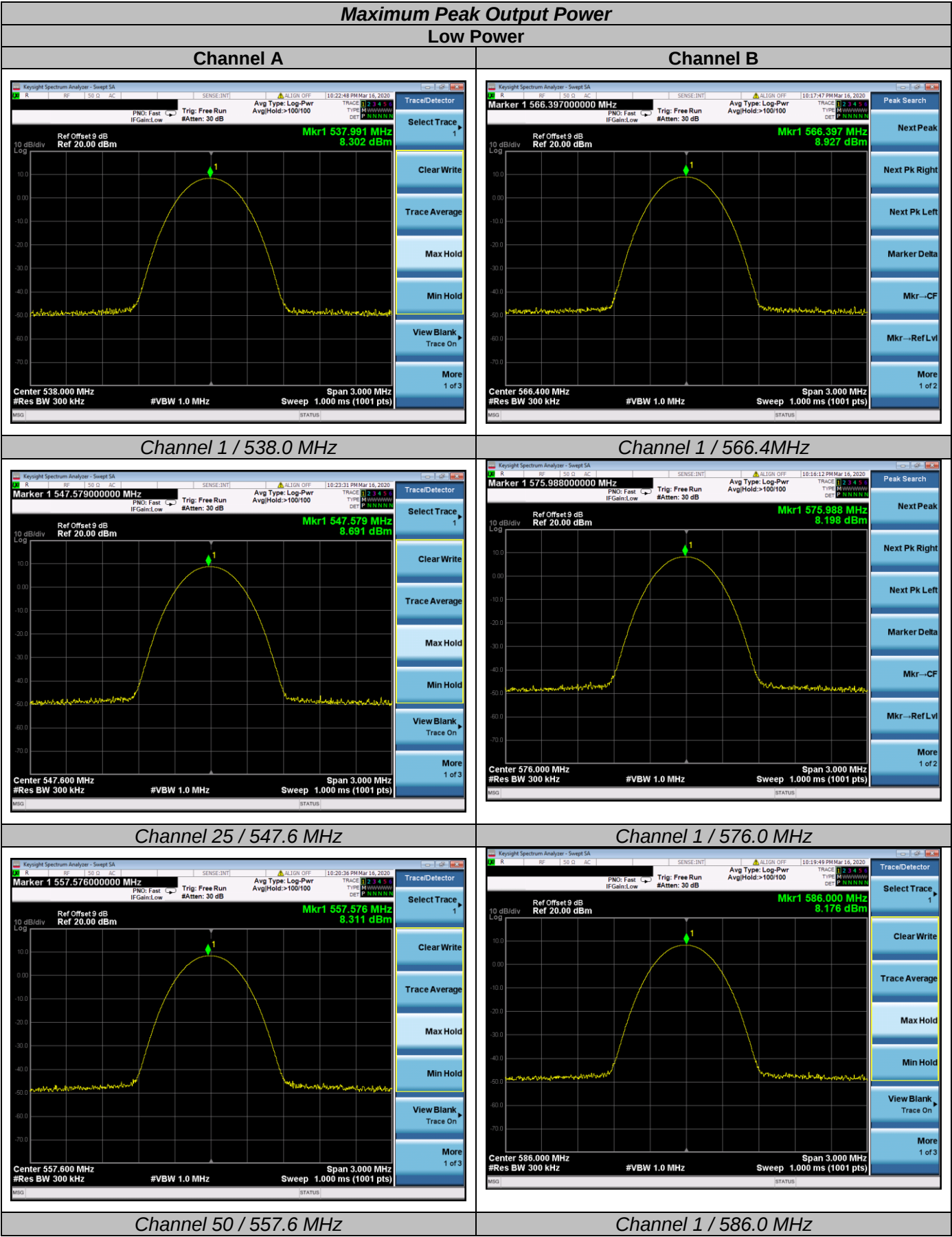
| High Power |         |                 |                                  |                                     |                      |         |
|------------|---------|-----------------|----------------------------------|-------------------------------------|----------------------|---------|
| Test Mode  | Channel | Frequency (MHz) | Measured Maximum Peak Power(dBm) | Measured Maximum Average Power(dBm) | Limits Average (dBm) | Verdict |
| FM         | 01      | 538.0           | 11.241                           | /                                   | 24                   | PASS    |
|            | 25      | 547.6           | 11.268                           | /                                   |                      |         |
|            | 50      | 557.6           | 11.072                           | /                                   |                      |         |

| High Power |         |                 |                                  |                                     |                      |         |
|------------|---------|-----------------|----------------------------------|-------------------------------------|----------------------|---------|
| Test Mode  | Channel | Frequency (MHz) | Measured Maximum Peak Power(dBm) | Measured Maximum Average Power(dBm) | Limits Average (dBm) | Verdict |
| FM         | 01      | 566.4           | 11.235                           | /                                   | 24                   | PASS    |
|            | 25      | 576.0           | 11.824                           | /                                   |                      |         |
|            | 50      | 586.0           | 11.525                           | /                                   |                      |         |

| Low Power |         |                 |                                  |                                     |                      |         |
|-----------|---------|-----------------|----------------------------------|-------------------------------------|----------------------|---------|
| Test Mode | Channel | Frequency (MHz) | Measured Maximum Peak Power(dBm) | Measured Maximum Average Power(dBm) | Limits Average (dBm) | Verdict |
| FM        | 01      | 538.0           | 8.302                            | /                                   | 24                   | PASS    |
|           | 25      | 547.6           | 8.691                            | /                                   |                      |         |
|           | 50      | 557.6           | 8.311                            | /                                   |                      |         |

| Low Power |         |                 |                                  |                                     |                      |         |
|-----------|---------|-----------------|----------------------------------|-------------------------------------|----------------------|---------|
| Test Mode | Channel | Frequency (MHz) | Measured Maximum Peak Power(dBm) | Measured Maximum Average Power(dBm) | Limits Average (dBm) | Verdict |
| FM        | 01      | 566.4           | 8.927                            | /                                   | 24                   | PASS    |
|           | 25      | 576.0           | 8.198                            | /                                   |                      |         |
|           | 50      | 586.0           | 8.176                            | /                                   |                      |         |





#### 4.4. Occupied bandwidth and Emission Mask

##### Measurement description

Two traces are captured to show the difference between input- and output signals and to measure the effective bandwidth of the output signal. Trace 1 shows the measurement results of the output signal and trace 2 shows the measurement results of the input signal.

##### Measurement

| Measurement parameter |                                                |
|-----------------------|------------------------------------------------|
| Detector:             | Peak                                           |
| Sweep time:           | Auto                                           |
| Resolution bandwidth: | 1 % to 5 % of the occupied bandwidth           |
| Video bandwidth:      | 3 x resolution bandwidth                       |
| Span:                 | 2 x emission bandwidth                         |
| Trace mode:           | Max. hold                                      |
| Analyzer function:    | 99% power occupied bandwidth function          |
| EUT:                  | Modulated signal with max. frequency deviation |

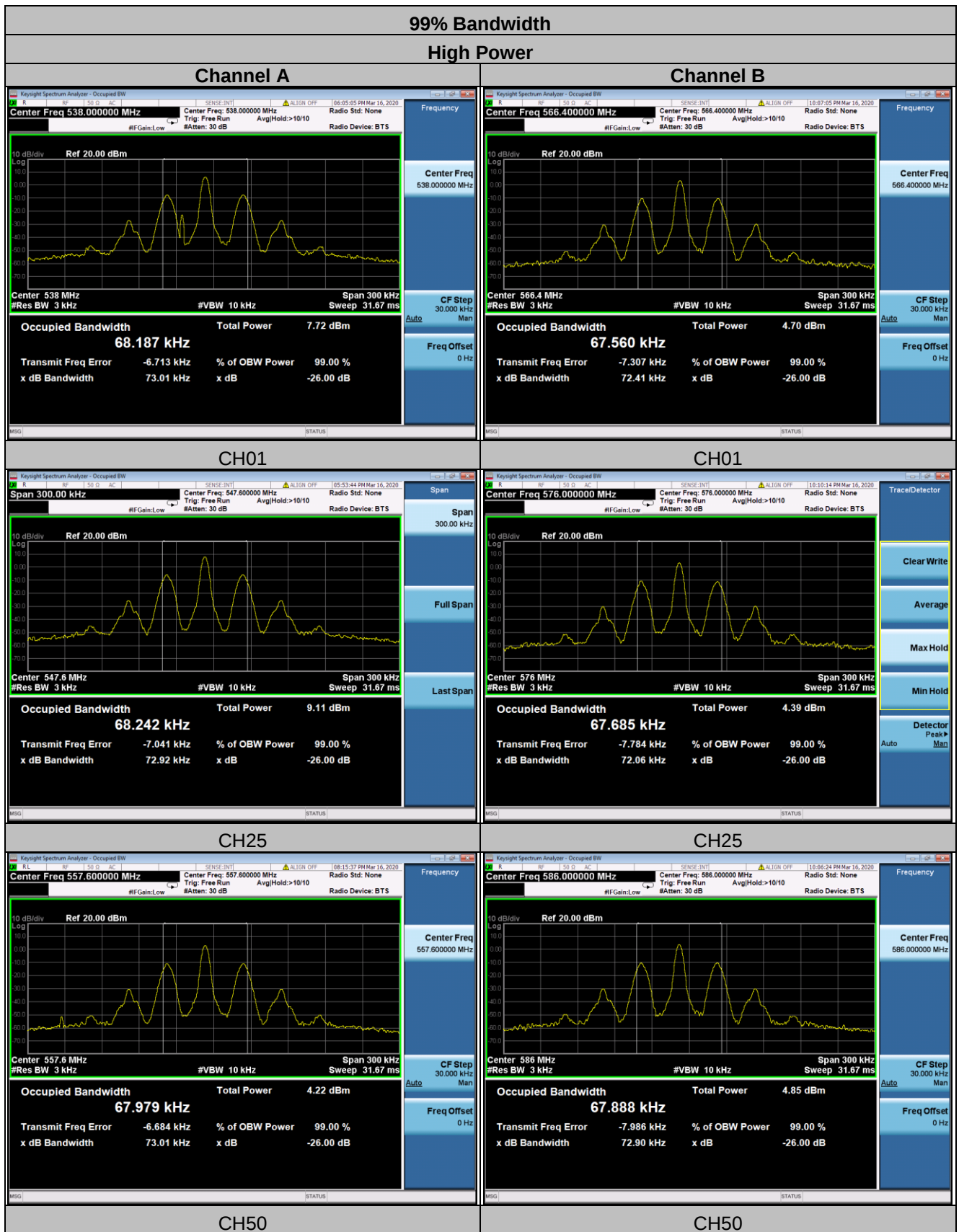
##### TEST RESULTS

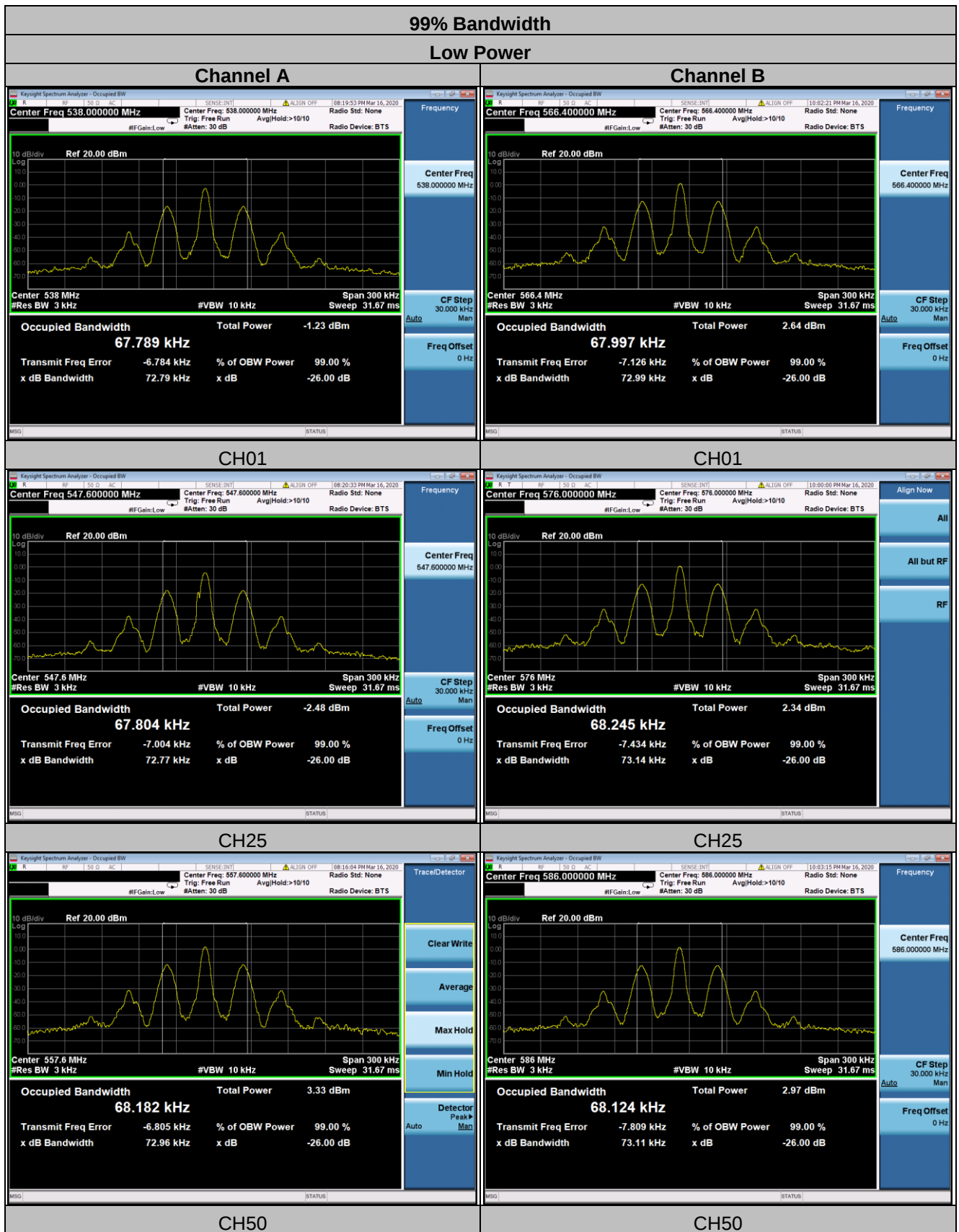
| High Power |                 |                    |              |        |
|------------|-----------------|--------------------|--------------|--------|
| Modulation | Frequency (MHz) | 99% Bandwidth(KHz) | Limits (KHz) | Result |
| FM         | 538.0           | 68.187             | 200          | PASS   |
|            | 547.6           | 68.242             |              | PASS   |
|            | 557.6           | 69.979             |              | PASS   |

| High Power |                 |                    |              |        |
|------------|-----------------|--------------------|--------------|--------|
| Modulation | Frequency (MHz) | 99% Bandwidth(KHz) | Limits (KHz) | Result |
| FM         | 566.4           | 67.560             | 200          | PASS   |
|            | 576.0           | 67.685             |              | PASS   |
|            | 586.0           | 67.888             |              | PASS   |

| Low Power  |                 |                    |              |        |
|------------|-----------------|--------------------|--------------|--------|
| Modulation | Frequency (MHz) | 99% Bandwidth(KHz) | Limits (KHz) | Result |
| FM         | 538.0           | 67.789             | 200          | PASS   |
|            | 547.6           | 67.804             |              | PASS   |
|            | 557.6           | 68.182             |              | PASS   |

| Low Power  |                 |                    |              |        |
|------------|-----------------|--------------------|--------------|--------|
| Modulation | Frequency (MHz) | 99% Bandwidth(KHz) | Limits (KHz) | Result |
| FM         | 566.4           | 67.997             | 200          | PASS   |
|            | 576.0           | 68.245             |              | PASS   |
|            | 586.0           | 68.124             |              | PASS   |





#### 4.5. Frequency Stability

Test Requirement:FCC CFR 47 Part 74.e) 4)

Test Method:FCC CFR 47 Part 2.1055

Requirements: +/-50 ppm

(e) For low power auxiliary stations operating in the bands allocated for TV broadcasting, the following technical requirements apply:

(4) The frequency tolerance of the transmitter shall be 0.005 percent.

Test Procedure:

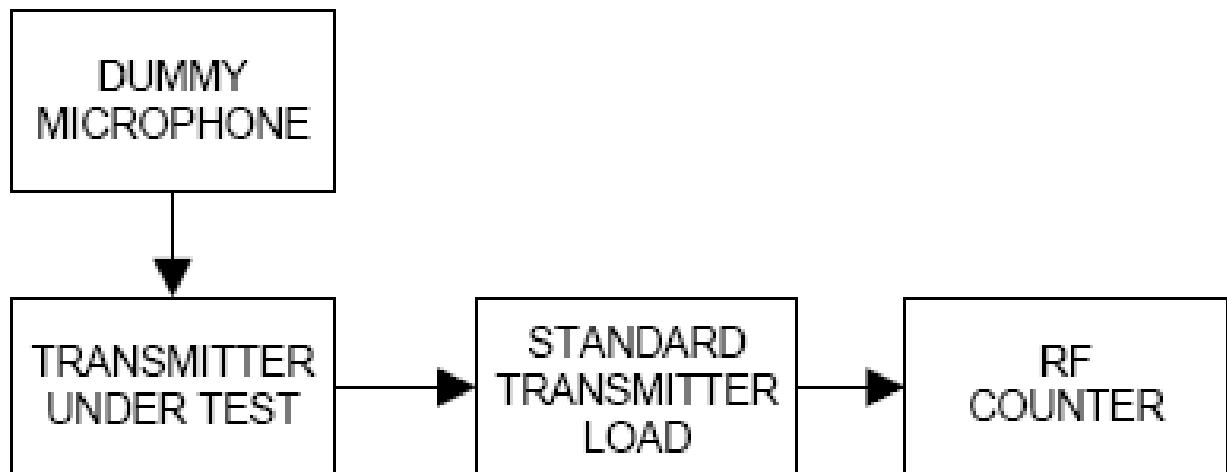
Frequency stability versus Environmental Temperature

The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feed through attenuators.

The EUT was placed inside the temperature chamber. After the temperature stabilized for approximately 20 minutes, the frequency of the output signal was recorded from the counter.

Frequency Stability versus Input Voltage

At room temperature ( $25 \pm 5^{\circ}\text{C}$ ), an external variable DC power supply was connected to the EUT. The frequency of the transmitter was measured for 115%, 100% and 85% of the nominal operating input voltage. For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.



**TEST RESULTS**

| <b>High Power</b>                      |                      |                                                                                |
|----------------------------------------|----------------------|--------------------------------------------------------------------------------|
| <b>Assigned Frequency: 538.000 MHz</b> |                      |                                                                                |
| Environment Temperature (°C)           | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within +/- 26.90 kHz     |
| 50                                     | 3.0                  | +8.5                                                                           |
| 40                                     | 3.0                  | +7.3                                                                           |
| 30                                     | 3.0                  | +5.2                                                                           |
| 20                                     | 3.0                  | +3.2                                                                           |
| 10                                     | 3.0                  | -0.7                                                                           |
| 0                                      | 3.0                  | -2.6                                                                           |
| -10                                    | 3.0                  | -3.1                                                                           |
| -20                                    | 3.0                  | -4.7                                                                           |
| -30                                    | 3.0                  | -5.4                                                                           |
| Environment Temperature (°C)           | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within Max +/- 26.90 kHz |
| 25                                     | 3.0                  | +1.2                                                                           |
| 25                                     | 2.7                  | -1.5                                                                           |
| 25                                     | 2.7                  | -1.9                                                                           |
|                                        |                      |                                                                                |

| <b>High Power</b>                      |                      |                                                                                |
|----------------------------------------|----------------------|--------------------------------------------------------------------------------|
| <b>Assigned Frequency: 547.600 MHz</b> |                      |                                                                                |
| Environment Temperature (°C)           | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within +/- 27.38 kHz     |
| 50                                     | 3.0                  | +8.9                                                                           |
| 40                                     | 3.0                  | +7.6                                                                           |
| 30                                     | 3.0                  | +5.5                                                                           |
| 20                                     | 3.0                  | +4.2                                                                           |
| 10                                     | 3.0                  | -0.7                                                                           |
| 0                                      | 3.0                  | -1.3                                                                           |
| -10                                    | 3.0                  | -2.7                                                                           |
| -20                                    | 3.0                  | -3.9                                                                           |
| -30                                    | 3.0                  | -4.5                                                                           |
| Environment Temperature (°C)           | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within Max +/- 27.38 kHz |
| 25                                     | 3.0                  | +2.5                                                                           |
| 25                                     | 2.7                  | -1.8                                                                           |
| 25                                     | 2.7                  | -2.7                                                                           |
|                                        |                      |                                                                                |

| High Power                      |                      |                                                                                |
|---------------------------------|----------------------|--------------------------------------------------------------------------------|
| Assigned Frequency: 557.600 MHz |                      |                                                                                |
| Environment Temperature (°C)    | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within +/- 27.88 kHz     |
| 50                              | 3.0                  | +8.6                                                                           |
| 40                              | 3.0                  | +7.5                                                                           |
| 30                              | 3.0                  | +6.4                                                                           |
| 20                              | 3.0                  | +4.5                                                                           |
| 10                              | 3.0                  | 3.4                                                                            |
| 0                               | 3.0                  | -1.7                                                                           |
| -10                             | 3.0                  | -2.5                                                                           |
| -20                             | 3.0                  | -3.7                                                                           |
| -30                             | 3.0                  | -4.9                                                                           |
| Environment Temperature (°C)    | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within Max +/- 27.88 kHz |
| 25                              | 3.0                  | +1.6                                                                           |
| 25                              | 2.7                  | -2.3                                                                           |
| 25                              | 2.7                  | -3.4                                                                           |
|                                 |                      |                                                                                |

| High Power                      |                      |                                                                                |
|---------------------------------|----------------------|--------------------------------------------------------------------------------|
| Assigned Frequency: 566.400 MHz |                      |                                                                                |
| Environment Temperature (°C)    | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within +/- 28.32 kHz     |
| 50                              | 3.0                  | +8.8                                                                           |
| 40                              | 3.0                  | +7.6                                                                           |
| 30                              | 3.0                  | +5.3                                                                           |
| 20                              | 3.0                  | +3.4                                                                           |
| 10                              | 3.0                  | -0.7                                                                           |
| 0                               | 3.0                  | -1.6                                                                           |
| -10                             | 3.0                  | -2.7                                                                           |
| -20                             | 3.0                  | -3.9                                                                           |
| -30                             | 3.0                  | -5.5                                                                           |
| Environment Temperature (°C)    | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within Max +/- 28.32 kHz |
| 25                              | 3.0                  | +1.7                                                                           |
| 25                              | 2.7                  | -2.1                                                                           |
| 25                              | 2.7                  | -2.5                                                                           |
|                                 |                      |                                                                                |

| High Power                      |                      |                                                                                |
|---------------------------------|----------------------|--------------------------------------------------------------------------------|
| Assigned Frequency: 576.000 MHz |                      |                                                                                |
| Environment Temperature (°C)    | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within +/- 28.80 kHz     |
| 50                              | 3.0                  | +7.8                                                                           |
| 40                              | 3.0                  | +6.3                                                                           |
| 30                              | 3.0                  | +3.7                                                                           |
| 20                              | 3.0                  | +2.2                                                                           |
| 10                              | 3.0                  | -1.0                                                                           |
| 0                               | 3.0                  | -2.4                                                                           |
| -10                             | 3.0                  | -2.9                                                                           |
| -20                             | 3.0                  | -3.3                                                                           |
| -30                             | 3.0                  | -4.7                                                                           |
| Environment Temperature (°C)    | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within Max +/- 28.80 kHz |
| 25                              | 3.0                  | +2.5                                                                           |
| 25                              | 2.7                  | -1.9                                                                           |
| 25                              | 2.7                  | -2.7                                                                           |
|                                 |                      |                                                                                |

| High Power                      |                      |                                                                                |
|---------------------------------|----------------------|--------------------------------------------------------------------------------|
| Assigned Frequency: 586.000 MHz |                      |                                                                                |
| Environment Temperature (°C)    | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within +/- 29.30 kHz     |
| 50                              | 3.0                  | +7.2                                                                           |
| 40                              | 3.0                  | +6.3                                                                           |
| 30                              | 3.0                  | +5.2                                                                           |
| 20                              | 3.0                  | +2.8                                                                           |
| 10                              | 3.0                  | -1.4                                                                           |
| 0                               | 3.0                  | -3.6                                                                           |
| -10                             | 3.0                  | -4.1                                                                           |
| -20                             | 3.0                  | -4.9                                                                           |
| -30                             | 3.0                  | -5.8                                                                           |
| Environment Temperature (°C)    | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within Max +/- 29.30 kHz |
| 25                              | 3.0                  | +1.4                                                                           |
| 25                              | 2.7                  | -1.7                                                                           |
| 25                              | 2.7                  | -2.2                                                                           |
|                                 |                      |                                                                                |

| Low Power                       |                      |                                                                                |
|---------------------------------|----------------------|--------------------------------------------------------------------------------|
| Assigned Frequency: 538.000 MHz |                      |                                                                                |
| Environment Temperature (°C)    | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within +/- 26.90 kHz     |
| 50                              | 3.0                  | +8.9                                                                           |
| 40                              | 3.0                  | +7.5                                                                           |
| 30                              | 3.0                  | +5.3                                                                           |
| 20                              | 3.0                  | +2.2                                                                           |
| 10                              | 3.0                  | -1.3                                                                           |
| 0                               | 3.0                  | -2.6                                                                           |
| -10                             | 3.0                  | -3.3                                                                           |
| -20                             | 3.0                  | -3.8                                                                           |
| -30                             | 3.0                  | -4.6                                                                           |
| Environment Temperature (°C)    | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within Max +/- 26.90 kHz |
| 25                              | 3.0                  | +1.6                                                                           |
| 25                              | 2.7                  | -2.2                                                                           |
| 25                              | 2.7                  | -2.7                                                                           |
|                                 |                      |                                                                                |

| Low Power                       |                      |                                                                                |
|---------------------------------|----------------------|--------------------------------------------------------------------------------|
| Assigned Frequency: 547.600 MHz |                      |                                                                                |
| Environment Temperature (°C)    | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within +/- 27.38 kHz     |
| 50                              | 3.0                  | +7.9                                                                           |
| 40                              | 3.0                  | +6.8                                                                           |
| 30                              | 3.0                  | +5.5                                                                           |
| 20                              | 3.0                  | +1.8                                                                           |
| 10                              | 3.0                  | -1.5                                                                           |
| 0                               | 3.0                  | -2.4                                                                           |
| -10                             | 3.0                  | -4.7                                                                           |
| -20                             | 3.0                  | -4.9                                                                           |
| -30                             | 3.0                  | -5.3                                                                           |
| Environment Temperature (°C)    | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within Max +/- 27.38 kHz |
| 25                              | 3.0                  | +2.3                                                                           |
| 25                              | 2.7                  | -1.5                                                                           |
| 25                              | 2.7                  | -2.4                                                                           |
|                                 |                      |                                                                                |

| Low Power                       |                      |                                                                                |
|---------------------------------|----------------------|--------------------------------------------------------------------------------|
| Assigned Frequency: 557.600 MHz |                      |                                                                                |
| Environment Temperature (°C)    | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within +/- 27.88 kHz     |
| 50                              | 3.0                  | +8.1                                                                           |
| 40                              | 3.0                  | +6.9                                                                           |
| 30                              | 3.0                  | +5.5                                                                           |
| 20                              | 3.0                  | +4.2                                                                           |
| 10                              | 3.0                  | -1.2                                                                           |
| 0                               | 3.0                  | -2.5                                                                           |
| -10                             | 3.0                  | -2.8                                                                           |
| -20                             | 3.0                  | -3.7                                                                           |
| -30                             | 3.0                  | -4.9                                                                           |
| Environment Temperature (°C)    | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within Max +/- 27.88 kHz |
| 25                              | 3.0                  | +1.4                                                                           |
| 25                              | 2.7                  | -2.1                                                                           |
| 25                              | 2.7                  | -2.5                                                                           |
|                                 |                      |                                                                                |

| Low Power                       |                      |                                                                                |
|---------------------------------|----------------------|--------------------------------------------------------------------------------|
| Assigned Frequency: 566.400 MHz |                      |                                                                                |
| Environment Temperature (°C)    | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within +/- 28.32 kHz     |
| 50                              | 3.0                  | +7.9                                                                           |
| 40                              | 3.0                  | +6.3                                                                           |
| 30                              | 3.0                  | +6.5                                                                           |
| 20                              | 3.0                  | +5.7                                                                           |
| 10                              | 3.0                  | -4.5                                                                           |
| 0                               | 3.0                  | -3.7                                                                           |
| -10                             | 3.0                  | -4.8                                                                           |
| -20                             | 3.0                  | -5.7                                                                           |
| -30                             | 3.0                  | -5.9                                                                           |
| Environment Temperature (°C)    | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within Max +/- 28.32 kHz |
| 25                              | 3.0                  | +2.7                                                                           |
| 25                              | 2.7                  | -2.3                                                                           |
| 25                              | 2.7                  | -3.5                                                                           |
|                                 |                      |                                                                                |

| Low Power                       |                      |                                                                                |
|---------------------------------|----------------------|--------------------------------------------------------------------------------|
| Assigned Frequency: 576.000 MHz |                      |                                                                                |
| Environment Temperature (°C)    | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within +/- 28.80 kHz     |
| 50                              | 3.0                  | +8.6                                                                           |
| 40                              | 3.0                  | +6.9                                                                           |
| 30                              | 3.0                  | +5.3                                                                           |
| 20                              | 3.0                  | +4.2                                                                           |
| 10                              | 3.0                  | -3.7                                                                           |
| 0                               | 3.0                  | -4.7                                                                           |
| -10                             | 3.0                  | -5.2                                                                           |
| -20                             | 3.0                  | -5.6                                                                           |
| -30                             | 3.0                  | -5.9                                                                           |
| Environment Temperature (°C)    | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within Max +/- 28.80 kHz |
| 25                              | 3.0                  | +2.7                                                                           |
| 25                              | 2.7                  | -2.3                                                                           |
| 25                              | 2.7                  | -2.9                                                                           |
|                                 |                      |                                                                                |

| Low Power                       |                      |                                                                                |
|---------------------------------|----------------------|--------------------------------------------------------------------------------|
| Assigned Frequency: 586.000 MHz |                      |                                                                                |
| Environment Temperature (°C)    | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within +/- 29.30 kHz     |
| 50                              | 3.0                  | +8.3                                                                           |
| 40                              | 3.0                  | +6.6                                                                           |
| 30                              | 3.0                  | +6.1                                                                           |
| 20                              | 3.0                  | +4.2                                                                           |
| 10                              | 3.0                  | -3.7                                                                           |
| 0                               | 3.0                  | -4.2                                                                           |
| -10                             | 3.0                  | -4.8                                                                           |
| -20                             | 3.0                  | -5.4                                                                           |
| -30                             | 3.0                  | -6.7                                                                           |
| Environment Temperature (°C)    | Power Supplied (Vdc) | Frequency Measure with Time Elapsed<br>Total emission within Max +/- 29.30 kHz |
| 25                              | 3.0                  | +3.1                                                                           |
| 25                              | 2.7                  | -2.5                                                                           |
| 25                              | 2.7                  | -3.6                                                                           |
|                                 |                      |                                                                                |

Battery end point: 2.7Vdc

The results: The unit does meet the FCC requirements.

## 4.6. Modulation Characteristics

Test Requirement: FCC CFR 47 Part 74.e) 3)

Test Method: FCC CFR 47 Part 2.1047 & TIA/EIA 603 E 2016: Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

Requirements:

(e) For low power auxiliary stations operating in the bands allocated for TV broadcasting, the following technical requirements apply:

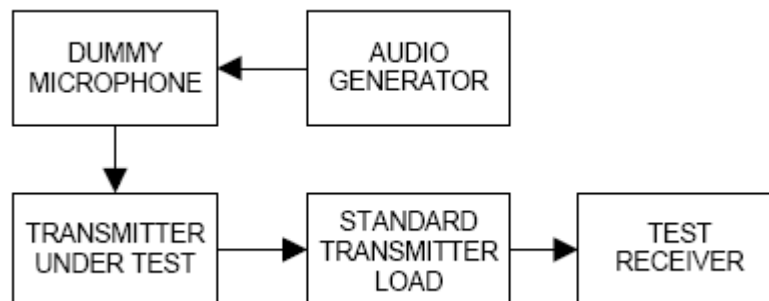
(3) Any form of modulation may be used. A maximum deviation of  $\pm 75$  kHz is permitted when frequency modulation is employed.

Test Procedure:

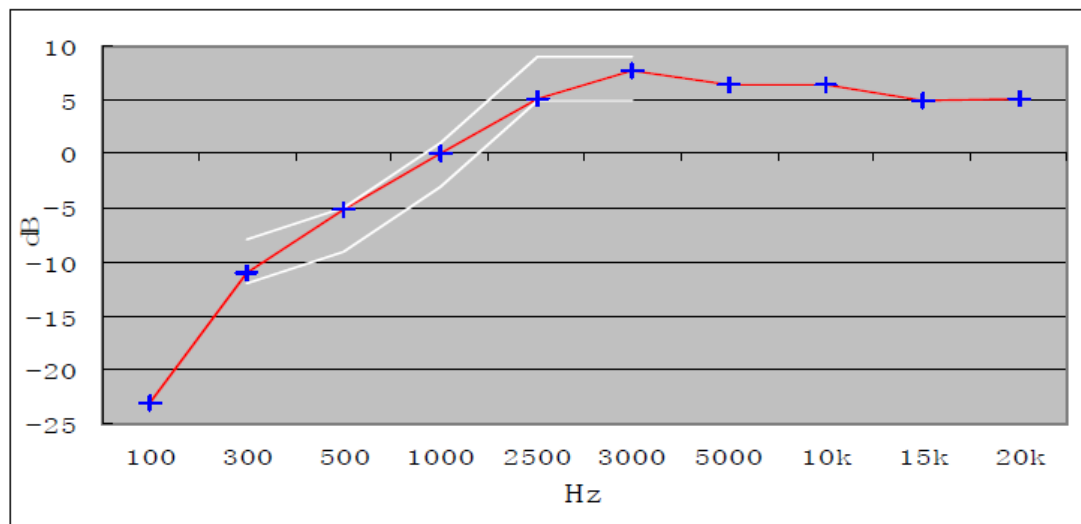
Audio Frequency Response

The RF output of the transceiver was connected to the input of FSP 30 with FM deviation module through sufficient attenuation so as not to overload the meter or distort the reading. An audio signal generator was connected to the audio input of microphone.

The audio signal input level was adjusted to obtain 20% of the maximum rated system deviation at 1 kHz, and recorded as DEV REF. With the audio signal generator level unchanged, set the generator frequency between 100 to 5000 Hz. The transmitter deviations (DEV FREQ) were measured and the audio frequency response was calculated as  $20\log_{10} [\text{DEV FREQ} / \text{DEV REF}]$



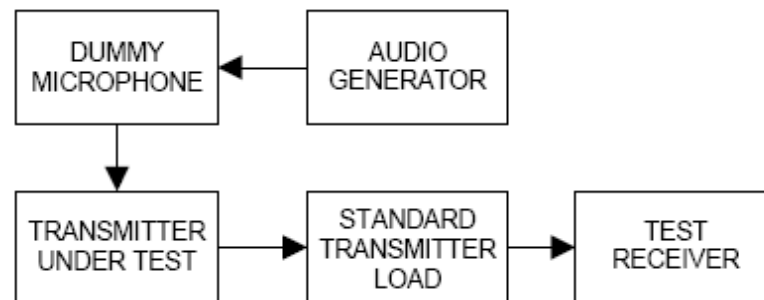
The plot(s) of Audio Frequency Response is presented hereinafter as reference.



0dB=10mV at 1kHz (20% of the maximum rated system deviation).

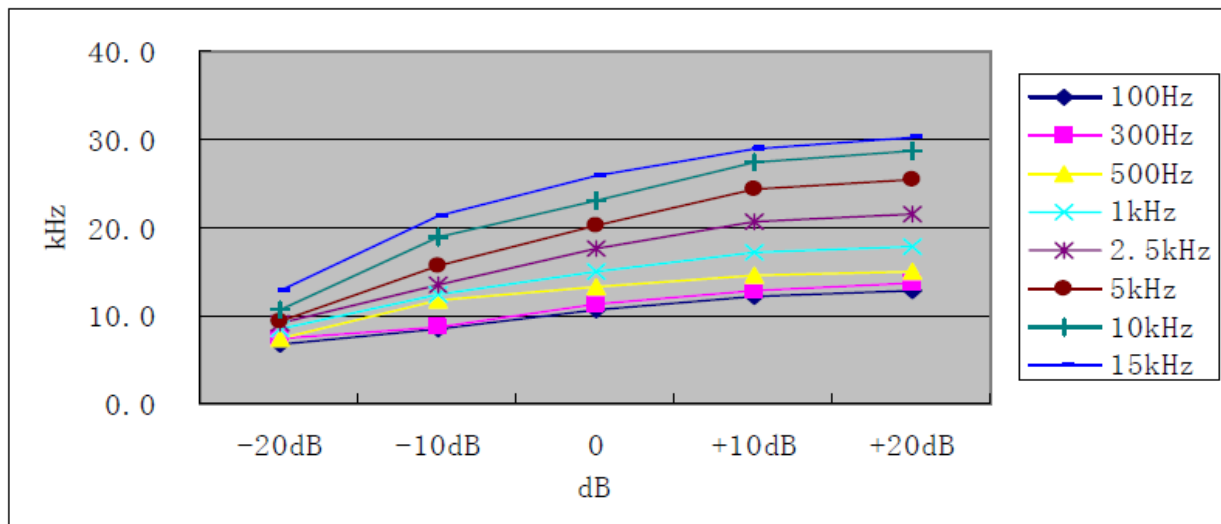
### Modulation Limiting

1. Adjust the transmitter per the manufacturer's procedure for full rated system deviation.  
Set the test receiver to measure peak positive deviation. Set the audio bandwidth for  $\leq 0.25$  Hz to  $\geq 15,000$  Hz. Turn the de-emphasis function off.
2. 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.
3. Increase the level from the audio frequency generator by 20 dB in one step (rise time between the 10% and 90% points shall be 0.1 second maximum).
4. Measure both the instantaneous and steady-state deviation at and after the time of increasing the audio input level.
5. With the level from the audio frequency generator held constant at the level obtained in step e), slowly vary the audio frequency from 100 to 15k Hz and observe the steady-state deviation. Record the maximum deviation.



Test at five different modulating frequencies (100Hz, 300Hz, 500Hz, 1kHz, 2.5kHz, 5kHz, 10kHz, 15kHz), the output level of the audio generator was varied up to 1V and the FM deviation level was recorded.

Positive peak deviation:

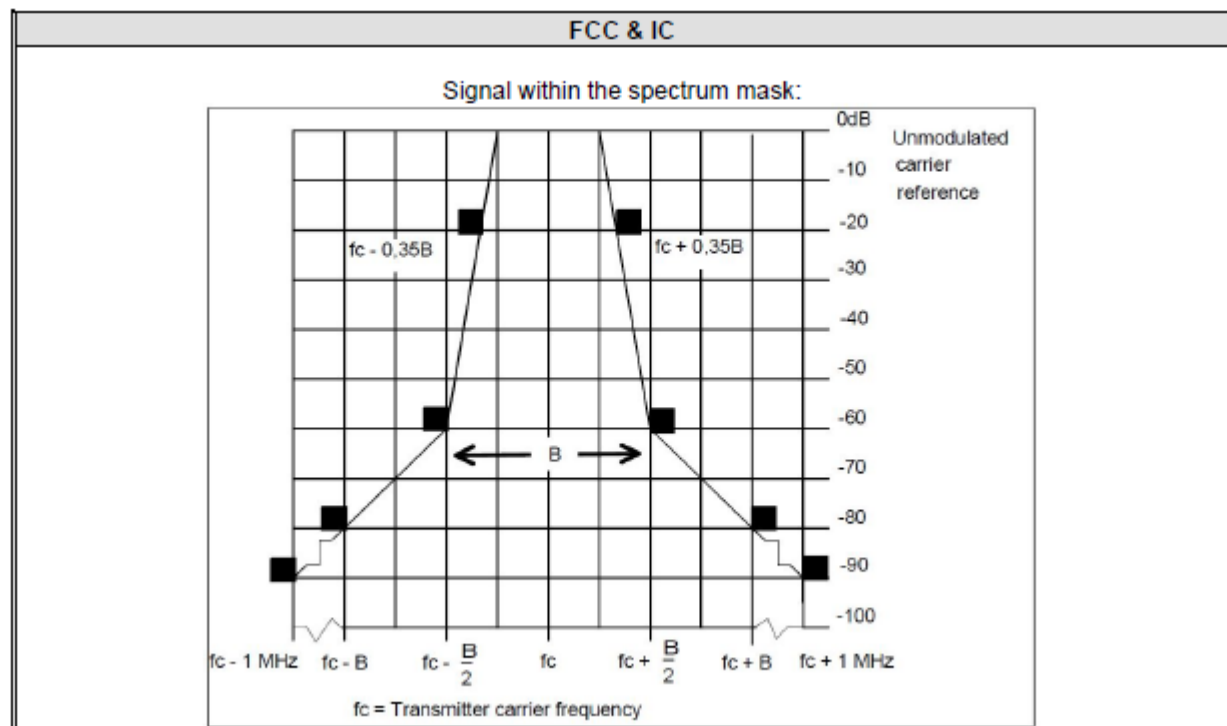


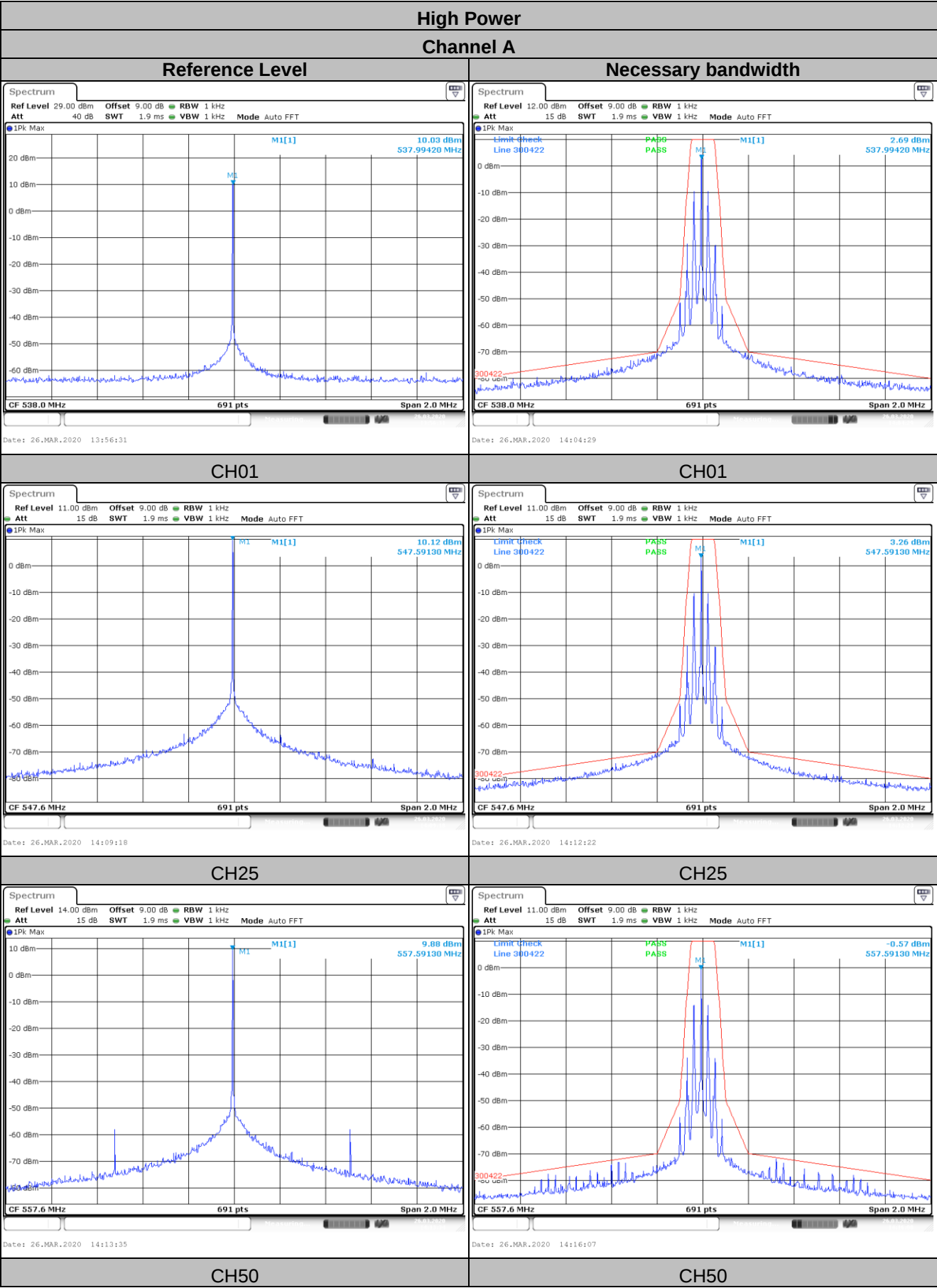
#### 4.7. Necessary bandwidth (BN) for analogue systems

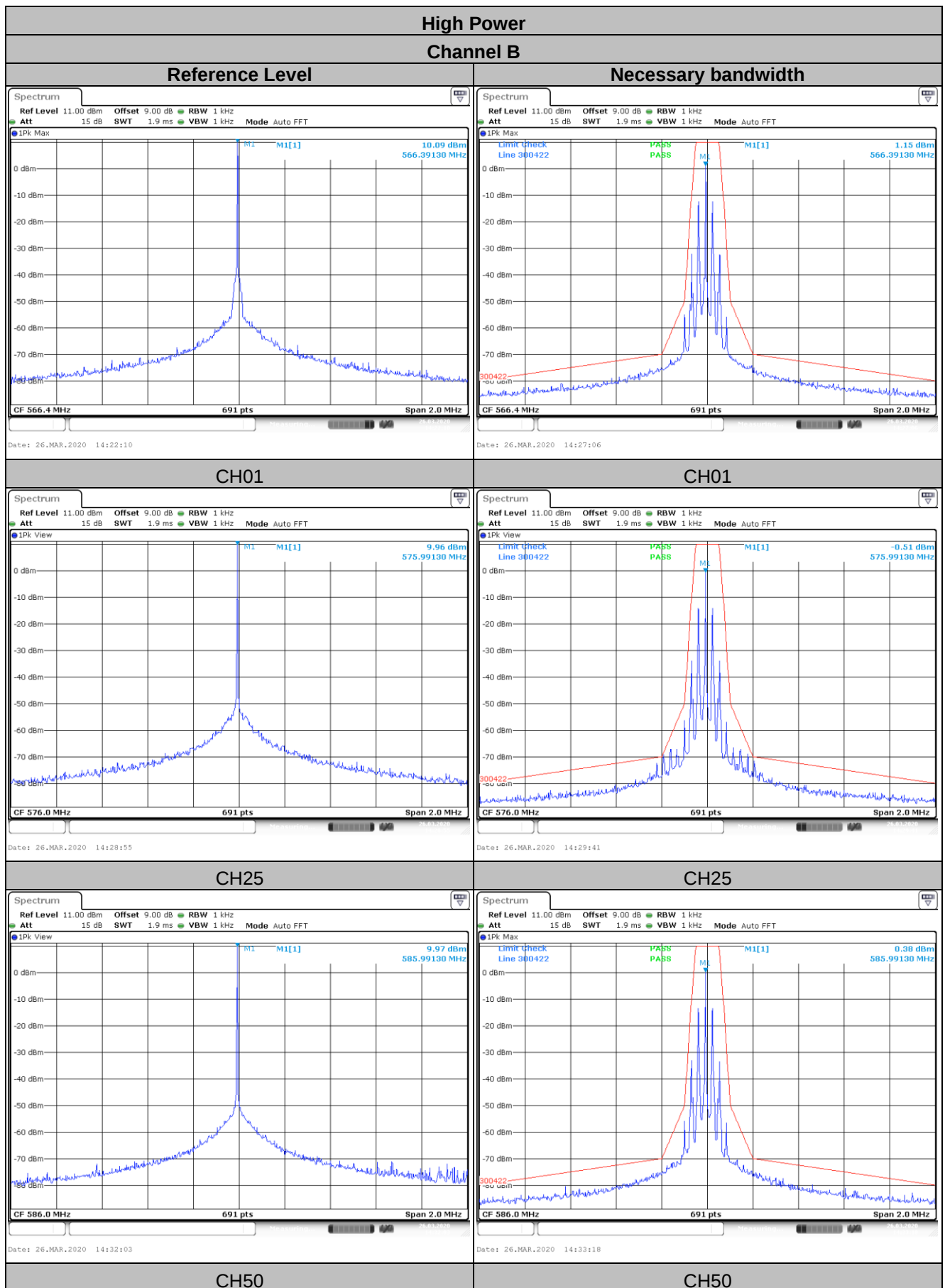
##### Measurement

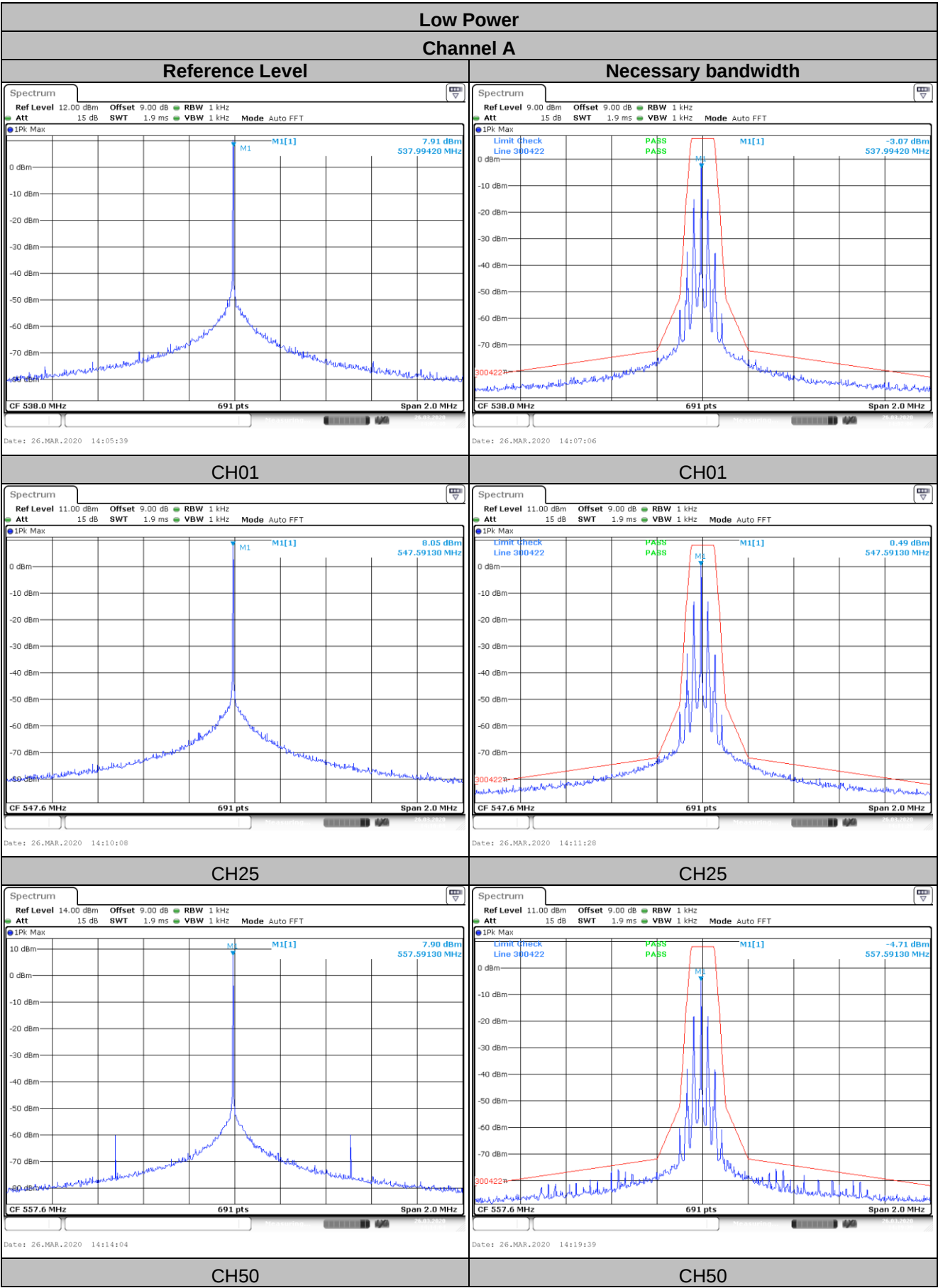
| Measurement parameter |                             |
|-----------------------|-----------------------------|
| Detector:             | Peak - Quasi Peak / Average |
| Sweep time:           | Auto                        |
| Resolution bandwidth: | 1 kHz                       |
| Video bandwidth:      | 1 kHz                       |
| Span:                 | Fc-1MHz to fc+1MHz(2MHz)    |
| Trace mode:           | Max Hold                    |

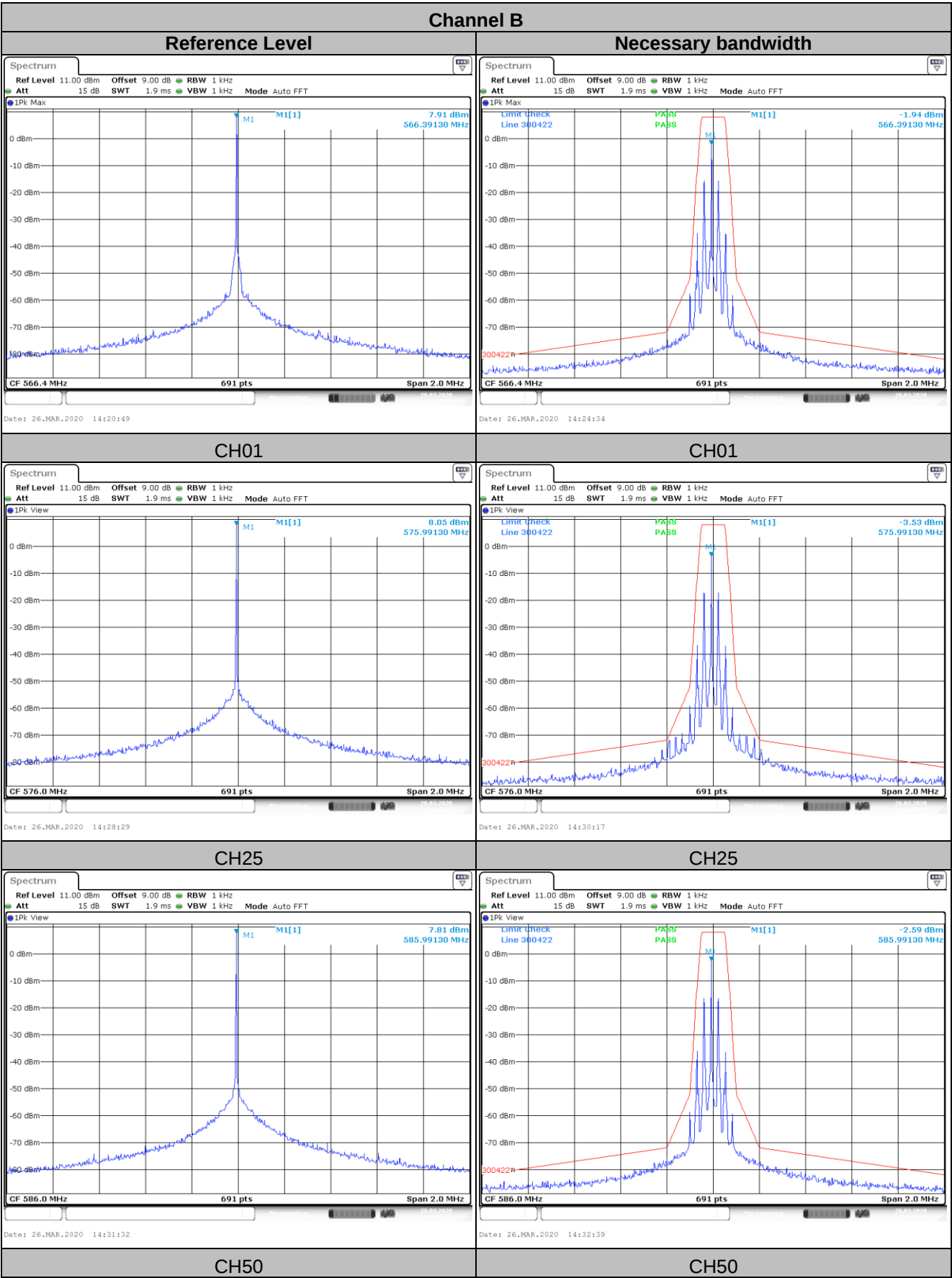
##### LIMIT











## 5. TEST SETUP PHOTOS OF THE EUT

Photo of Radiated Emissions Measurement



Fig. 1



Fig. 2

Photo of Conducted Emission Measurement



Fig. 3

## 6. EXTERNAL AND INTERNAL PHOTOS OF THE EUT

### 6.1.External photos of the EUT



Fig. 1



Fig. 2



Fig. 3



Fig. 4

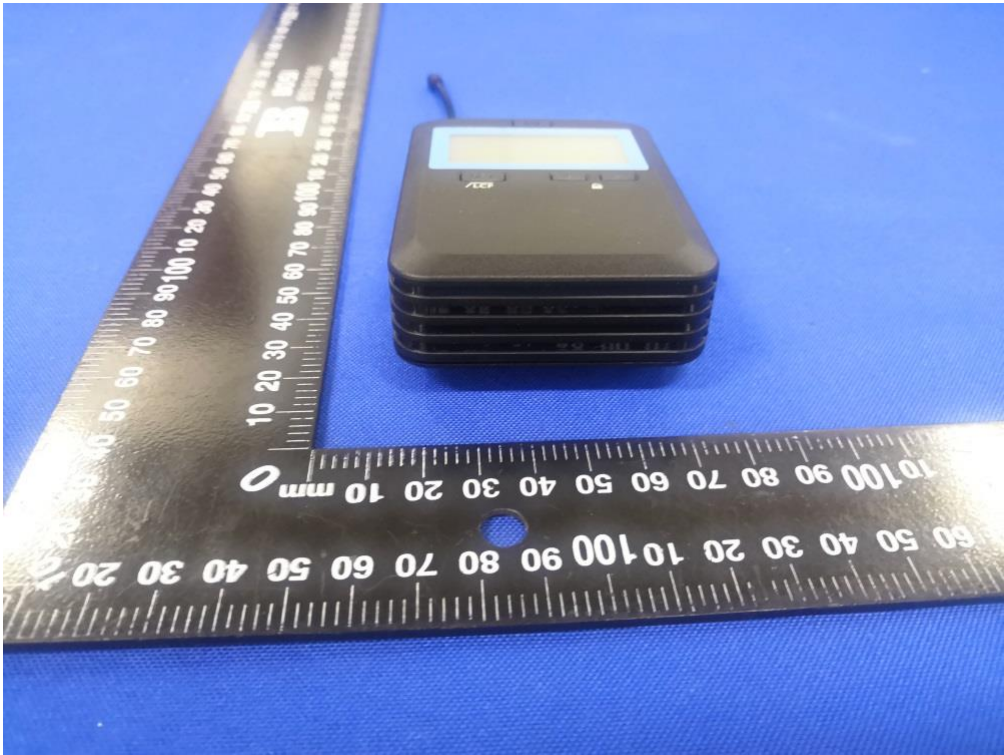


Fig. 5

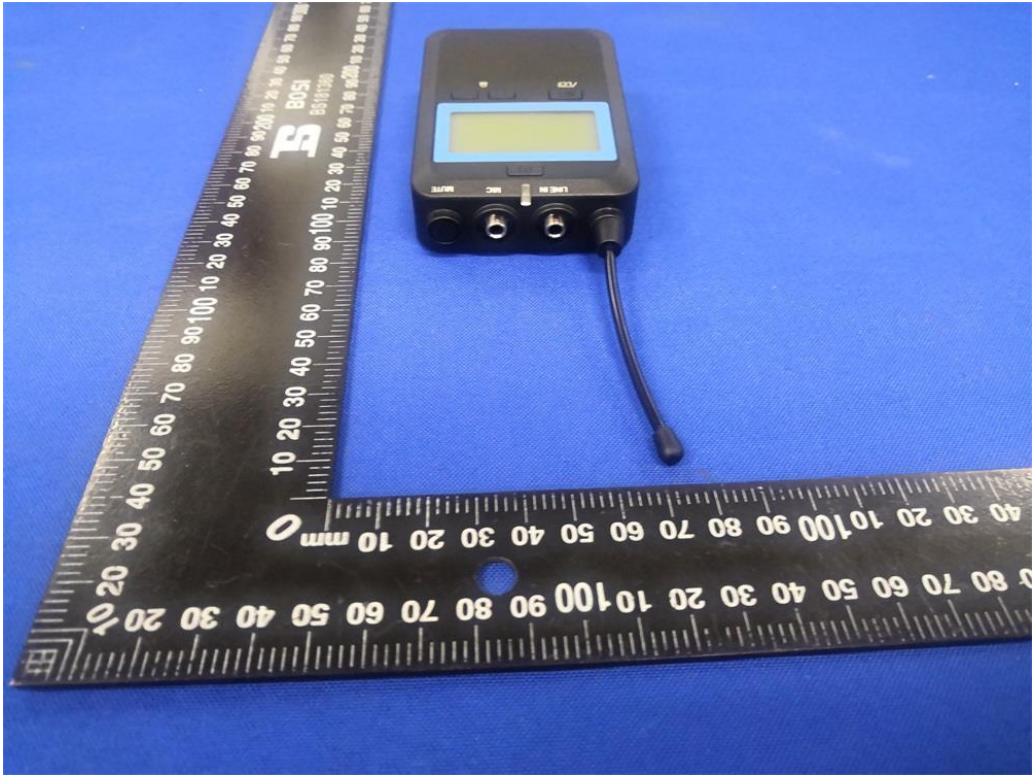


Fig. 6

## 6.2. Internal photos of the EUT



Fig. 7

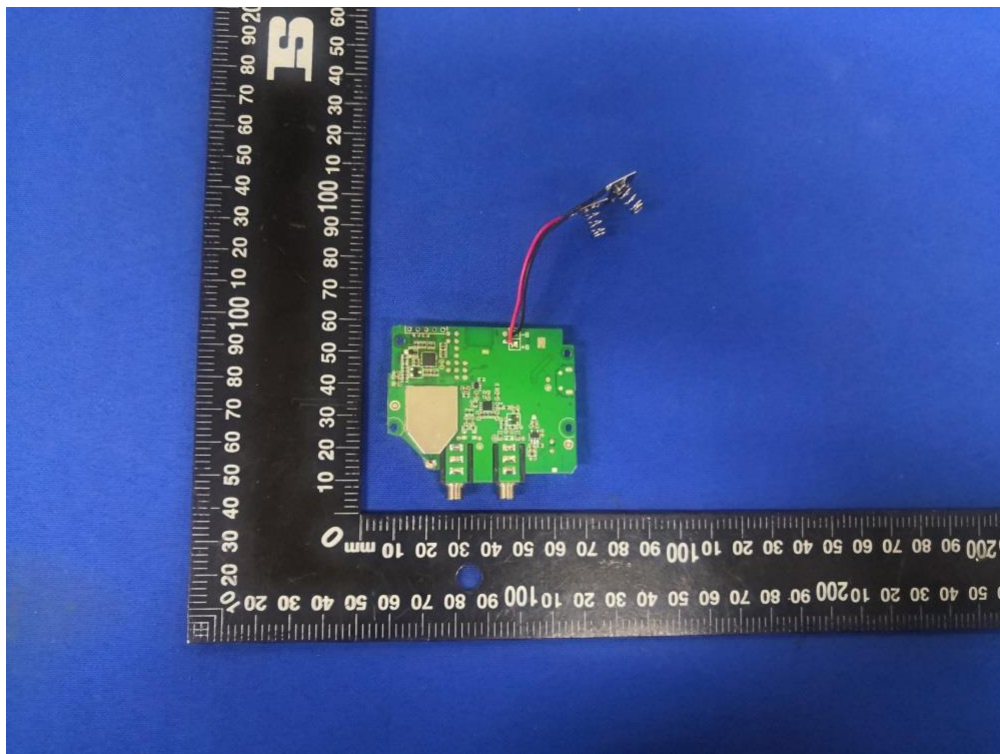


Fig. 8

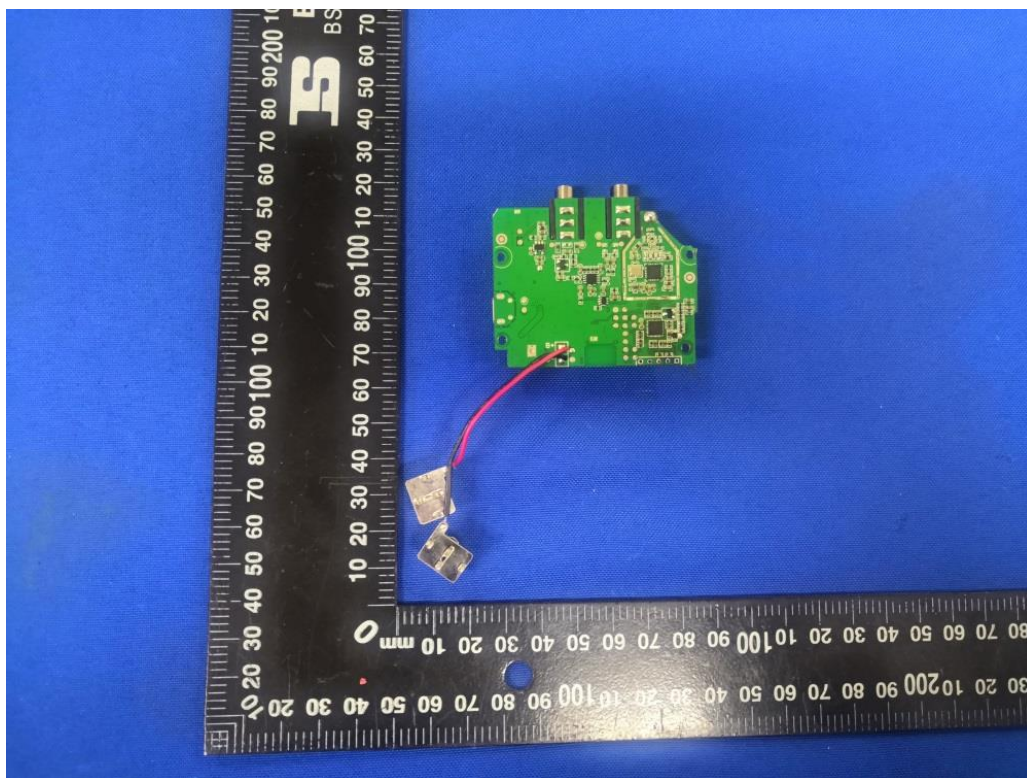


Fig. 9

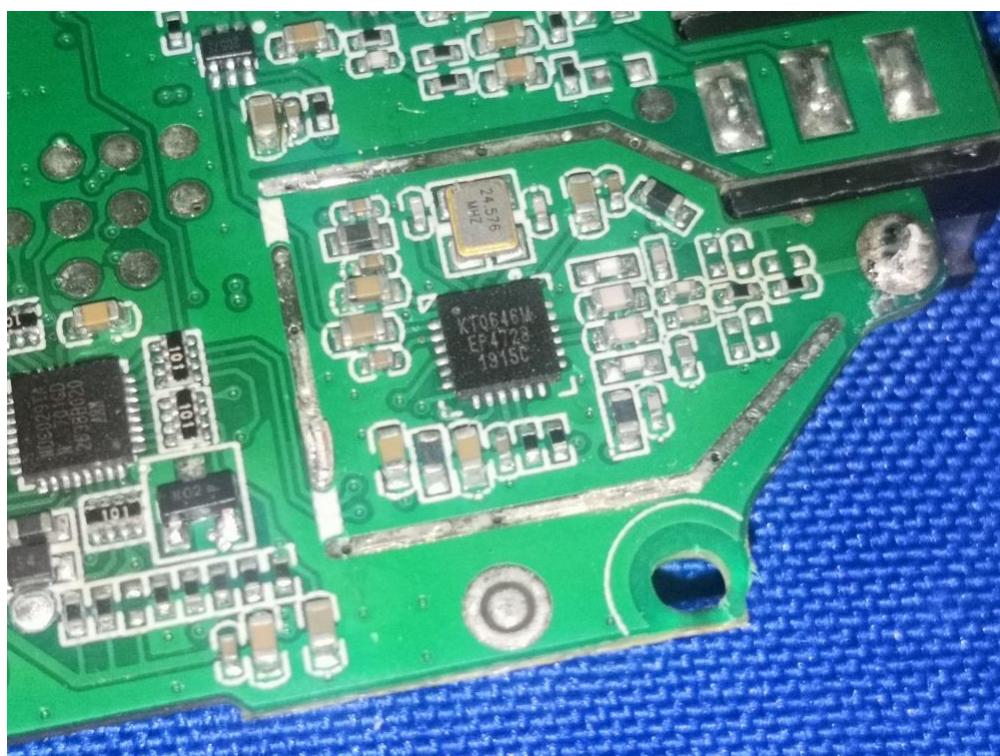


Fig. 10

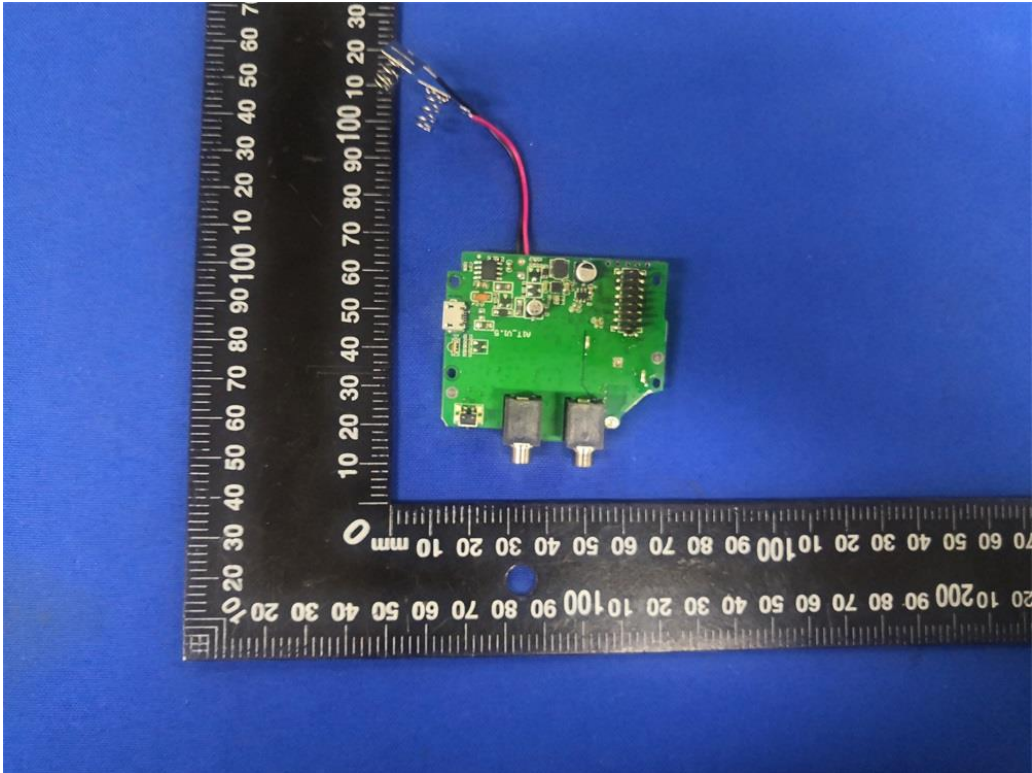


Fig. 11

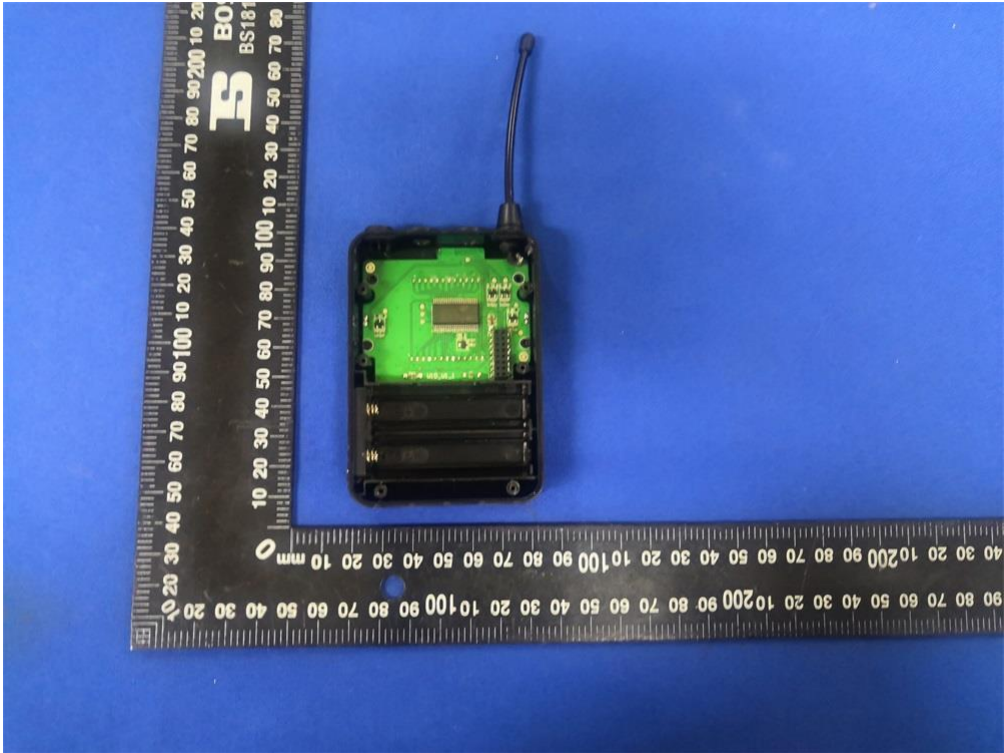


Fig. 12

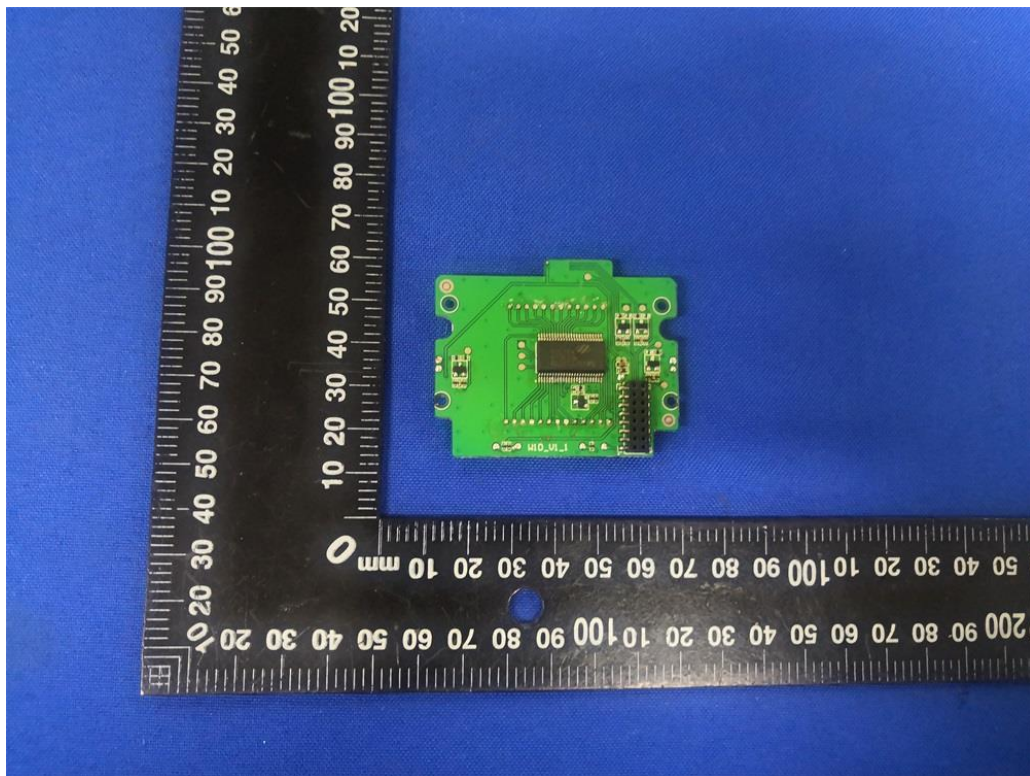


Fig. 13

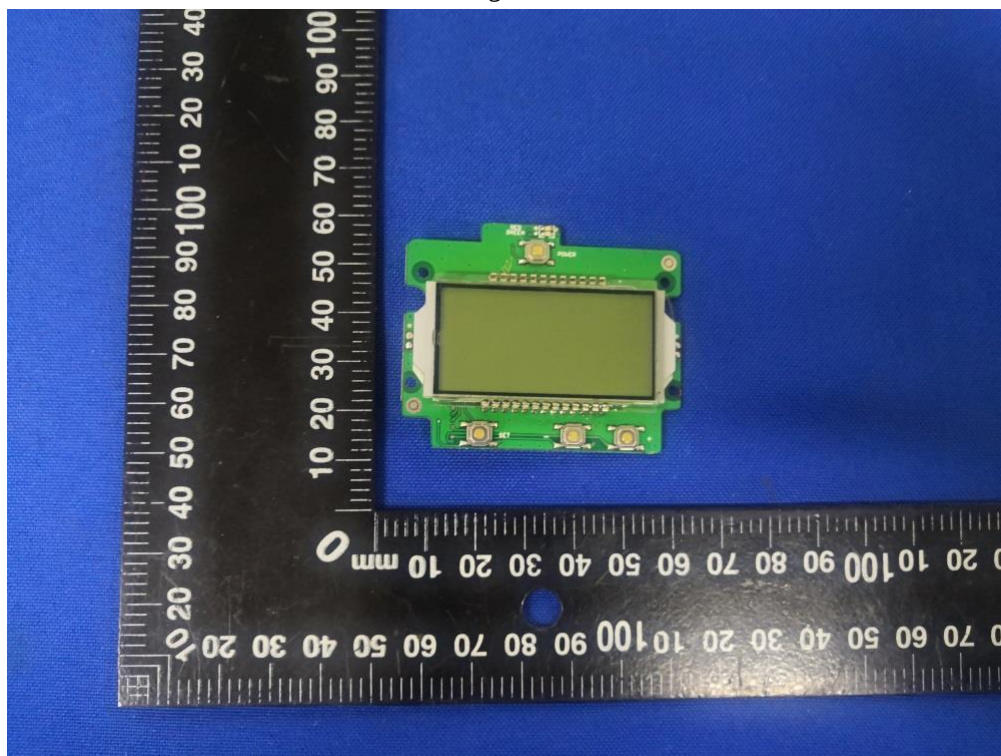


Fig. 14

.....End of Report.....