

# MEASUREMENT REPORT

## FCC PART 15.247 Bluetooth

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**FCC ID:** A2HCN6Q14D

**Applicant:** ALCO Electronics Limited.

**Application Type:** Certification

**Product:** Notebook

**Model No.:** NS14A6 D

**Serial Model No.:** CN6Q14 D

**Brand Name:** AVITA, VENTURER

**FCC Classification:** FCC Part 15 Spread Spectrum Transmitter (DSS)

**FCC Rule Part(s):** Part 15 Subpart C (Section 15.247)

**Test Procedure(s):** ANSI C63.10-2013

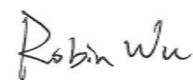
**Test Date:** July 24 ~ August 20, 2020

Reviewed By:



( Sunny Sun )

Approved By:



( Robin Wu )



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. Test results reported herein relate only to the item(s) tested.

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

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### Revision History

| Report No.    | Version | Description    | Issue Date | Note  |
|---------------|---------|----------------|------------|-------|
| 2007RSU054-U2 | Rev. 01 | Initial Report | 10-12-2020 | Valid |
|               |         |                |            |       |

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## General Information

|                              |                                                                                                            |
|------------------------------|------------------------------------------------------------------------------------------------------------|
| <b>Applicant:</b>            | ALCO Electronics Limited.                                                                                  |
| <b>Applicant Address:</b>    | 11/F Metropole Square, 2 On Yiu Street, Sha Tin, New Territories, Hong Kong                                |
| <b>Manufacturer:</b>         | ALCO Electronics Limited.                                                                                  |
| <b>Manufacturer Address:</b> | 11/F Metropole Square, 2 On Yiu Street, Sha Tin, New Territories, Hong Kong                                |
| <b>Test Site:</b>            | MRT Technology (Suzhou) Co., Ltd                                                                           |
| <b>Test Site Address:</b>    | D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China |

## Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Tian'edang Rd., Suzhou, China.

- MRT facility is an FCC accredited testing laboratory (MRT Designation No. CN1166) on the FCC website.
- MRT facility is an ISED recognized testing laboratory (MRT Reg. No. CN0001) on the ISED website.
- MRT facility is a VCCI registered (R-20025, G-20034, C-20020, T-20020) test laboratory with the site description on file at VCCI Council.
- MRT Lab is accredited to ISO 17025 by the A2LA under the A2LA Program (Cert. No. 3628.01) and CNAS under the CNAS Program (Cert. No. L10551) in EMC, Safety, Radio, Telecommunications and SAR testing.

## 1. INTRODUCTION

### 1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada and Certification and Engineering Bureau.

### 1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The measurement facility compliant with the test site requirements specified in ANSI C63.4-2014.



## 2. PRODUCT INFORMATION

### 2.1. Equipment Description

|                      |                                                                                                   |
|----------------------|---------------------------------------------------------------------------------------------------|
| Product Name:        | Notebook                                                                                          |
| Model No.:           | NS14A6 D                                                                                          |
| Serial Model No.:    | CN6Q14 D                                                                                          |
| Brand Name:          | AVITA, VENTURER                                                                                   |
| Wi-Fi Specification: | 802.11a/b/g/n/ac                                                                                  |
| Bluetooth Version:   | v4.2 dual mode                                                                                    |
| <b>Accessory</b>     |                                                                                                   |
| Adapter:             | MODEL: ADS-25SGP-12 12024E 2520<br>INPUT: 100-240V ~ 50/60Hz, Max. 0.7A<br>OUTPUT: 24W, 12Vdc, 2A |

Note: The different models are only for marketing different clients, others are the same.

### 2.2. Product Specification Subjective to this Standard

|                      |                                               |
|----------------------|-----------------------------------------------|
| Operating Frequency: | 2402~2480MHz                                  |
| Channel Number:      | 79                                            |
| Modulation:          | GFSK, Pi/4 DQPSK, 8DPSK                       |
| Data Rate:           | 1Mbps(GFSK), 2Mbps(Pi/4 DQPSK), 3Mbps (8DPSK) |

Note: For other features of this EUT, test report will be issued separately.

The test data contained in this report pertains only to the emissions due to the EUT's Bluetooth transmitter.

- 15.247(g): In accordance with the Bluetooth Industry Standard, the system is designed to comply with all of the regulations in Section 15.247 when the transmitter is presented with a continuous data (or information) system.
- 15.247(h): In accordance with the Bluetooth Industry Standard, the system does not coordinate its channels selection/ hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.
- 15.247(h): The EUT employs Adaptive Frequency Hopping (AFH) which identifies sources of interference namely devices operating in 802.11 WLAN and excludes them from the list of available channels. The process of re-mapping reduces the number of test channels from 79 channels to a minimum number of 20 channels.

### 2.3. Working Frequencies for this report

| Channel | Frequency | Channel | Frequency | Channel | Frequency |
|---------|-----------|---------|-----------|---------|-----------|
| 00      | 2402 MHz  | 01      | 2403 MHz  | 02      | 2404 MHz  |
| 03      | 2405 MHz  | 04      | 2406 MHz  | 05      | 2407 MHz  |
| 06      | 2408 MHz  | 07      | 2409 MHz  | 08      | 2410 MHz  |
| 09      | 2411 MHz  | 10      | 2412 MHz  | 11      | 2413 MHz  |
| 12      | 2414 MHz  | 13      | 2415 MHz  | 14      | 2416 MHz  |
| 15      | 2417 MHz  | 16      | 2418 MHz  | 17      | 2419 MHz  |
| 18      | 2420 MHz  | 19      | 2421 MHz  | 20      | 2422 MHz  |
| 21      | 2423 MHz  | 22      | 2424 MHz  | 23      | 2425 MHz  |
| 24      | 2426 MHz  | 25      | 2427 MHz  | 26      | 2428 MHz  |
| 27      | 2429 MHz  | 28      | 2430 MHz  | 29      | 2431 MHz  |
| 30      | 2432 MHz  | 31      | 2433 MHz  | 32      | 2434 MHz  |
| 33      | 2435 MHz  | 34      | 2436 MHz  | 35      | 2437 MHz  |
| 36      | 2438 MHz  | 37      | 2439 MHz  | 38      | 2440 MHz  |
| 39      | 2441 MHz  | 40      | 2442 MHz  | 41      | 2443 MHz  |
| 42      | 2444 MHz  | 43      | 2445 MHz  | 44      | 2446 MHz  |
| 45      | 2447 MHz  | 46      | 2448 MHz  | 47      | 2449 MHz  |
| 48      | 2450 MHz  | 49      | 2451 MHz  | 50      | 2452 MHz  |
| 51      | 2453 MHz  | 52      | 2454 MHz  | 53      | 2455 MHz  |
| 54      | 2456 MHz  | 55      | 2457 MHz  | 56      | 2458 MHz  |
| 57      | 2459 MHz  | 58      | 2460 MHz  | 59      | 2461 MHz  |
| 60      | 2462 MHz  | 61      | 2463 MHz  | 62      | 2464 MHz  |
| 63      | 2465 MHz  | 64      | 2466 MHz  | 65      | 2467 MHz  |
| 66      | 2468 MHz  | 67      | 2469 MHz  | 68      | 2470 MHz  |
| 69      | 2471 MHz  | 70      | 2472 MHz  | 71      | 2473 MHz  |
| 72      | 2474 MHz  | 73      | 2475 MHz  | 74      | 2476 MHz  |
| 75      | 2477 MHz  | 76      | 2478 MHz  | 77      | 2479 MHz  |
| 78      | 2480 MHz  | -       | -         | -       | -         |

## 2.4. Description of Available Antennas

| Antenna Type                     | Frequency Band (MHz) | Max Peak Antenna Gain (dBi) |
|----------------------------------|----------------------|-----------------------------|
| Main Antenna (WLAN / BT Antenna) |                      |                             |
| PIFA Antenna                     | 2400 ~ 2483.5        | 2.65                        |
|                                  | 5150 ~ 5250          | -0.30                       |
|                                  | 5725 ~ 5850          | 0.90                        |
| Aux Antenna (WLAN Antenna)       |                      |                             |
| PIFA Antenna                     | 2400 ~ 2483.5        | 4.14                        |
|                                  | 5150 ~ 5250          | 4.58                        |
|                                  | 5725 ~ 5850          | 5.26                        |

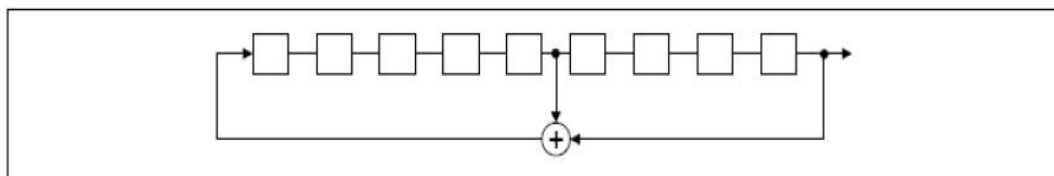
Note 1: This device only supports SISO mode.

Note 2: The antenna gains are declared by the manufacturer.

## 2.5. Pseudorandom Frequency Hopping Sequence

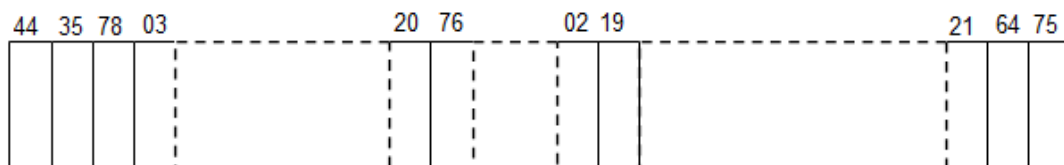
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONES; i.e. the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence:  $2^9 - 1 = 511$  bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.

The system receivers have input bandwidths that match the hopping channel bandwidths of their Corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

## 2.6. Test Mode

|           |                          |
|-----------|--------------------------|
| Test Mode | Mode 1: Transmit by DH5  |
|           | Mode 2: Transmit by 2DH5 |
|           | Mode 3: Transmit by 3DH5 |

## 2.7. Test Software

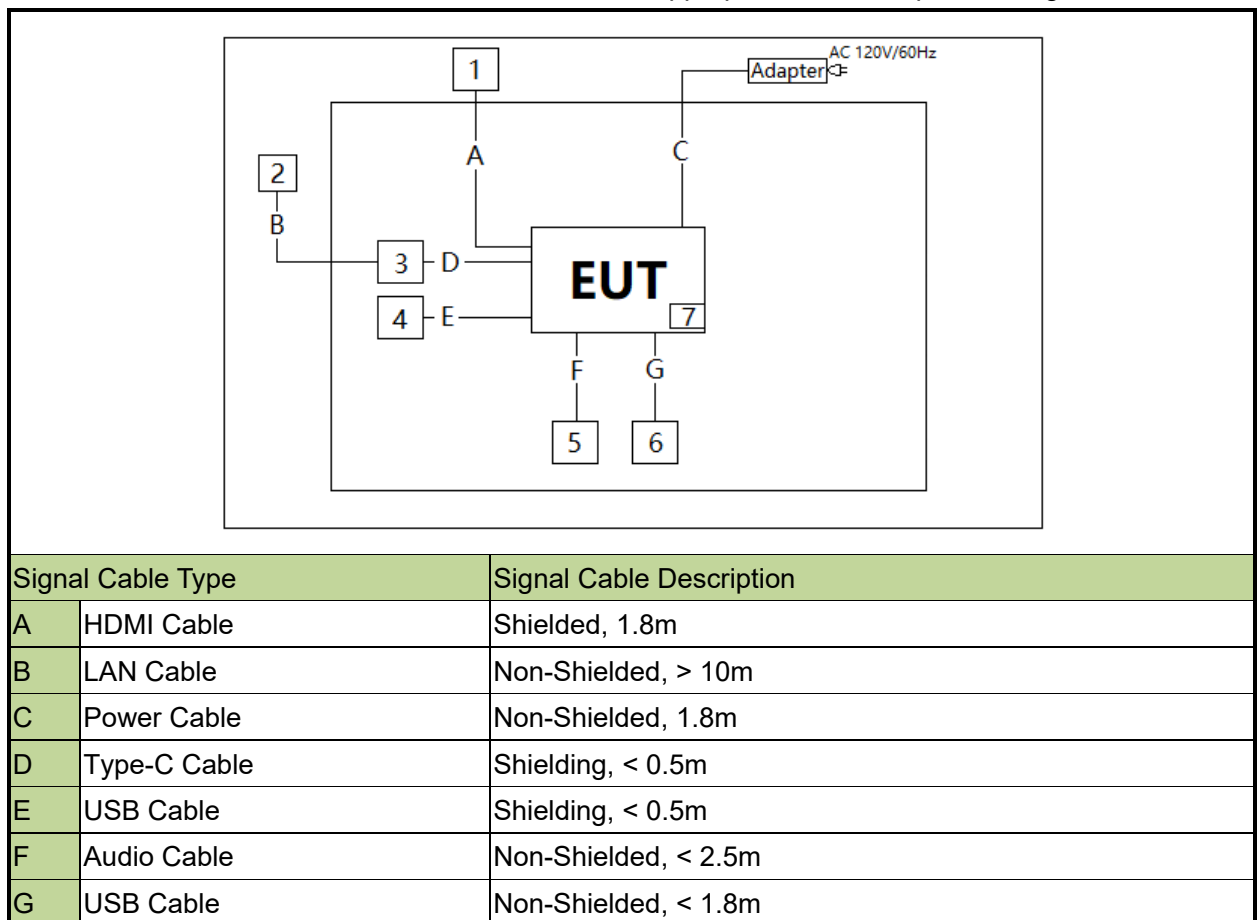
The test utility software used during testing was “Bluetooth MP Tool”.

## 2.8. Test Environment Condition

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

## 2.9. Description of Test Configuration

The ANSI C63.10: 2013 was used to reference the appropriate EUT setup for testing.



## 2.10. Test System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

| Product     | Manufacturer | Model No.  |
|-------------|--------------|------------|
| 1 Monitor   | SAMSUNG      | U32H850UMC |
| 2 Notebook  | Lenovo       | E495       |
| 3 GIGABIT   | UGREEN       | N/A        |
| 4 Hard Disk | ORICO        | 500G       |
| 5 Headset   | Logitech     | N/A        |
| 6 Mouse     | Dell         | MS111-L    |
| 7 SD Card   | Kingston     | Micro SD   |

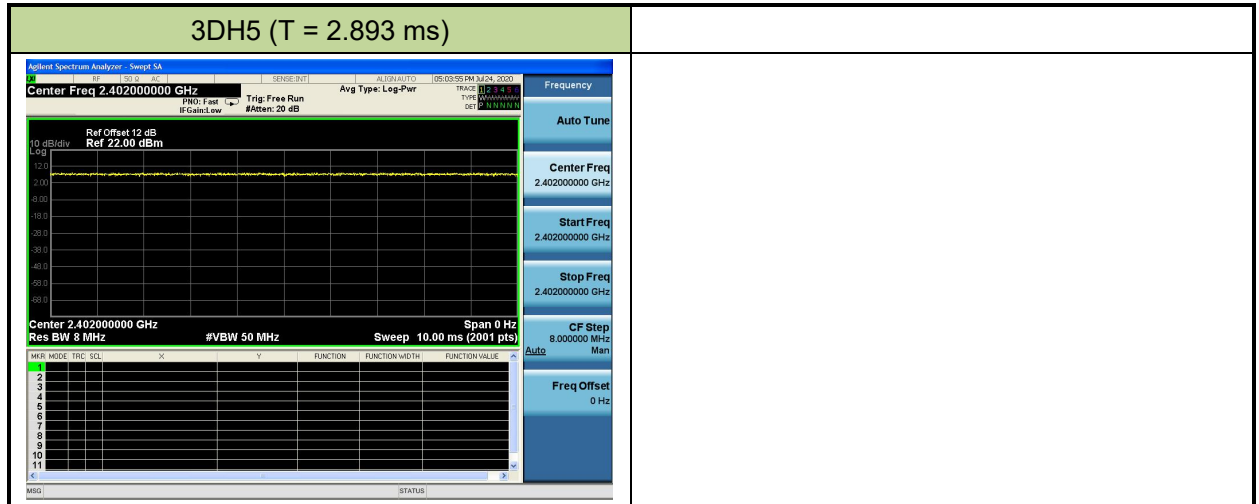
## 2.11. Duty Cycle

The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz.

The duty cycles are as follows:

| Test Mode | Duty Cycle |
|-----------|------------|
| DH5       | 100%       |
| 2DH5      | 100%       |
| 3DH5      | 100%       |





### 3. ANTENNA REQUIREMENTS

**Excerpt from §15.203 of the FCC Rules/Regulations:**

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”

- The antenna of the device is **permanently attached**.
- There are no provisions for connection to an external antenna.

**Conclusion:**

The device complies with the requirement of §15.203.

#### 4. TEST EQUIPMENT CALIBRATION DATE

##### Conducted Emissions - SR2

| Instrument         | Manufacturer | Type No.    | Asset No.   | Cali. Interval | Cali. Due Date |
|--------------------|--------------|-------------|-------------|----------------|----------------|
| EMI Test Receiver  | R&S          | ESR3        | MRTSUE06185 | 1 year         | 2021/01/18     |
| Two-Line V-Network | R&S          | ENV 216     | MRTSUE06002 | 1 year         | 2021/06/11     |
| Two-Line V-Network | R&S          | ENV 216     | MRTSUE06003 | 1 year         | 2021/06/11     |
| Thermal Hygrometer | testo        | 608-H1      | MRTSUE06404 | 1 year         | 2021/07/26     |
| Shielding Room     | MIX-BEP      | Chamber-SR2 | MRTSUE06215 | N/A            | N/A            |

##### Radiated Emissions - AC1

| Instrument                 | Manufacturer | Type No.    | Asset No.   | Cali. Interval | Cali. Due Date |
|----------------------------|--------------|-------------|-------------|----------------|----------------|
| EMI Test Receiver          | R&S          | ESR7        | MRTSUE06001 | 1 year         | 2021/01/18     |
| PXA Signal Analyzer        | Keysight     | N9030B      | MRTSUE06395 | 1 year         | 2020/09/03     |
| Loop Antenna               | Schwarzbeck  | FMZB 1519   | MRTSUE06025 | 1 year         | 2020/11/13     |
| Bilog Period Antenna       | Schwarzbeck  | VULB 9168   | MRTSUE06172 | 1 year         | 2021/04/03     |
| Horn Antenna               | Schwarzbeck  | BBHA 9120D  | MRTSUE06023 | 1 year         | 2020/10/13     |
| Horn Antenna               | Schwarzbeck  | BBHA9170    | MRTSUE06597 | 1 year         | 2020/12/17     |
| Microwave System Amplifier | Agilent      | 83017A      | MRTSUE06076 | 1 year         | 2020/11/15     |
| Preamplifier               | Schwarzbeck  | BBV 9721    | MRTSUE06121 | 1 year         | 2021/06/11     |
| Thermal Hygrometer         | testo        | 608-H1      | MRTSUE06403 | 1 year         | 2021/07/26     |
| Anechoic Chamber           | TDK          | Chamber-AC1 | MRTSUE06212 | 1 year         | 2021/04/30     |

##### Radiated Emission - AC2

| Instrument                     | Manufacturer | Type No.    | Asset No.   | Cali. Interval | Cali. Due Date |
|--------------------------------|--------------|-------------|-------------|----------------|----------------|
| MXE EMI Receiver               | Keysight     | N9038A      | MRTSUE06125 | 1 year         | 2021/07/02     |
| Loop Antenna                   | Schwarzbeck  | FMZB 1519   | MRTSUE06025 | 1 year         | 2020/11/13     |
| Bilog Period Antenna           | Schwarzbeck  | VULB 9162   | MRTSUE06022 | 1 year         | 2020/10/13     |
| Broad-Band Horn Antenna        | Schwarzbeck  | BBHA 9120D  | MRTSUE06171 | 1 year         | 2020/10/27     |
| Horn Antenna                   | Schwarzbeck  | BBHA9170    | MRTSUE06597 | 1 year         | 2020/12/17     |
| Broadband Coaxial Preamplifier | Schwarzbeck  | BBV 9718    | MRTSUE06176 | 1 year         | 2020/11/15     |
| Preamplifier                   | Schwarzbeck  | BBV 9721    | MRTSUE06121 | 1 year         | 2021/06/11     |
| Thermal Hygrometer             | Minggao      | ETH529      | MRTSUE06170 | 1 year         | 2020/12/15     |
| Anechoic Chamber               | RIKEN        | Chamber-AC2 | MRTSUE06213 | 1 year         | 2021/04/30     |

## Conducted Test Equipment - TR3

| Instrument                             | Manufacturer | Type No.    | Asset No.   | Cali. Interval | Cali. Due Date |
|----------------------------------------|--------------|-------------|-------------|----------------|----------------|
| EXA Signal Analyzer                    | Agilent      | N9020A      | MRTSUE06106 | 1 year         | 2021/04/14     |
| EXA Signal Analyzer                    | Keysight     | N9010B      | MRTSUE06607 | 1 year         | 2021/01/08     |
| Signal Analyzer                        | R&S          | FSV40       | MRTSUE06218 | 1 year         | 2021/04/14     |
| Power Meter                            | Agilent      | U2021XA     | MRTSUE06030 | 1 year         | 2020/11/18     |
| USB wideband power sensor              | Keysight     | U2021XA     | MRTSUE06446 | 1 year         | 2021/06/11     |
| USB wideband power sensor              | Keysight     | U2021XA     | MRTSUE06447 | 1 year         | 2021/06/11     |
| Bluetooth Test Set                     | Anritsu      | MT8852B-042 | MRTSUE06389 | 1 year         | 2021/06/11     |
| Audio Analyzer                         | Agilent      | U8903B      | MRTSUE06143 | 1 year         | 2021/06/11     |
| Modulation Analyzer                    | HP           | HP8901A     | MRTSUE06098 | 1 year         | 2020/10/10     |
| Wideband Radio<br>Communication Tester | R&S          | CMW 500     | MRTSUE06243 | 1 year         | 2020/11/07     |
| DC Power Supply                        | GWINSTEK     | DPS-3303C   | MRTSUE06064 | N/A            | N/A            |
| Temperature & Humidity<br>Chamber      | BAOYT        | BYH-150CL   | MRTSUE06051 | 1 year         | 2020/11/07     |
| Thermal Hygrometer                     | testo        | 608-H1      | MRTSUE06401 | 1 year         | 2021/07/26     |

| Software     | Version | Function          |
|--------------|---------|-------------------|
| EMI Software | V3      | EMI Test Software |

## 5. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k = 2$ .

|                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>AC Conducted Emission Measurement</b>                                                                                                                                                                                                  |
| Measurement Uncertainty for a Level of Confidence of 95% ( $U=2U_c(y)$ ):<br>9kHz~150kHz: 3.74dB<br>150kHz~30MHz: 3.44dB                                                                                                                  |
| <b>Radiated Disturbance</b>                                                                                                                                                                                                               |
| Measurement Uncertainty for a Level of Confidence of 95% ( $U=2U_c(y)$ ):<br>Horizontal: 30MHz~300MHz: 5.04dB<br>300MHz~1GHz: 4.95dB<br>1GHz~40GHz: 6.40dB<br>Vertical: 30MHz~300MHz: 5.24dB<br>300MHz~1GHz: 6.03dB<br>1GHz~40GHz: 6.40dB |
| <b>Spurious Emissions, Conducted</b>                                                                                                                                                                                                      |
| Measurement Uncertainty for a Level of Confidence of 95% ( $U=2U_c(y)$ ):<br>0.78dB                                                                                                                                                       |
| <b>Output Power</b>                                                                                                                                                                                                                       |
| Measurement Uncertainty for a Level of Confidence of 95% ( $U=2U_c(y)$ ):<br>1.13dB                                                                                                                                                       |
| <b>Power Spectrum Density</b>                                                                                                                                                                                                             |
| Measurement Uncertainty for a Level of Confidence of 95% ( $U=2U_c(y)$ ):<br>1.15dB                                                                                                                                                       |
| <b>Occupied Bandwidth</b>                                                                                                                                                                                                                 |
| Measurement Uncertainty for a Level of Confidence of 95% ( $U=2U_c(y)$ ):<br>0.28%                                                                                                                                                        |

## 6. TEST RESULT

### 6.1. Summary

| FCC Part Section(s) | Test Description                                                                 | Test Limit                                                                     | Test Condition | Test Result | Reference          |
|---------------------|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------|----------------|-------------|--------------------|
| 15.247(a)(1)        | 20dB Bandwidth                                                                   | N/A                                                                            | Conducted      | Pass        | Section 6.2        |
| 15.247(b)(1)        | Peak Transmitter Output Power                                                    | <1 Watt if > 75 non-overlapping channels used                                  |                | Pass        | Section 6.3        |
| 15.247(a)(1)        | Channel Separation                                                               | > 2/3 of 20 dB BW for systems with Output Power < 125mW                        |                | Pass        | Section 6.4        |
| 15.247(a)(1) (iii)  | Number of Channels                                                               | > 15 Channels                                                                  |                | Pass        | Section 6.5        |
| 15.247(a)(1) (iii)  | Time of Occupancy                                                                | < 0.4 sec in 31.6 sec period                                                   |                | Pass        | Section 6.6        |
| 15.247(d)           | Band Edge / out-of-Band Emissions                                                | Conducted $\geq$ 20dBc                                                         |                | Pass        | Section 6.7 & 6.8  |
| 15.205, 15.209      | General Field Strength Limits<br>(Restricted Bands and Radiated Emission Limits) | Emissions in restricted bands must meet the radiated limits detailed in 15.209 | Radiated       | Pass        | Section 6.9 & 6.10 |
| 15.207              | AC Conducted Emissions<br>150kHz - 30MHz                                         | < FCC 15.207 limits                                                            | Line Conducted | Pass        | Section 6.11       |

#### Notes:

- 1) All modes of operation and data rates were investigated. For radiated emission test, the test results shown in the following sections represent the worst case emissions.
- 2) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.

## 6.2. 20dB Bandwidth Measurement

### 6.2.1. Test Limit

N/A

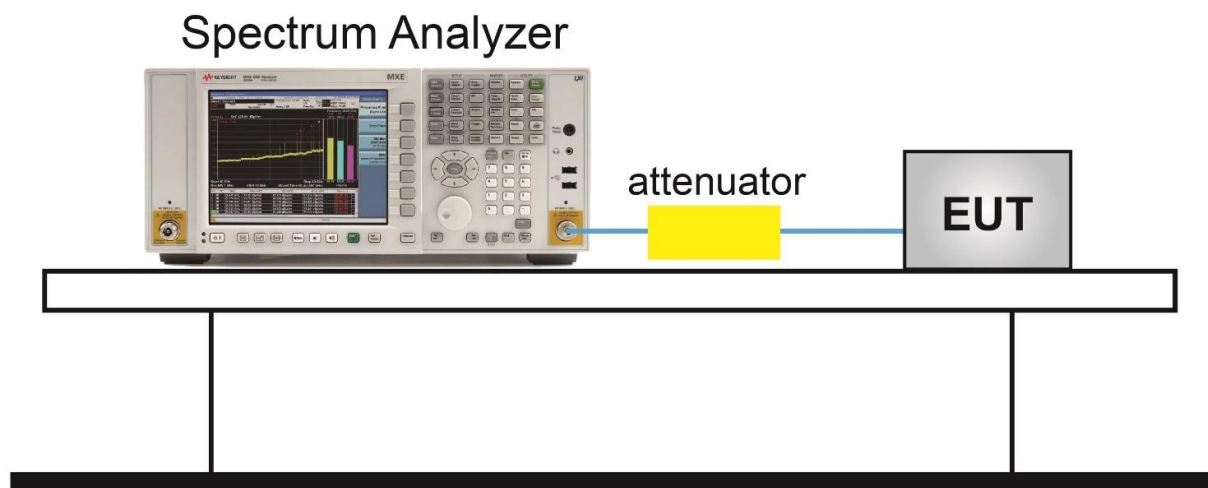
### 6.2.2. Test Procedure used

ANSI C63.10-2013 - Section 6.9.2

### 6.2.3. Test Setting

1. Set the spectrum span range to overlap the nominal center frequency
2. Set span = 2 ~ 5 times the OBW
3. Set RBW = 1% ~ 5% of the OBW
4. VBW  $\geq 3 \times$  RBW
5. Detector = Peak
6. Trace mode = max hold
7. Sweep = auto couple
8. Allow the trace to stabilize

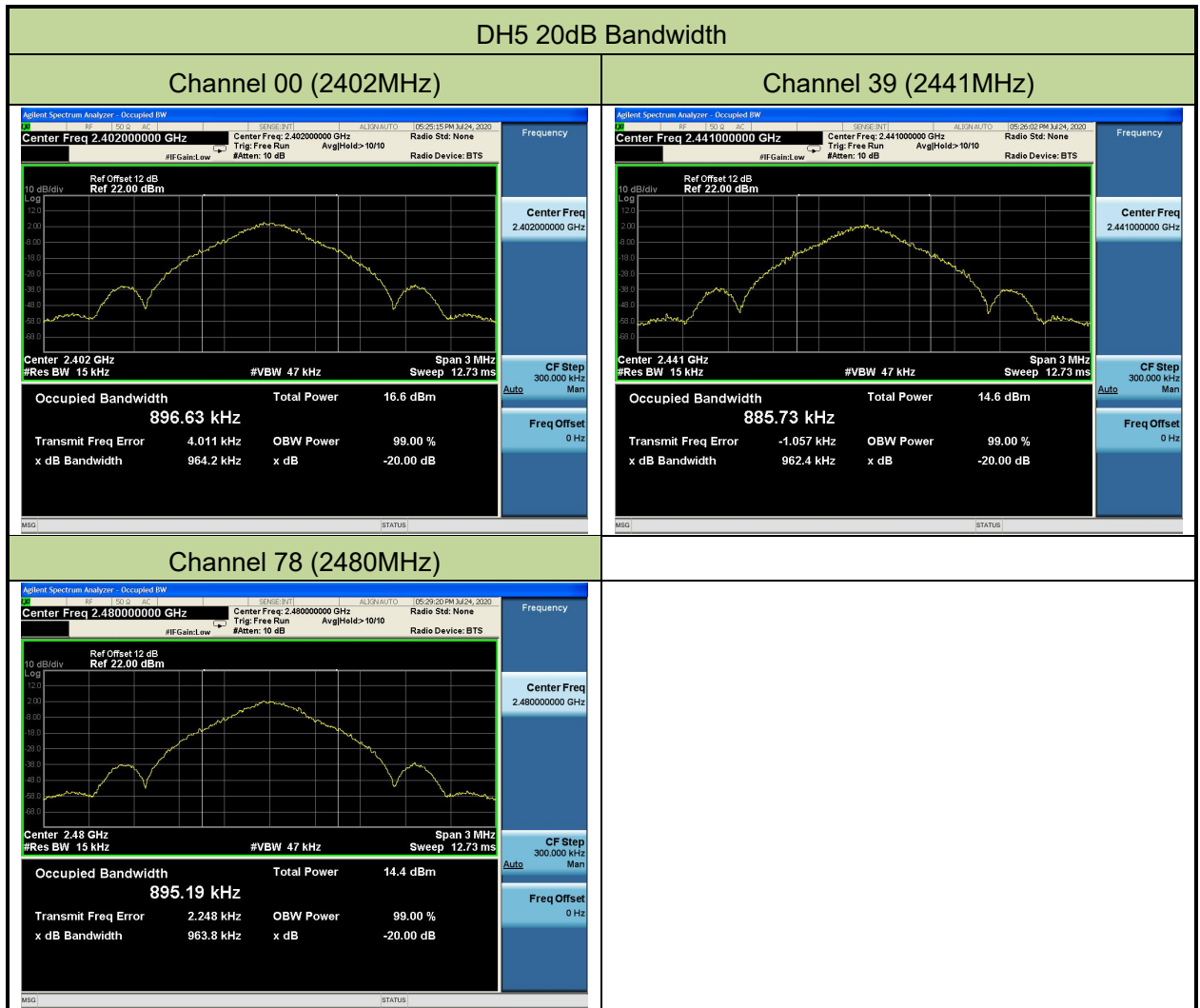
### 6.2.4. Test Setup



### 6.2.5. Test Result

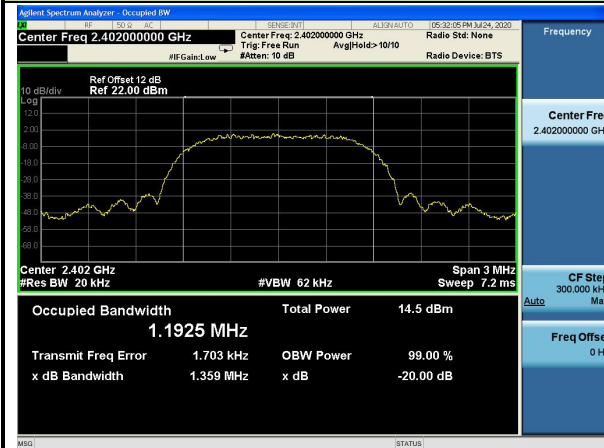
|           |          |               |            |
|-----------|----------|---------------|------------|
| Product   | Notebook | Test Engineer | Dandy Li   |
| Test Site | TR3      | Test Date     | 2020/07/24 |

| Test Mode | Channel No. | Frequency (MHz) | 20dB Bandwidth (kHz) | Result |
|-----------|-------------|-----------------|----------------------|--------|
| DH5       | 00          | 2402            | 964.2                | Pass   |
| DH5       | 39          | 2441            | 962.4                | Pass   |
| DH5       | 78          | 2480            | 963.8                | Pass   |
| 2DH5      | 00          | 2402            | 1359.0               | Pass   |
| 2DH5      | 39          | 2441            | 1360.0               | Pass   |
| 2DH5      | 78          | 2480            | 1343.0               | Pass   |
| 3DH5      | 00          | 2402            | 1363.0               | Pass   |
| 3DH5      | 39          | 2441            | 1363.0               | Pass   |
| 3DH5      | 78          | 2480            | 1357.0               | Pass   |



## 2DH5 20dB Bandwidth

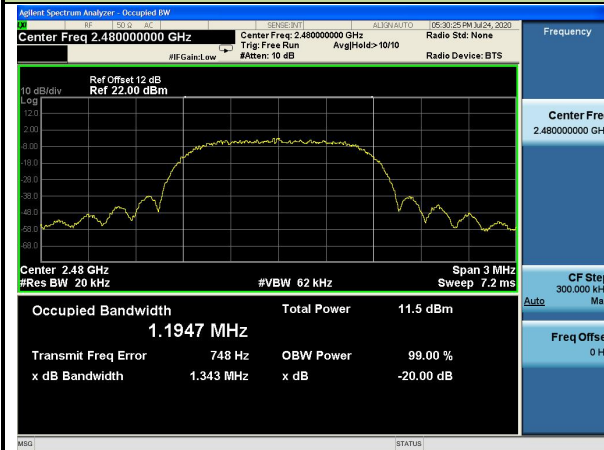
### Channel 00 (2402MHz)



### Channel 39 (2441MHz)

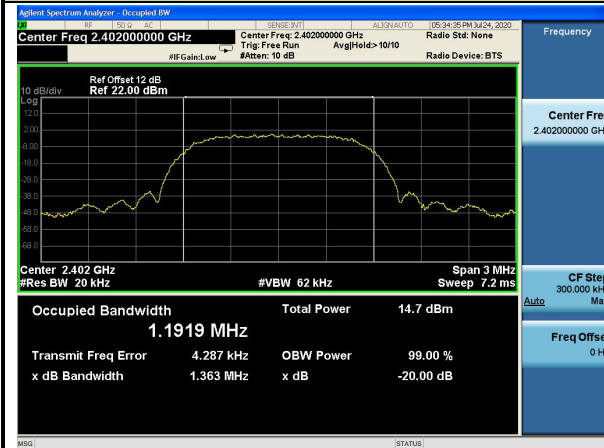


### Channel 78 (2480MHz)



### 3DH5 20dB Bandwidth

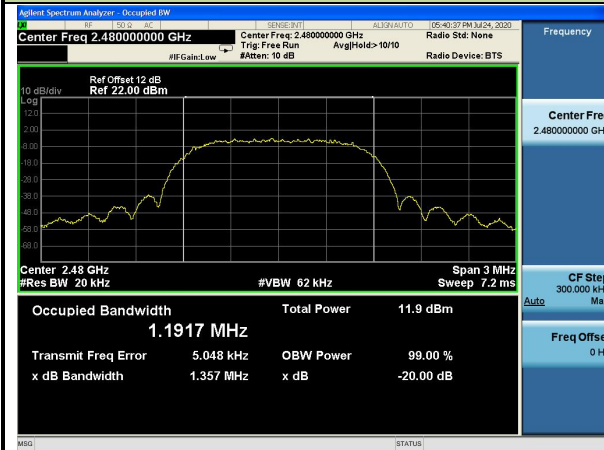
#### Channel 00 (2402MHz)



#### Channel 39 (2441MHz)



#### Channel 78 (2480MHz)



### 6.3. Output Power Measurement

#### 6.3.1. Test Limit

For frequency hopping systems operating in the 2400-2483.5MHz band employing at least 75 non-overlapping hopping channels: 1watt.

For all other frequency hopping systems in the 2400-2483.5MHz band: 0.125 watt

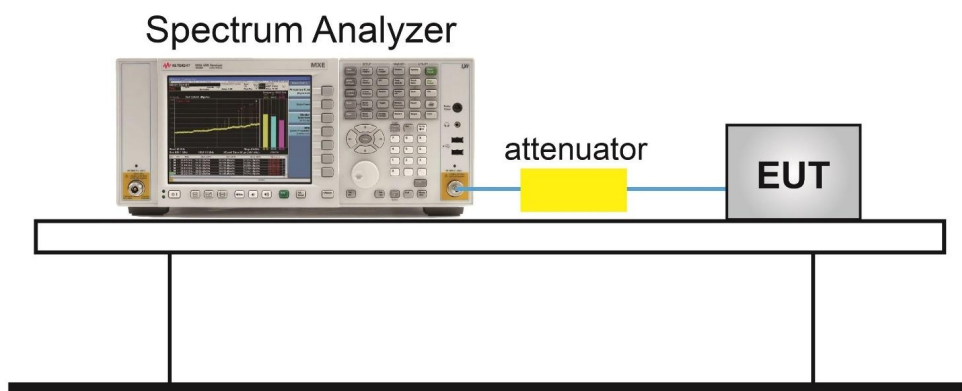
#### 6.3.2. Test Procedure Used

ANSI C63.10-2013 - Section 7.8.5

#### 6.3.3. Test Setting

1. RBW > 20 dB bandwidth of the emission being measured.
2. VBW  $\geq$  RBW
3. Span = Approximately five times the 20dB bandwidth, centered on a hopping channel
4. Detector = Peak
5. Trace mode = Max hold
6. Sweep = Auto
7. Allow the trace to stabilize, Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

#### 6.3.4. Test Setup



### 6.3.5. Test Result

|           |          |               |            |
|-----------|----------|---------------|------------|
| Product   | Notebook | Test Engineer | Dandy Li   |
| Test Site | TR3      | Test Date     | 2020/07/24 |

| Test Mode | Channel No. | Frequency (MHz) | Peak Power (dBm) | Peak Power Limit (dBm) | Result |
|-----------|-------------|-----------------|------------------|------------------------|--------|
| DH5       | 00          | 2402            | 7.53             | ≤ 30.00                | Pass   |
| DH5       | 39          | 2441            | 6.40             | ≤ 30.00                | Pass   |
| DH5       | 78          | 2480            | 5.08             | ≤ 30.00                | Pass   |
| 2DH5      | 00          | 2402            | 7.61             | ≤ 30.00                | Pass   |
| 2DH5      | 39          | 2441            | 6.58             | ≤ 30.00                | Pass   |
| 2DH5      | 78          | 2480            | 5.20             | ≤ 30.00                | Pass   |
| 3DH5      | 00          | 2402            | 8.20             | ≤ 30.00                | Pass   |
| 3DH5      | 39          | 2441            | 7.20             | ≤ 30.00                | Pass   |
| 3DH5      | 78          | 2480            | 5.80             | ≤ 30.00                | Pass   |

## DH5 Output Power

### Channel 00 (2402MHz)

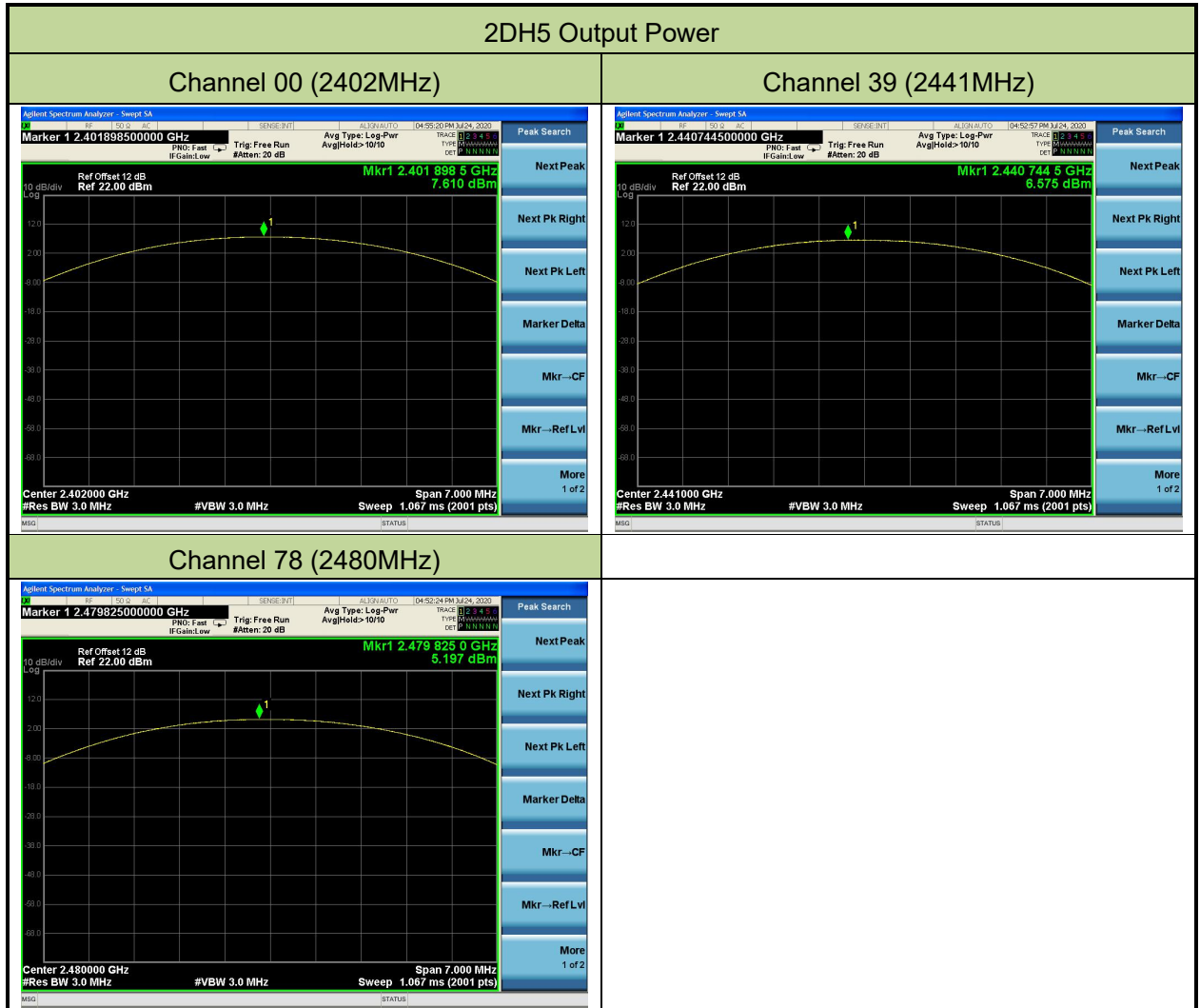


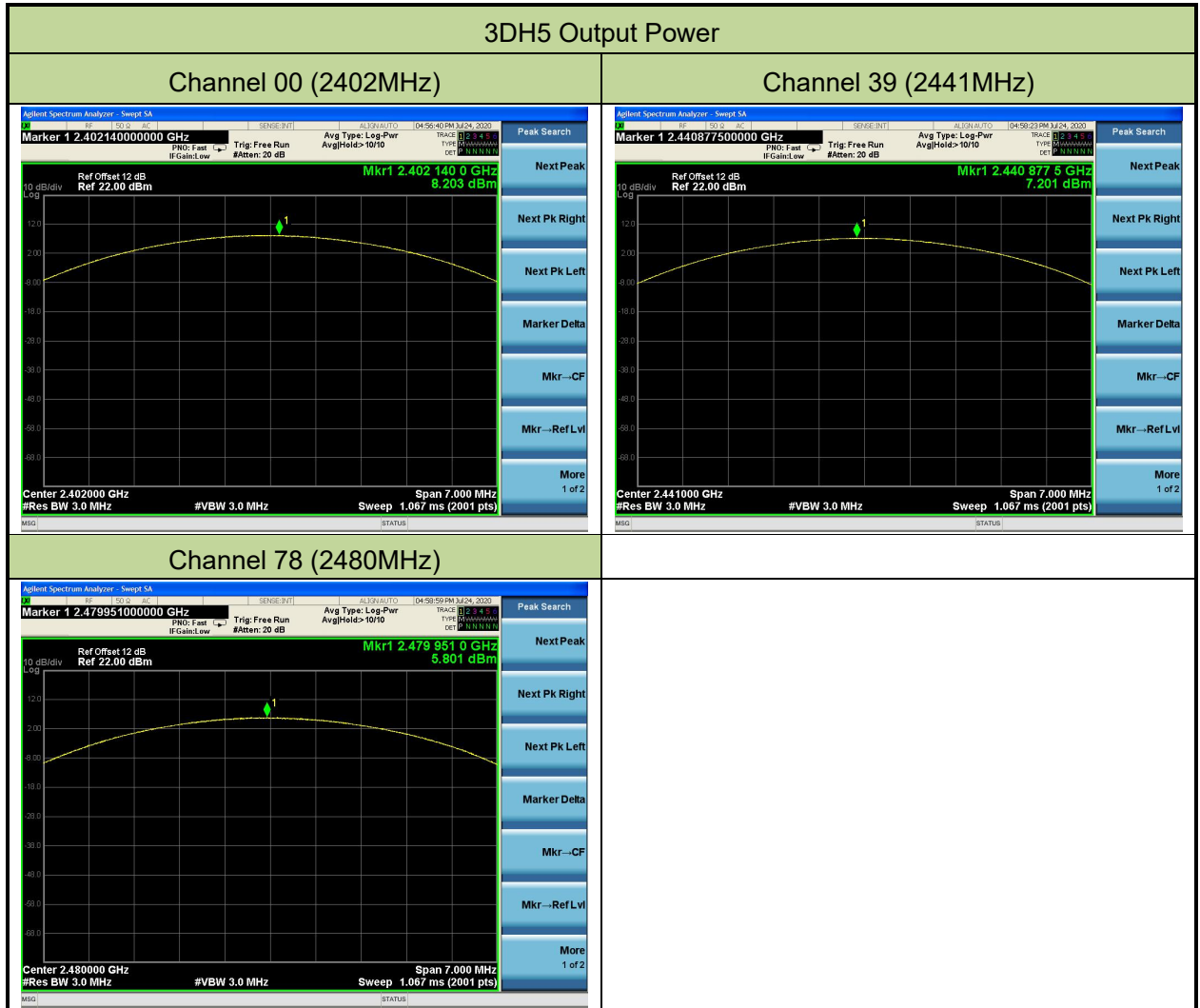
### Channel 39 (2441MHz)



### Channel 78 (2480MHz)







## 6.4. Carrier Frequency Separation Measurement

### 6.4.1. Test Limit

The minimum permissible channel separation for this system is 2/3 the value of the 20dB BW.

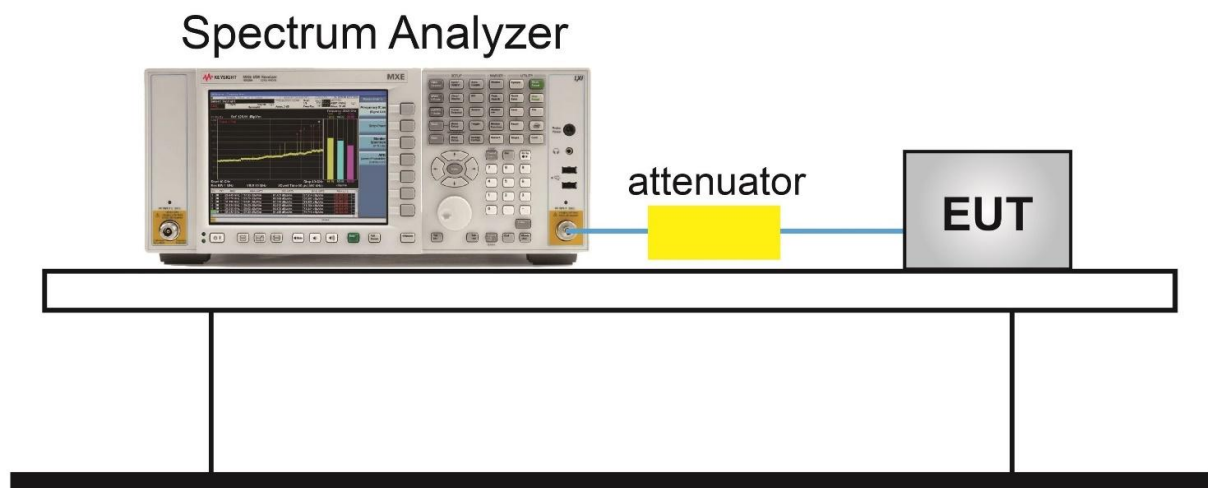
### 6.4.2. Test Procedure Used

ANSI C63.10-2013 - Section 7.8.2

### 6.4.3. Test Setting

1. Span: Wide enough to capture the peaks of two adjacent channels.
2. RBW: Start with the RBW set to approximately 30 % of the channel spacing; adjust as necessary to best identify the center of each individual channel.
3. VBW  $\geq$  RBW
4. Detector = Peak
5. Sweep time = Auto
6. Trace mode = Max hold
7. Trace was allowed to stabilize

### 6.4.4. Test Setup



#### 6.4.5. Test Result

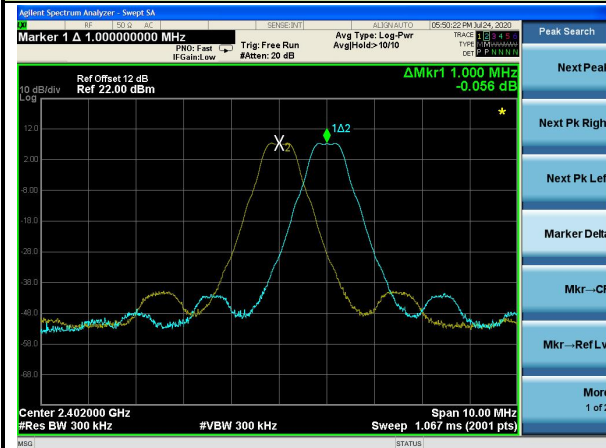
|           |          |               |            |
|-----------|----------|---------------|------------|
| Product   | Notebook | Test Engineer | Dandy Li   |
| Test Site | TR3      | Test Date     | 2020/07/24 |

| Test Mode | Channel No. | Frequency (MHz) | Limit (kHz)  | Result |
|-----------|-------------|-----------------|--------------|--------|
| DH5       | 00          | 2402            | $\geq 642.8$ | Pass   |
| DH5       | 39          | 2441            | $\geq 641.6$ | Pass   |
| DH5       | 78          | 2480            | $\geq 642.5$ | Pass   |
| 2DH5      | 00          | 2402            | $\geq 906.0$ | Pass   |
| 2DH5      | 39          | 2441            | $\geq 906.7$ | Pass   |
| 2DH5      | 78          | 2480            | $\geq 895.3$ | Pass   |
| 3DH5      | 00          | 2402            | $\geq 908.7$ | Pass   |
| 3DH5      | 39          | 2441            | $\geq 908.7$ | Pass   |
| 3DH5      | 78          | 2480            | $\geq 904.7$ | Pass   |

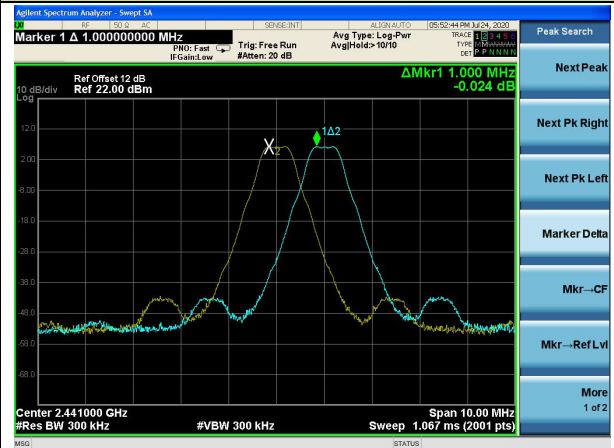
Note: The Limit is 2/3 the value of the 20dB BW.

## DH5 Carrier Frequency Separation

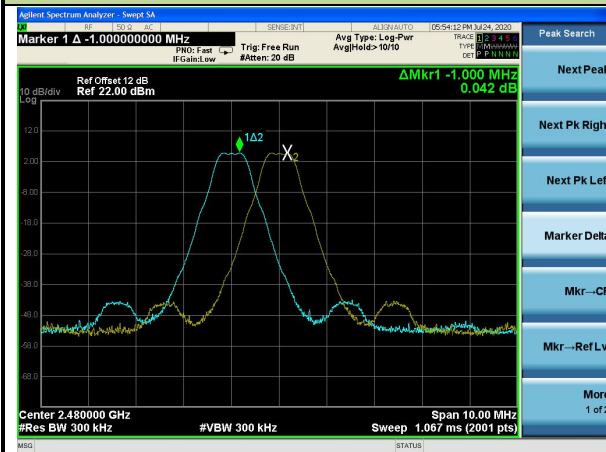
### Channel 00 (2402MHz)



### Channel 39 (2441MHz)



### Channel 78 (2480MHz)

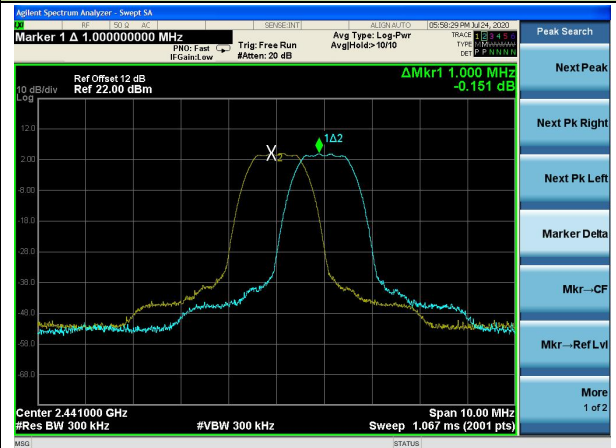


## 2DH5 Carrier Frequency Separation

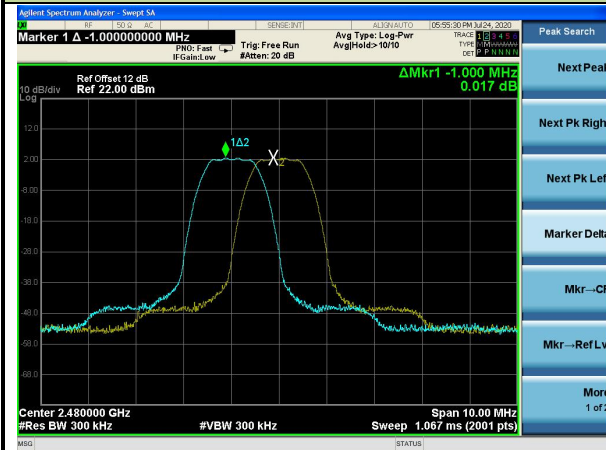
### Channel 00 (2402MHz)



### Channel 39 (2441MHz)



### Channel 78 (2480MHz)

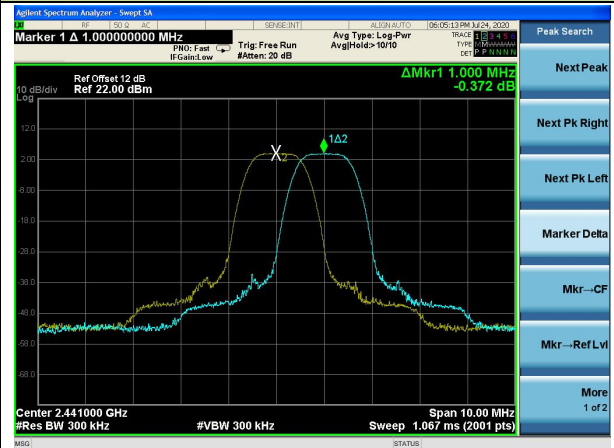


### 3DH5 Carrier Frequency Separation

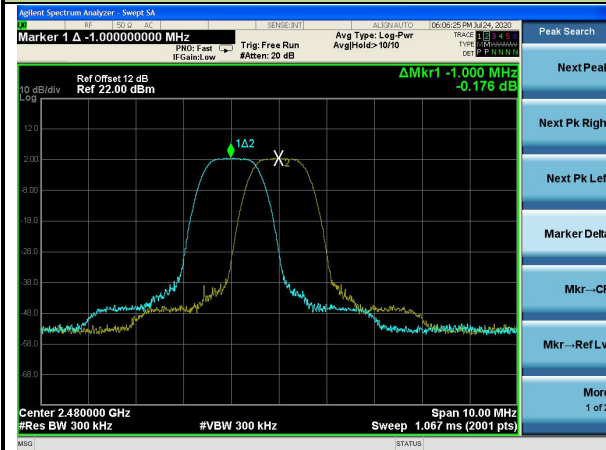
#### Channel 00 (2402MHz)



#### Channel 39 (2441MHz)



#### Channel 78 (2480MHz)



## 6.5. Number of Hopping Channels Measurement

### 6.5.1. Test Limit

This frequency hopping system must employ a minimum of 15 hopping channels.

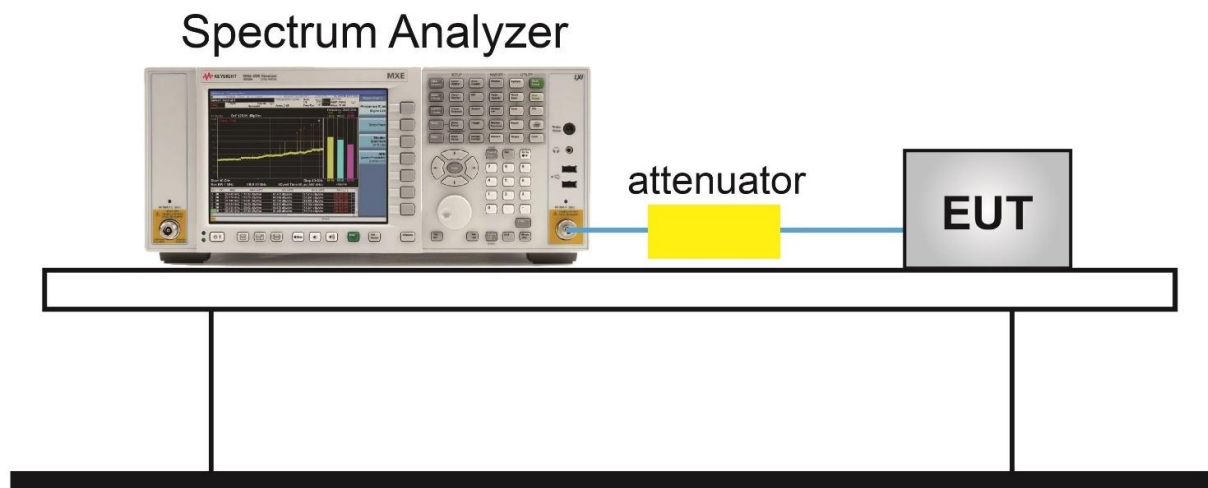
### 6.5.2. Test Procedure Used

ANSI C63.10-2013 - Section 7.8.3

### 6.5.3. Test Setting

1. Span = the frequency band of operation.
2. RBW < 30 % of the channel spacing or the 20 dB bandwidth, whichever is smaller.
3. VBW  $\geq$  RBW
4. Detector = Peak
5. Trace mode = Max hold
6. Sweep time = Auto
7. The trace was allowed to stabilize

### 6.5.4. Test Setup



### 6.5.5.Test Result

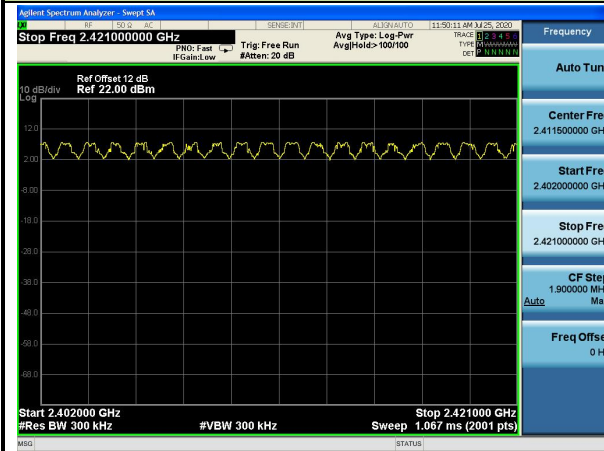
|           |          |               |            |
|-----------|----------|---------------|------------|
| Product   | Notebook | Test Engineer | Dandy Li   |
| Test Site | TR3      | Test Date     | 2020/07/25 |

| Test Mode<br>(Hopping) | Channel Numbers | Frequency<br>(MHz) | Limit<br>(Hopping Channels) | Result |
|------------------------|-----------------|--------------------|-----------------------------|--------|
| DH5                    | 79              | 2402~2480          | $\geq 15$                   | Pass   |
| 2DH5                   | 79              | 2402~2480          | $\geq 15$                   | Pass   |
| 3DH5                   | 79              | 2402~2480          | $\geq 15$                   | Pass   |

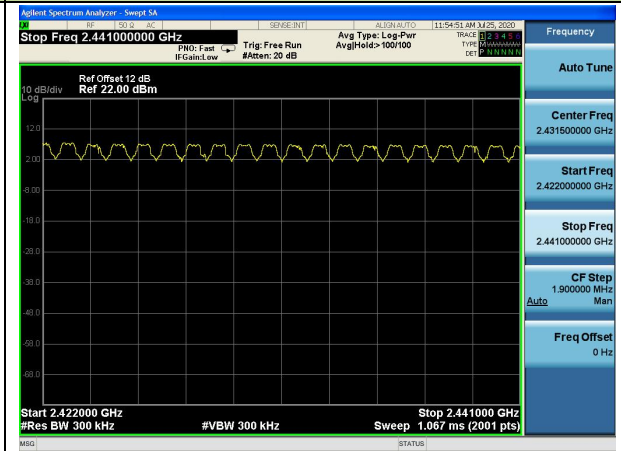


## 2DH5 Number of Hopping Channels

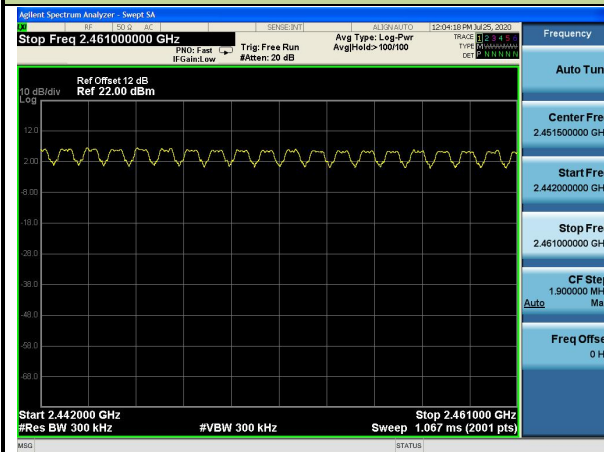
2402 ~ 2421MHz



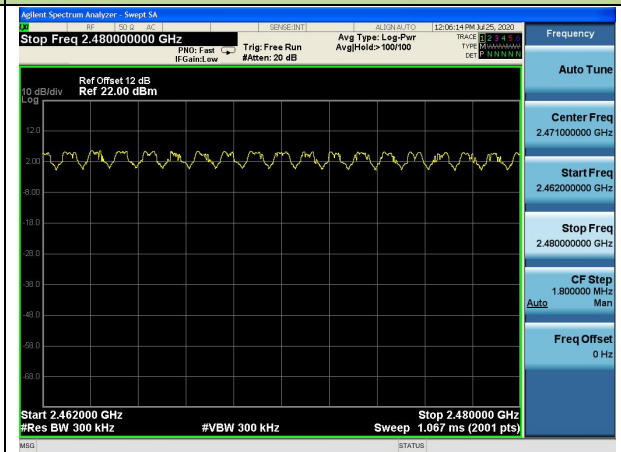
2422 ~ 2441MHz



2442 ~ 2461MHz

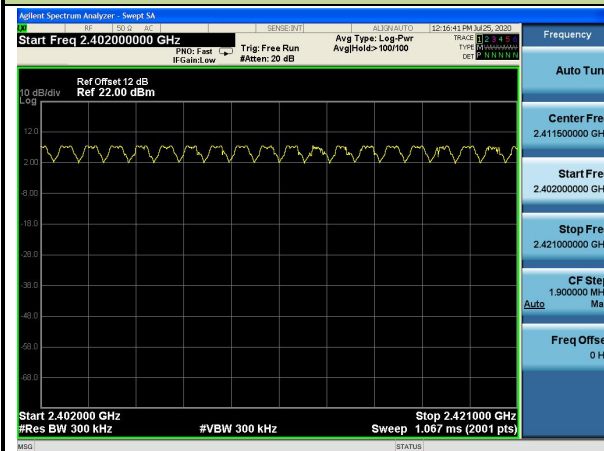


2462 ~ 2480MHz

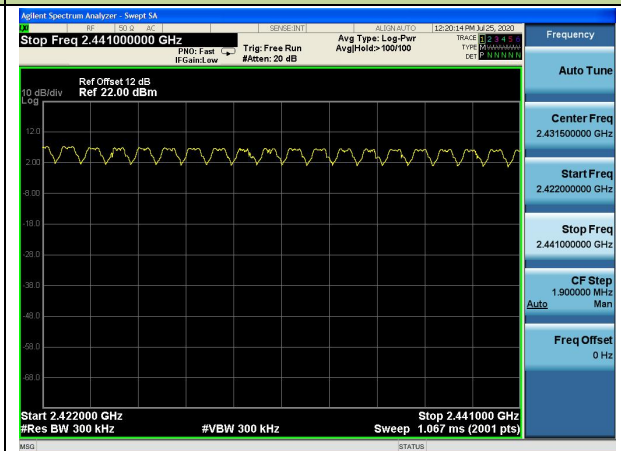


### 3DH5 Number of Hopping Channels

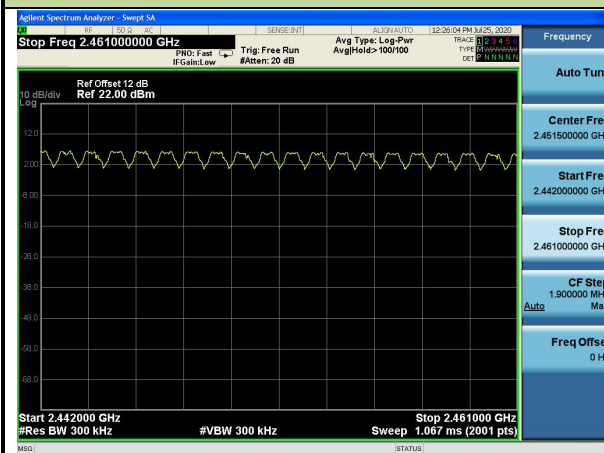
2402 ~ 2421MHz



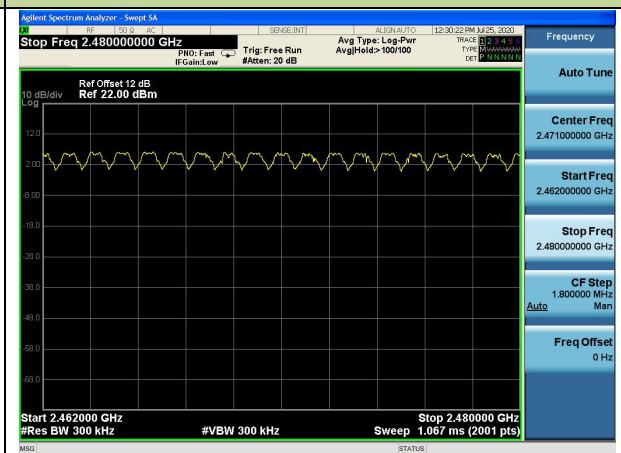
2422 ~ 2441MHz



2442 ~ 2461MHz



2462 ~ 2480MHz



## **6.6. Time of Occupancy Measurement**

### **6.6.1. Test Limit**

The maximum permissible time of occupancy is 400ms within a period of 400ms multiplied by the number of hopping channels employed.

### **6.6.2. Test Procedure Used**

ANSI C63.10-2013 - Section 7.8.4

### **6.6.3. Test Setting**

1. Span = zero span, centered on a hopping channel.
2.  $RBW \leq$  channel spacing and where possible should be set  $\gg 1 / T$ , where T is the expected dwell time per channel.
3.  $VBW \geq RBW$
4. Sweep time = as necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
5. Detector = Peak
6. Trace mode = max hold

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.

Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

---

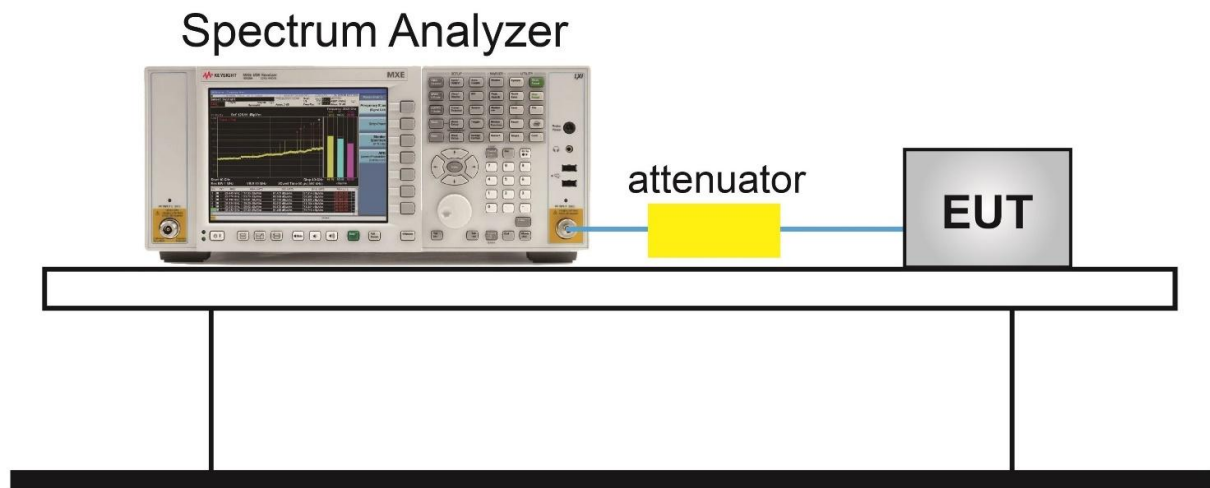
$$(\text{Number of hops in the period specified in the requirements}) =$$

$$(\text{Number of hops on spectrum analyzer}) \times (\text{period specified in the requirements} / \text{analyzer sweep time})$$

The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.

The measured transmit time and time between hops shall be consistent with the values described in the operational description for the EUT.

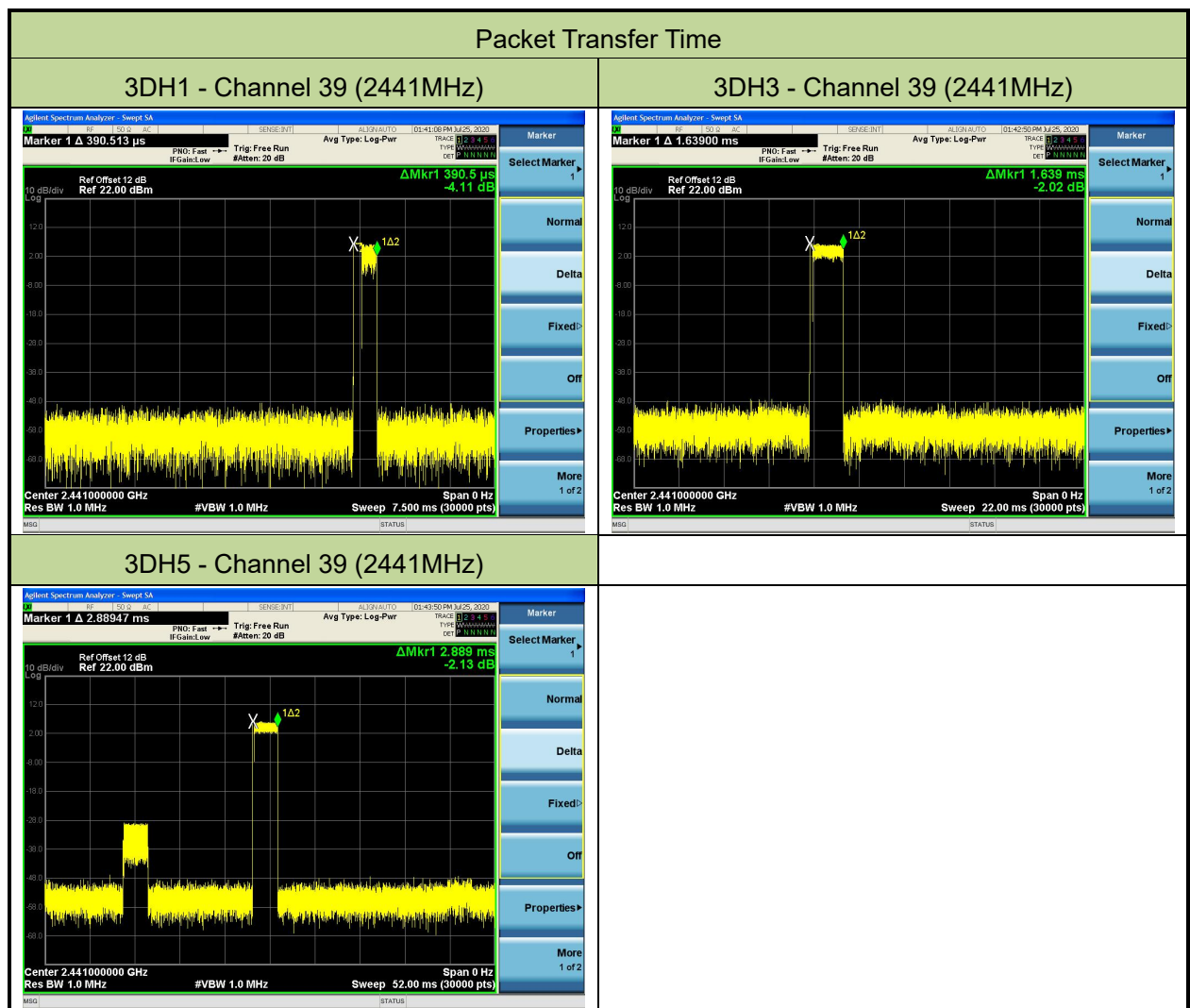
#### 6.6.4.Test Setup



### 6.6.5. Test Result

|           |          |               |            |
|-----------|----------|---------------|------------|
| Product   | Notebook | Test Engineer | Dandy Li   |
| Test Site | TR3      | Test Date     | 2020/07/25 |

| Test Mode | Channel No. | Frequency (MHz) | Hops Over Occupancy Time (Hops) | Packet Transfer Time (ms) | Time of Occupancy (ms) | Limit (ms) | Result |
|-----------|-------------|-----------------|---------------------------------|---------------------------|------------------------|------------|--------|
| 3DH1      | 39          | 2441            | 320                             | 0.39                      | 124.80                 | ≤ 400      | Pass   |
| 3DH3      | 39          | 2441            | 160                             | 1.64                      | 262.40                 | ≤ 400      | Pass   |
| 3DH5      | 39          | 2441            | 107                             | 2.89                      | 309.23                 | ≤ 400      | Pass   |



Note 1: According the Bluetooth Standard Specification, the nominal hop rate is 1600 hops/s. All Bluetooth unit participating in the piconet are time and hop synchronized to the channel.

Hops Over Occupancy Time in 31.6s for 3DH1 =  $1600 / 2 / 79 * 31.6 = 320$ .

Hops Over Occupancy Time in 31.6s for 3DH3 =  $1600 / 4 / 79 * 31.6 = 160$ .

Hops Over Occupancy Time in 31.6s for 3DH5 =  $1600 / 6 / 79 * 31.6 = 107$ .

Note 2: Time of Occupancy = Packet Transfer Time \* Hops Over Occupancy Time in 31.6s.

## **6.7. Band-edge Compliance Measurement**

### **6.7.1. Test Limit**

The maximum permissible emission level is 20dBc. Any emissions were lying outside of the emission bandwidth and in authorized band edges to a field strength limit specified in Section 15.209 of the Title 47 CFR.

### **6.7.2. Test Procedure Used**

ANSI C63.10-2013 - Section 6.10.4

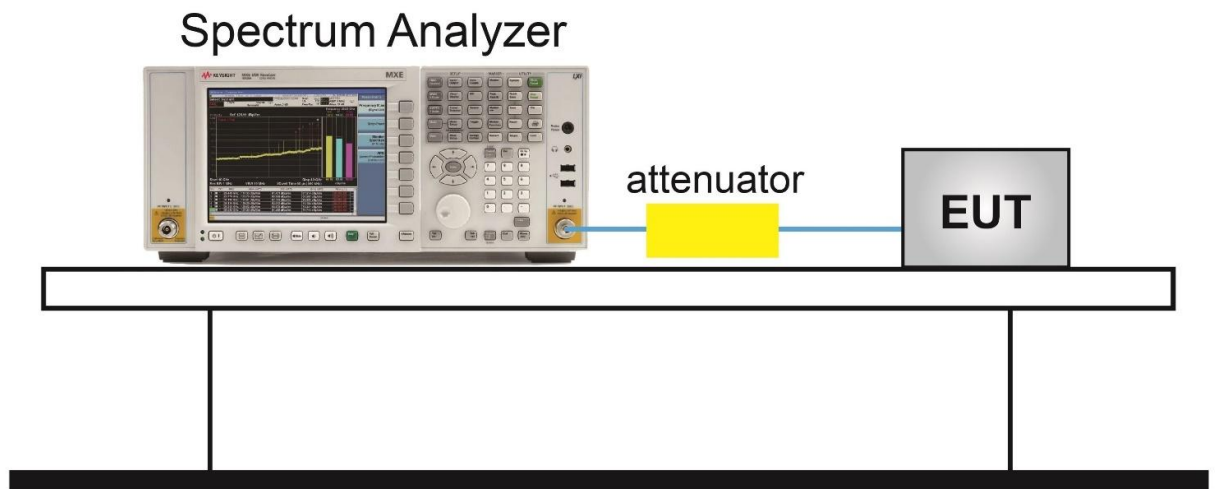
### **6.7.3. Test Setting**

1. Span = Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.
2. RBW = 100 kHz
3. VBW = 300 kHz
4. Detector = Peak
5. Sweep time = Coupled
6. Trace mode = max hold
7. Trace was allowed to stabilize

Allow the trace to stabilize. For the test with the hopping function turned ON, this can take several minutes to achieve a reasonable probability of intercepting any emissions due to oscillator overshoot.

Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.

#### 6.7.4. Test Setup



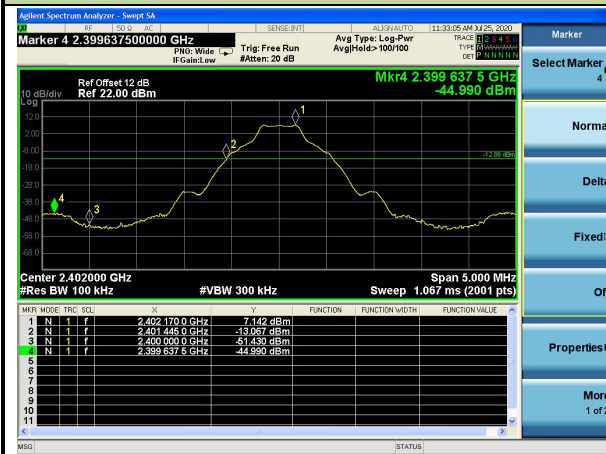
**6.7.5.Test Result**

|           |          |               |            |
|-----------|----------|---------------|------------|
| Product   | Notebook | Test Engineer | Dandy Li   |
| Test Site | TR3      | Test Date     | 2020/07/25 |

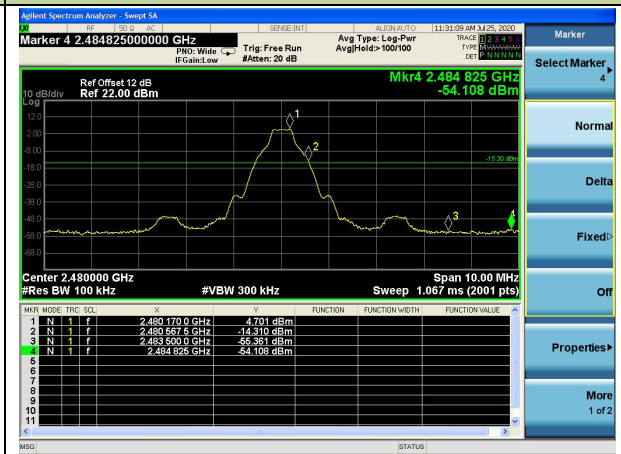
| Test Mode | Channel No. | Frequency<br>(MHz) | Limit | Result |
|-----------|-------------|--------------------|-------|--------|
| DH5       | 00          | 2402               | 20dBc | Pass   |
| DH5       | 78          | 2480               | 20dBc | Pass   |
| 2DH5      | 00          | 2402               | 20dBc | Pass   |
| 2DH5      | 78          | 2480               | 20dBc | Pass   |
| 3DH5      | 00          | 2402               | 20dBc | Pass   |
| 3DH5      | 78          | 2480               | 20dBc | Pass   |

### DH5 Band-edge Compliance

#### Channel 00 (2402MHz)

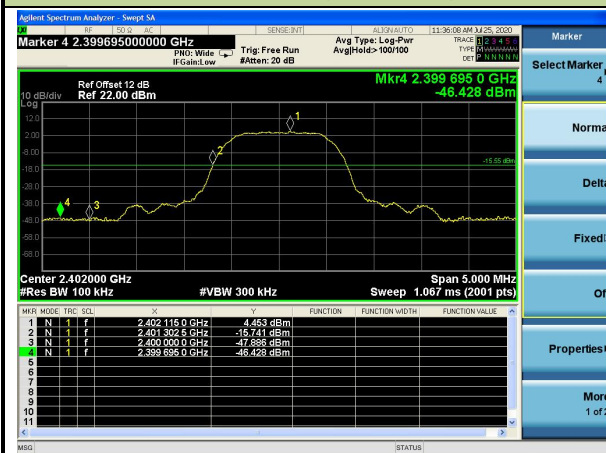


#### Channel 78 (2480MHz)

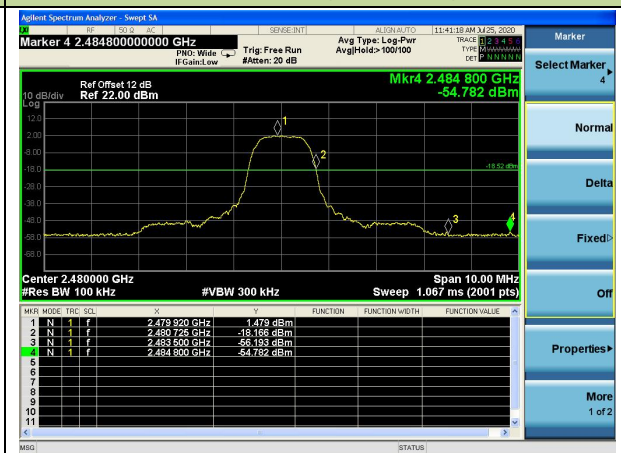


### 2DH5 Band-edge Compliance

#### Channel 00 (2402MHz)

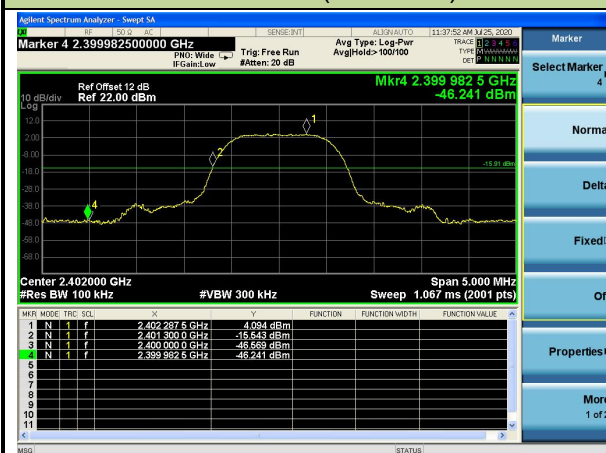


#### Channel 78 (2480MHz)



### 3DH5 Band-edge Compliance

#### Channel 00 (2402MHz)



#### Channel 78 (2480MHz)

