

# ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LOW-POWER, NON-LICENSED TRANSMITTER

**Test Report No.** : OT-196-RWD-033  
**AGR No.** : A195A-013  
**Applicant** : Samsung Electronics Co Ltd  
**Address** : 1 Samsung-ro, Giheung-gu, Yongin-si Gyeonggi-do, South Korea  
**Manufacturer** : Samsung Electronics Co Ltd  
**Address** : 1 Samsung-ro, Giheung-gu, Yongin-si Gyeonggi-do, South Korea  
**Type of Equipment** : IoT Module  
**FCC ID.** : 2AR3A-ITM-D-BZ  
**Model Name** : ITM-D-BZ  
**Serial number** : N/A  
**Total page of Report** : 93 pages (including this page)  
**Date of Incoming** : June 05, 2019  
**Date of issue** : June 17, 2019

## SUMMARY

The equipment complies with the regulation; **FCC PART 15 SUBPART C Section 15.247**

This test report only contains the result of a single test of the sample supplied for the examination.

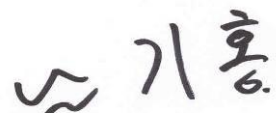
It is not a generally valid assessment of the features of the respective products of the mass-production.

Reviewed by:



Tae-Ho, Kim / Senior Manager  
ONETECH Corp.

Approved by:



Ki-Hong, Nam / Chief Engineer  
ONETECH Corp.

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**Revision History**

| Rev. No. | Issue Report No. | Issued Date   | Revisions       | Section Affected |
|----------|------------------|---------------|-----------------|------------------|
| 0        | OT-196-RWD-033   | June 17, 2019 | Initial Release | All              |
|          |                  |               |                 |                  |
|          |                  |               |                 |                  |

## 1. VERIFICATION OF COMPLIANCE

Applicant : Samsung Electronics Co Ltd  
Address : 1 Samsung-ro, Giheung-gu, Yongin-si Gyeonggi-do, South Korea  
Contact Person : Mounjin, Jang / Staff Engineer  
Telephone No. : +070-7142-1361  
FCC ID : 2AR3A-ITM-D-BZ  
Model Name : ITM-D-BZ  
Brand Name : -  
Serial Number : N/A  
Date : June 17, 2019

|                                                         |                                                                                |
|---------------------------------------------------------|--------------------------------------------------------------------------------|
| EQUIPMENT CLASS                                         | DTS – DIGITAL TRNSMISSION SYSTEM                                               |
| E.U.T. DESCRIPTION                                      | IoT Module                                                                     |
| THIS REPORT CONCERNS                                    | Original Grant                                                                 |
| MEASUREMENT PROCEDURES                                  | ANSI C63.10: 2013                                                              |
| TYPE OF EQUIPMENT TESTED                                | Pre-Production                                                                 |
| KIND OF EQUIPMENT<br>AUTHORIZATION REQUESTED            | Certification                                                                  |
| EQUIPMENT WILL BE OPERATED<br>UNDER FCC RULES PART(S)   | FCC PART 15 SUBPART C Section 15.247<br>558074 D01 15.247 Meas Guidance v05r02 |
| Modifications on the Equipment to Achieve<br>Compliance | None                                                                           |
| Final Test was Conducted On                             | 3 m, Semi Anechoic Chamber                                                     |

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

## 2. TEST SUMMARY

### 2.1 Test items and results

| SECTION        | TEST ITEMS                                          | RESULTS                |
|----------------|-----------------------------------------------------|------------------------|
| 15.247 (a) (2) | Minimum 6 dB Bandwidth & 99 % Occupied Bandwidth    | Met the Limit / PASS   |
| 15.247 (b) (3) | Maximum Peak Conducted Output Power                 | Met the Limit / PASS   |
| 15.247 (d)     | 100 kHz Bandwidth Outside the Frequency Band        | Met the Limit / PASS   |
| 15.247 (d)     | Radiated Emission which fall in the Restricted Band | Met the Limit / PASS   |
| 15.247 (e)     | Peak Power Spectral Density                         | Met the Limit / PASS   |
| 15.209         | Radiated Emission Limits                            | Met the Limit / PASS   |
| 15.207         | Conducted Limits                                    | Met the Limit / PASS   |
| 15.203         | Antenna Requirement                                 | Met requirement / PASS |

### 2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

### 2.3 Related Submittal(s) / Grant(s)

Original submittal only

### 2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART C Section 15.247.

### 2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

### 2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-14617/ G-10666 / T-1842

IC (Industry Canada) – Registration No. Site# 3736A-3

-. Site Accreditation:

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

### 3. GENERAL INFORMATION

#### 3.1 Product Description

The Samsung Electronics Co Ltd, Model ITM-D-BZ (referred to as the EUT in this report) is a IoT Module. The product specification described herein was obtained from product data sheet or user's manual.

|                                                       |                |                                                                                                                  |
|-------------------------------------------------------|----------------|------------------------------------------------------------------------------------------------------------------|
| DEVICE TYPE                                           | IoT Module     |                                                                                                                  |
| Temperature Range                                     | -20 °C ~ 50 °C |                                                                                                                  |
| OPERATING<br>FREQUENCY                                | Bluetooth      | 2 402 MHz ~ 2 480 MHz                                                                                            |
|                                                       | Zigbee         | 2 405 MHz ~ 2 480 MHz                                                                                            |
| MODULATION<br>TYPE                                    | Bluetooth      | GFSK                                                                                                             |
|                                                       | Zigbee         | O-QPSK                                                                                                           |
| RF OUTPUT<br>POWER                                    | Bluetooth      | LE Coded_125 kbps: 8.75 dBm<br>LE Coded_500 kbps: 8.50 dBm<br>LE 1 M_1 Mbps: 8.75 dBm<br>LE 2 M_2 Mbps: 7.85 dBm |
|                                                       | Zigbee         | 8.39 dBm                                                                                                         |
| Number of Channel                                     | Bluetooth      | 40 Channel                                                                                                       |
|                                                       | Zigbee         | 16 Channel                                                                                                       |
| ANTENNA TYPE                                          |                | PCB Antenna                                                                                                      |
| ANTENNA GAIN                                          |                | 3.6 dBi                                                                                                          |
| List of each Osc. or crystal<br>Freq.(Freq. >= 1 MHz) |                | 32 MHz                                                                                                           |

#### 3.2 Alternative type(s)/model(s); also covered by this test report.

-. None

### 4. EUT MODIFICATIONS

-. None

## 5. SYSTEM TEST CONFIGURATION

### 5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

| DEVICE TYPE | MANUFACTURER               | MODEL/PART NUMBER | FCC ID |
|-------------|----------------------------|-------------------|--------|
| Main Board  | Samsung Electronics Co Ltd | ITM-D-BZ R0.2     | N/A    |

### 5.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

| Model                | Manufacturer                             | Description      | Connected to |
|----------------------|------------------------------------------|------------------|--------------|
| ITM-D-BZ             | Samsung Electronics Co Ltd               | IoT Module (EUT) | -            |
| ITM-D-BZ_EVK Rev0.2  | Samsung Electronics Co Ltd               | Jig Board        | EUT          |
| HP Pavilion g series | HP                                       | Notebook PC      | -            |
| PPP009C              | LIE-ON TECHNOLOGY<br>(CHANGZHOU)CO.,LTD. | AC Adapter       | -            |

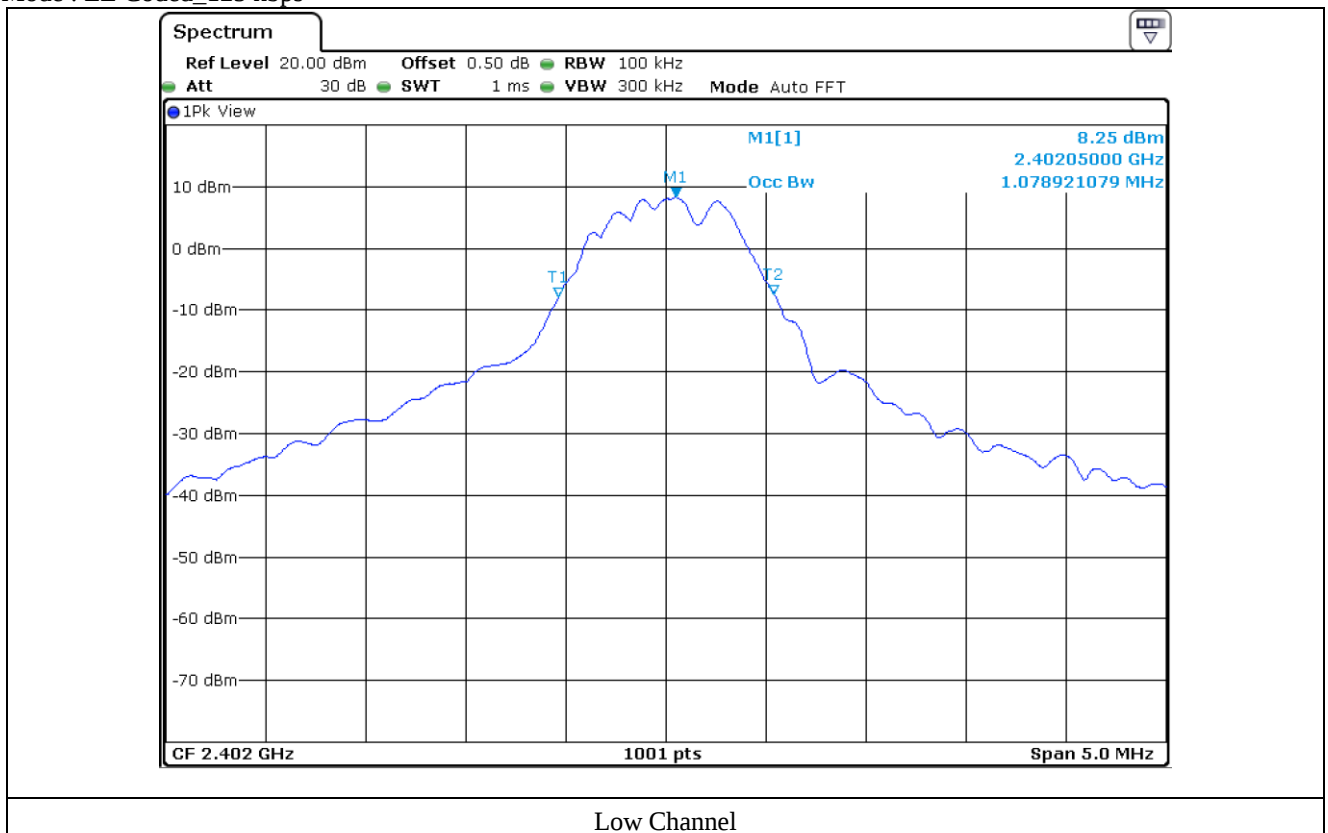
### 5.3 Mode of operation during the test

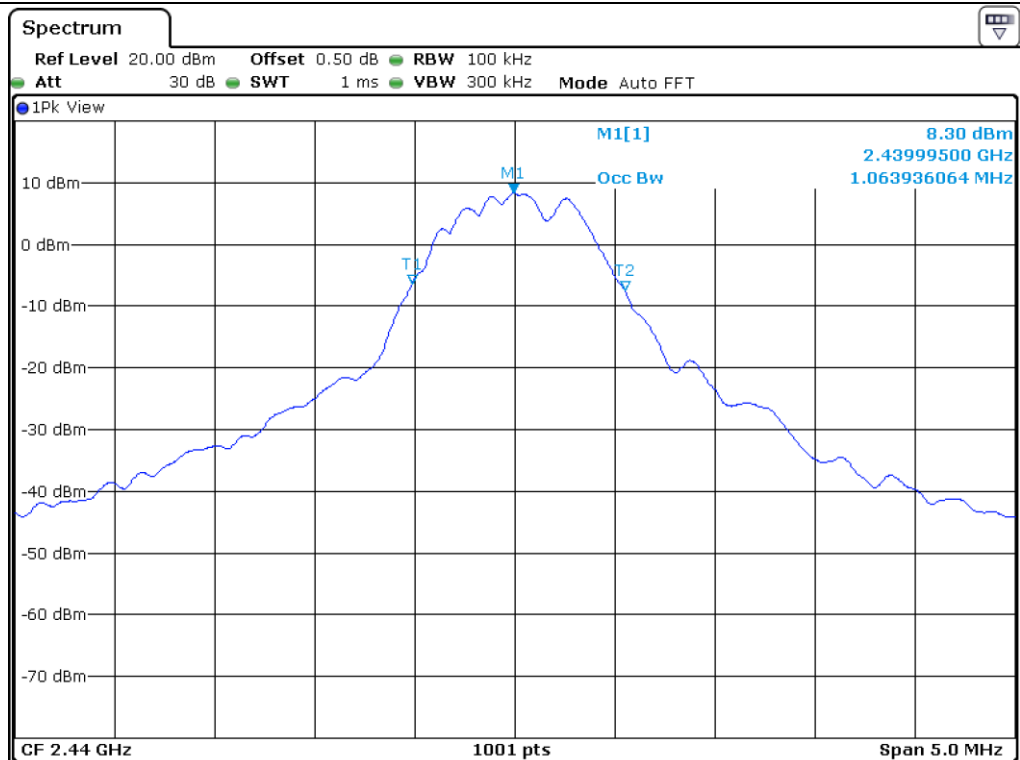
For the testing, software used to control the EUT for staying in continuous transmitting is programmed. For final testing, the EUT was set at 2 402 MHz, 2 440 MHz, and 2 480 MHz to get a maximum emission levels from the EUT. The EUT was moved throughout the XY, XZ, and YZ planes and the worst case is “XZ” axis, but the worst data was recorded in this report.

-. Occupied Bandwidth(99 %)

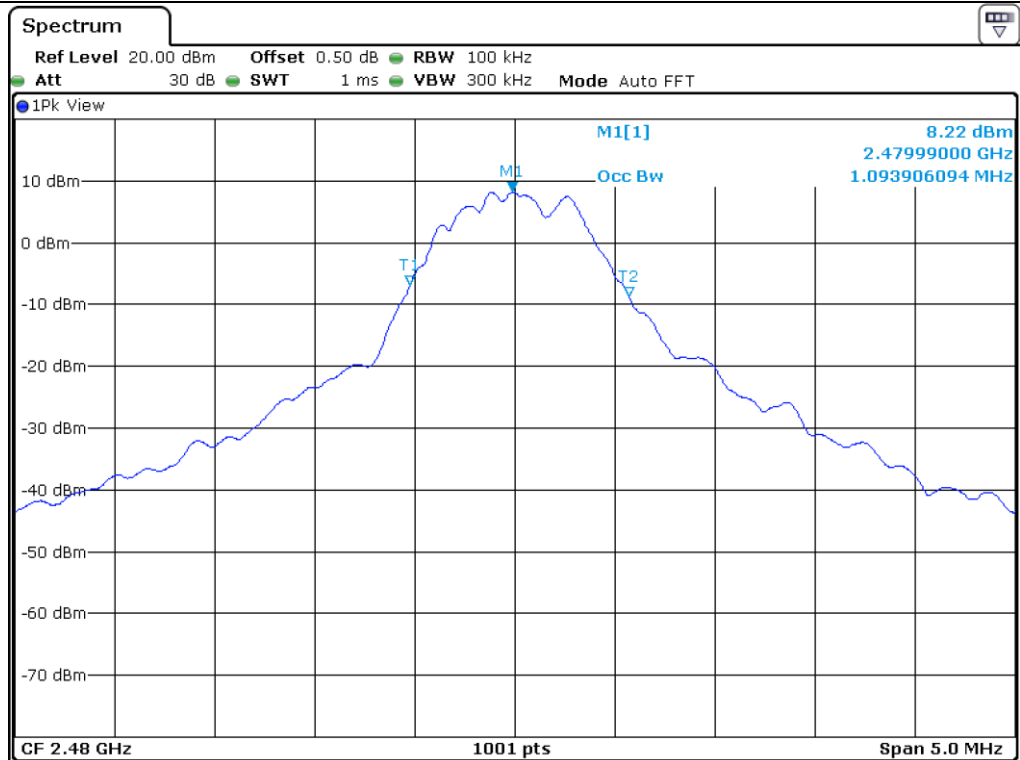
| Mode                  | CHANNEL | FREQUENCY (MHz) | Occupied Bandwidth(MHz) |
|-----------------------|---------|-----------------|-------------------------|
| LE Coded_<br>125 kbps | Low     | 2 402           | 1.08                    |
|                       | Middle  | 2 440           | 1.06                    |
|                       | High    | 2 480           | 1.09                    |
| LE Coded_<br>500 kbps | Low     | 2 402           | 1.05                    |
|                       | Middle  | 2 440           | 1.05                    |
|                       | High    | 2 480           | 1.06                    |
| LE 1 M_<br>1 Mbps     | Low     | 2 402           | 1.02                    |
|                       | Middle  | 2 440           | 1.03                    |
|                       | High    | 2 480           | 1.05                    |
| LE 2 M_<br>2 Mbps     | Low     | 2 402           | 1.96                    |
|                       | Middle  | 2 440           | 1.96                    |
|                       | High    | 2 480           | 1.97                    |

Mode : LE Coded\_125 kbps



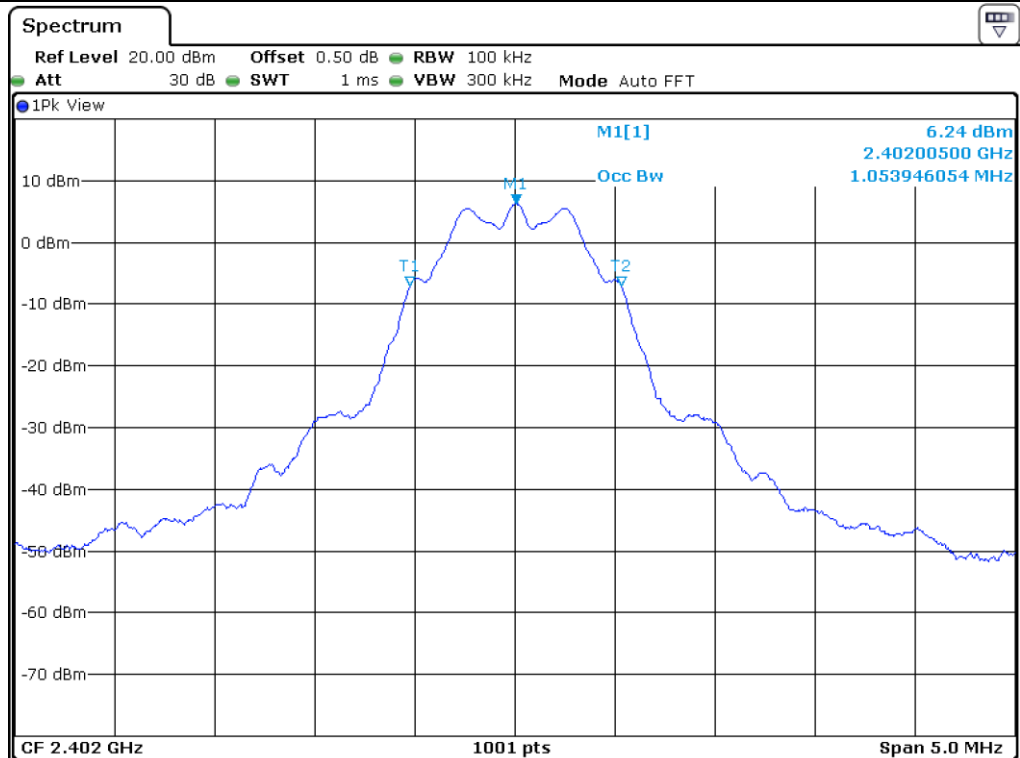


Middle Channel

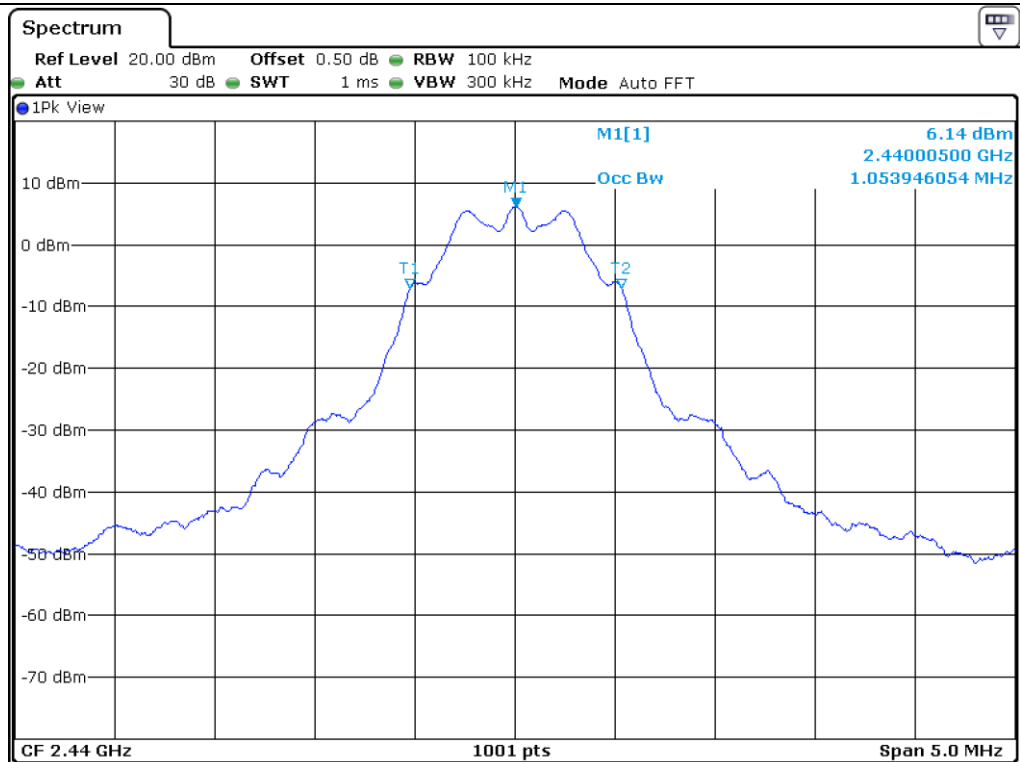


High Channel

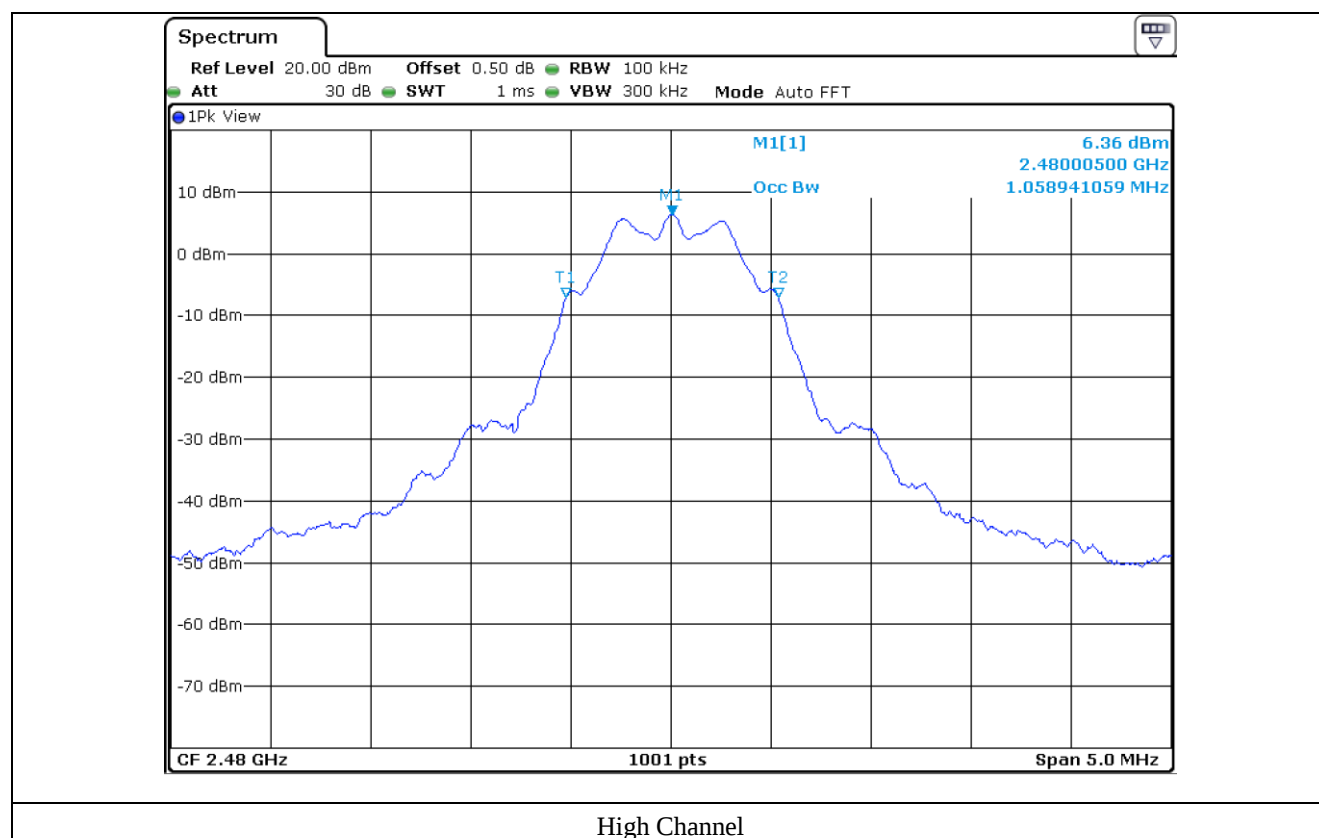
Mode : LE Coded\_500 kbps



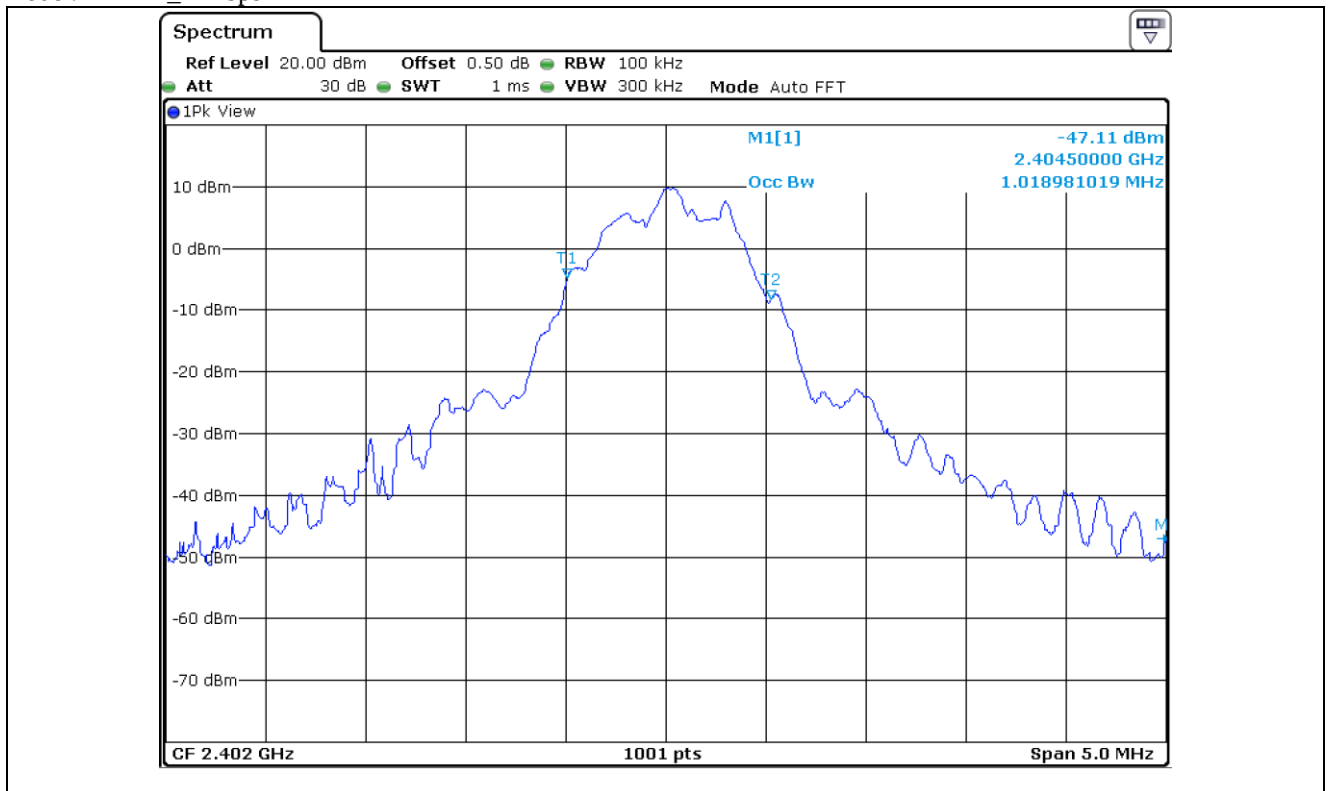
Low Channel



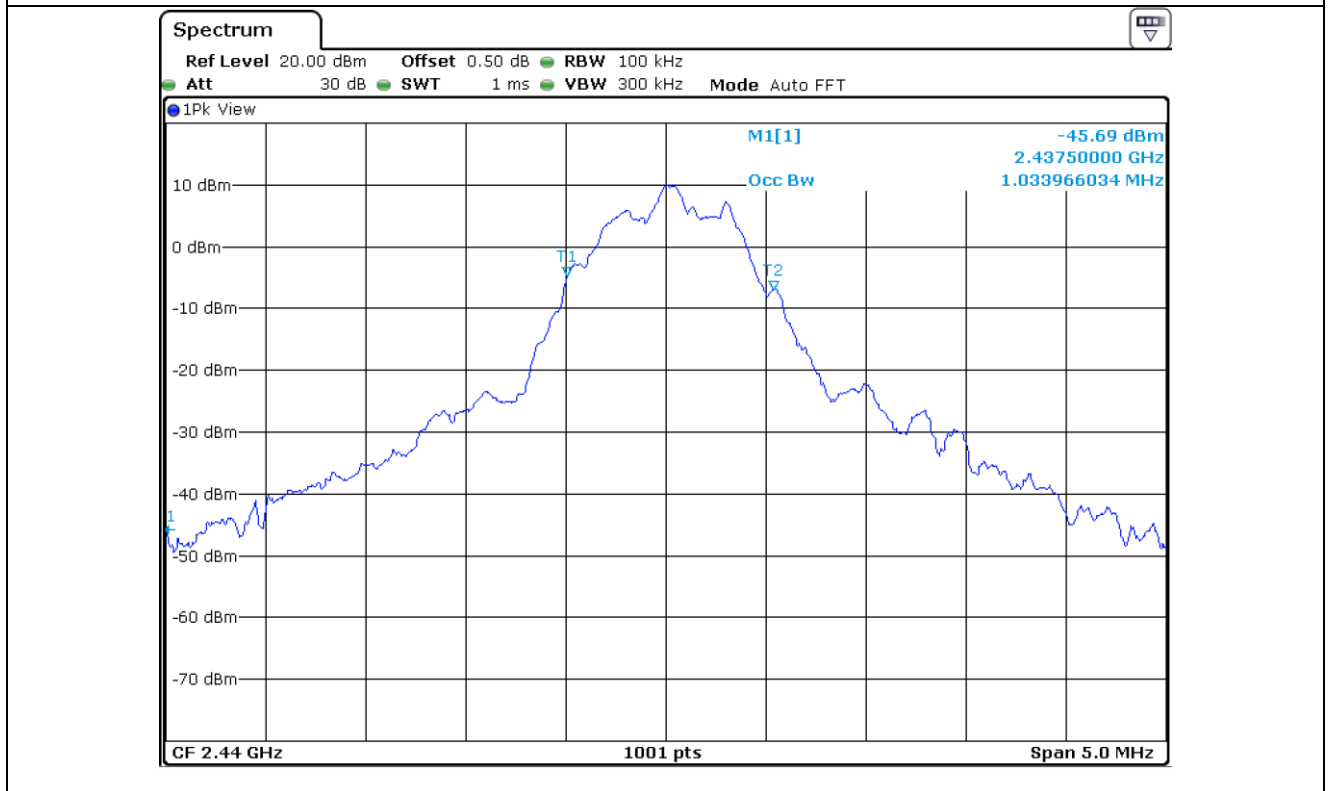
Middle Channel



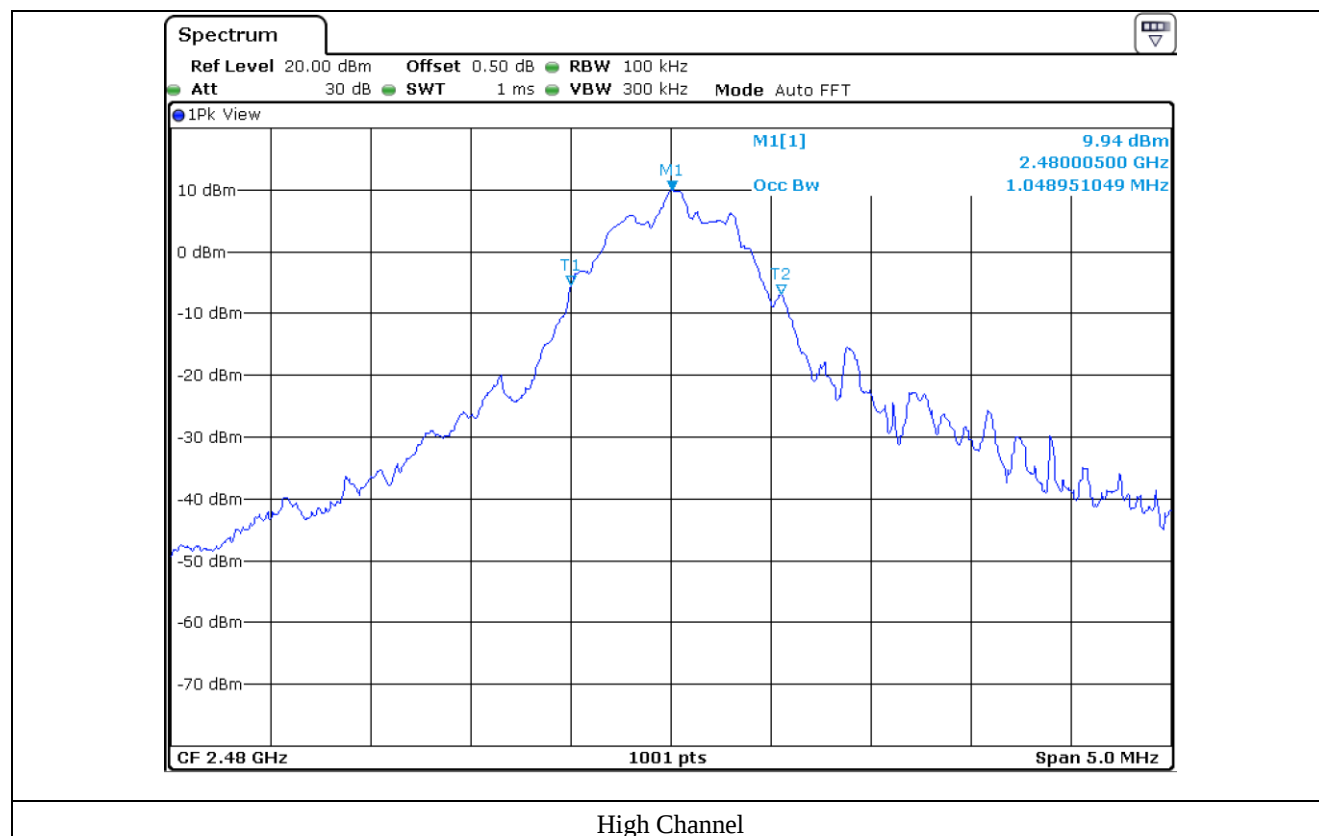
Mode : LE 1 M\_1 Mbps



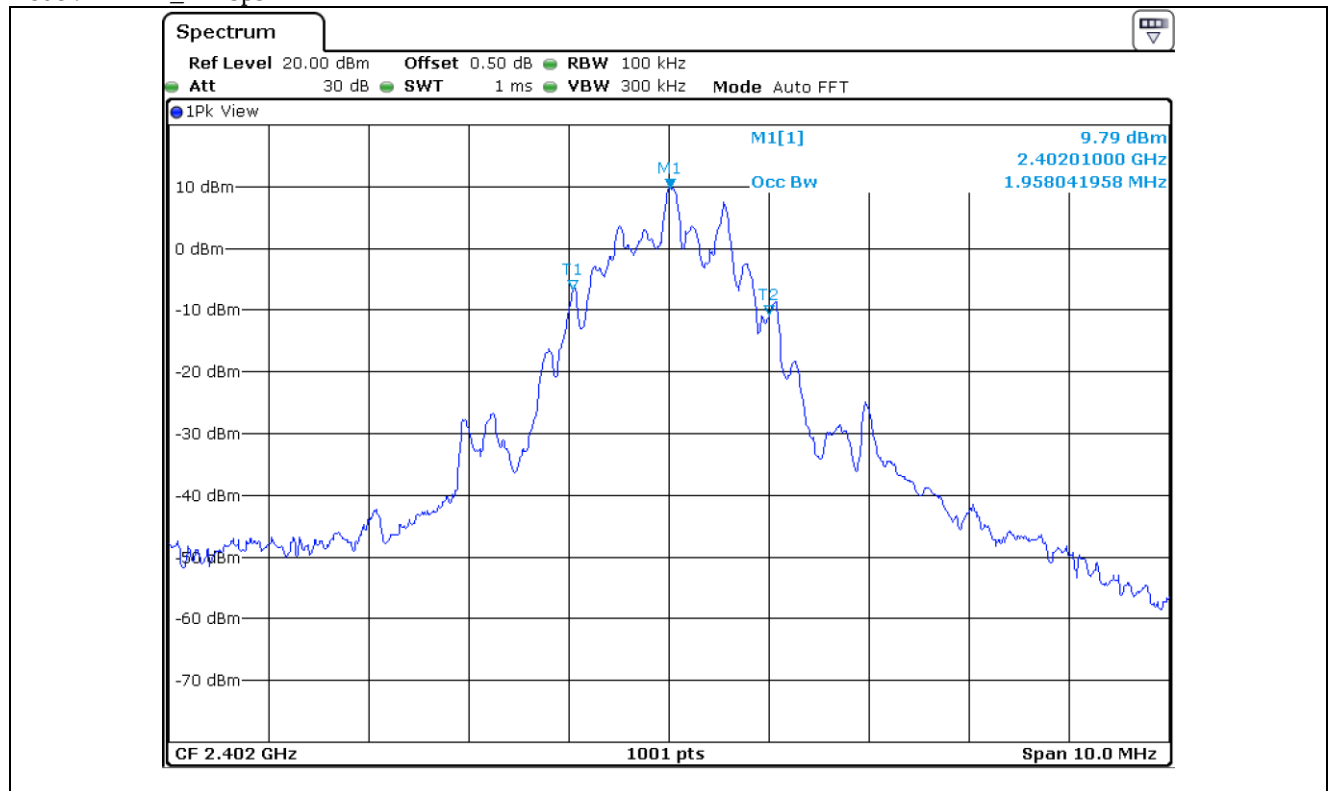
Low Channel



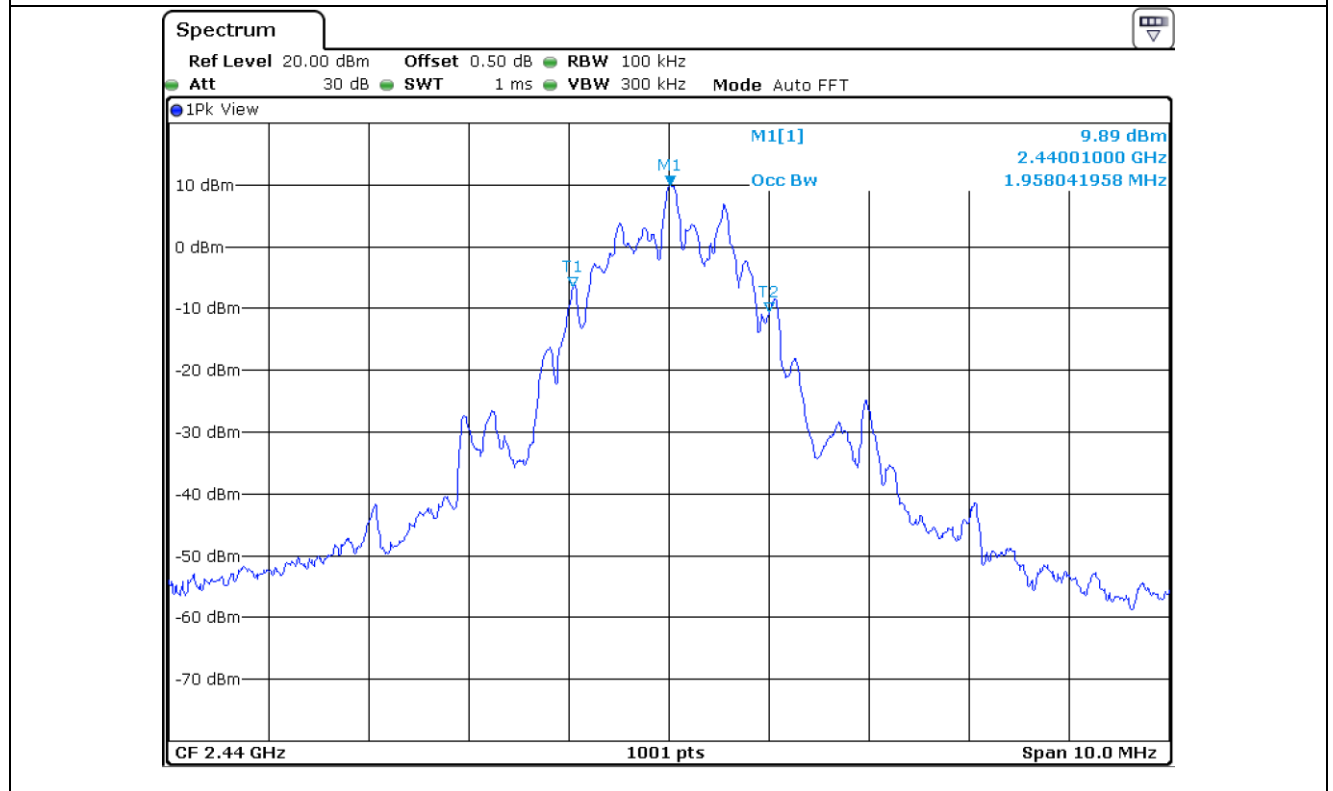
Middle Channel



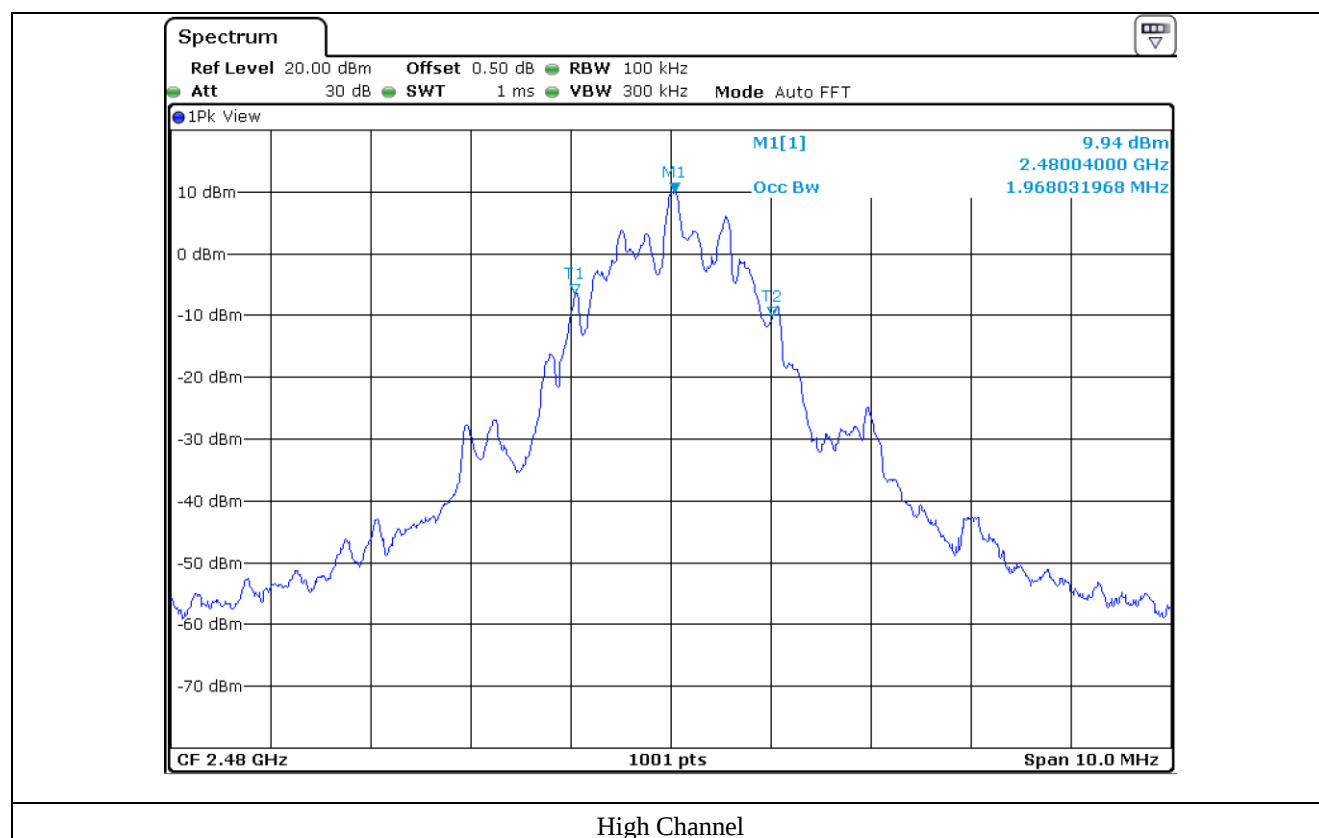
Mode : LE 2 M\_2 Mbps



Low Channel



Middle Channel



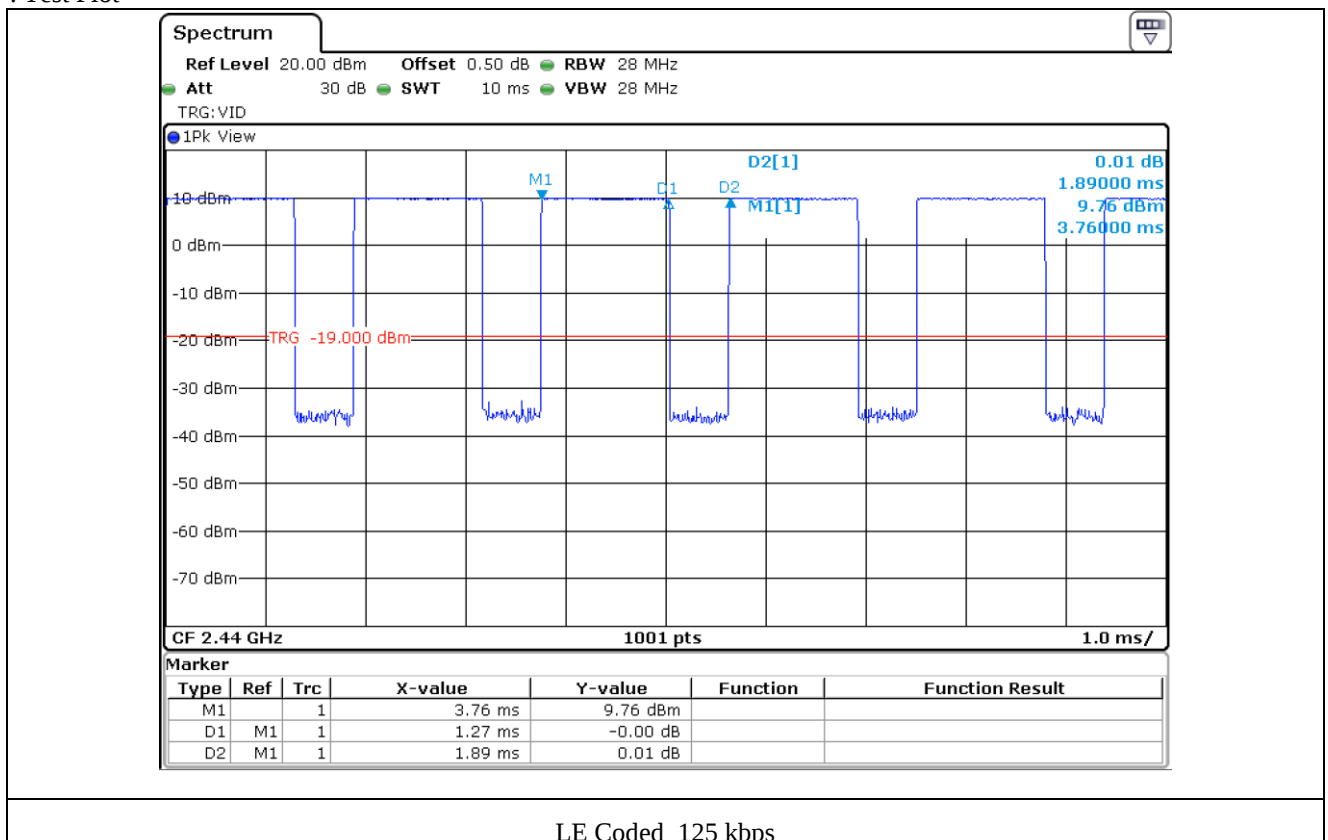
### -. Duty Cycle

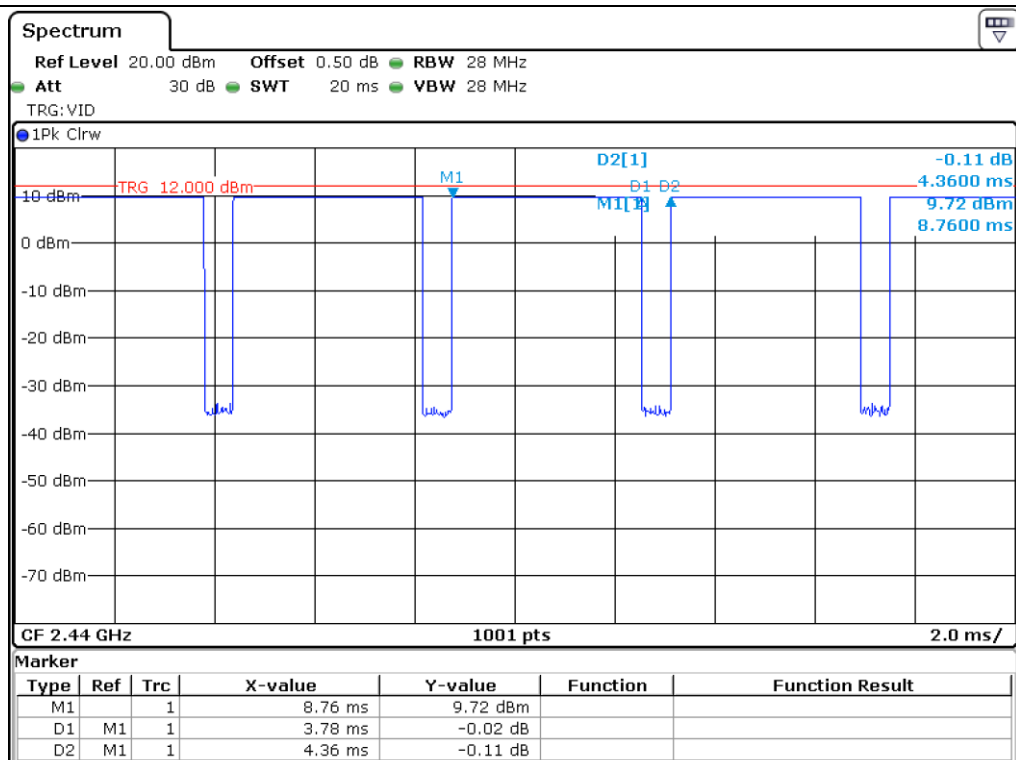
| Mode                  | Tx On Time<br>[ ms ] | Tx Off Time<br>[ ms ] | Duty Cycle<br>[ % ] | Correction Factor<br>[ dB ] |
|-----------------------|----------------------|-----------------------|---------------------|-----------------------------|
| LE Coded_<br>125 kbps | 1.270                | 0.620                 | 67.20               | 1.73                        |
| LE Coded_<br>500 kbps | 3.780                | 0.580                 | 86.70               | 0.62                        |
| LE 1 M_<br>1 Mbps     | 0.429                | 0.200                 | 68.42               | 1.65                        |
| LE 2 M_<br>2 Mbps     | 0.244                | 0.380                 | 38.92               | 4.10                        |

Note – Duty Cycle : (Tx On Time / (Tx On Time + Tx Off Time)) \* 100

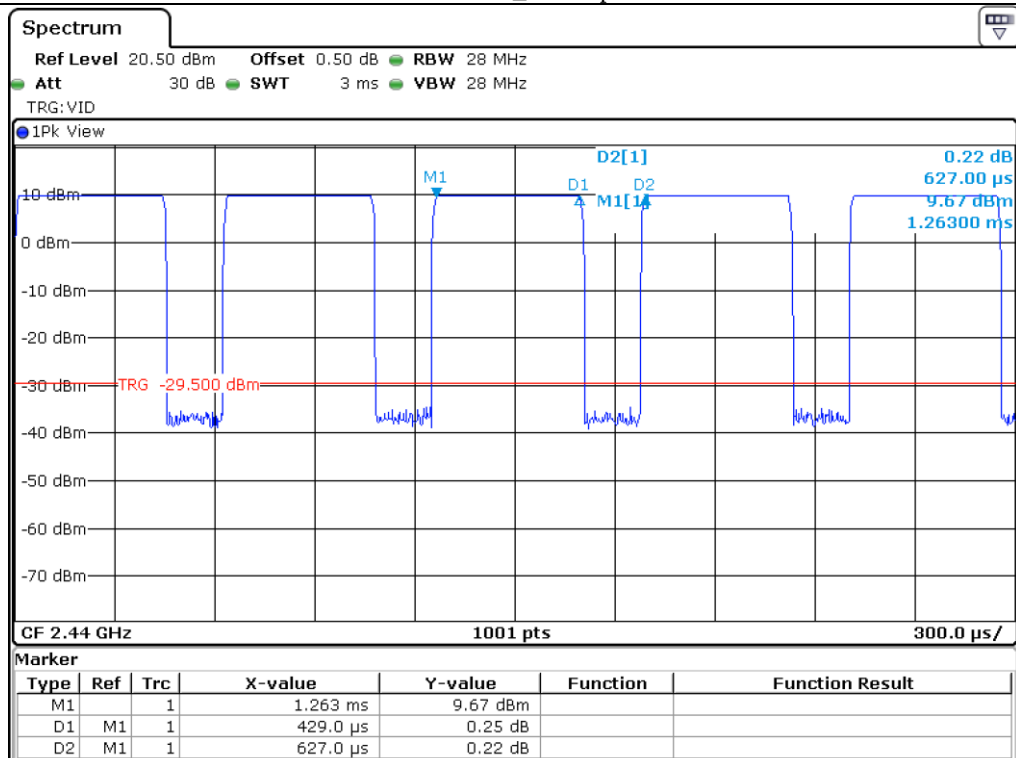
Correction Factor : 10 \* Log(1 / (Duty Cycle / 100))

### -. Test Plot

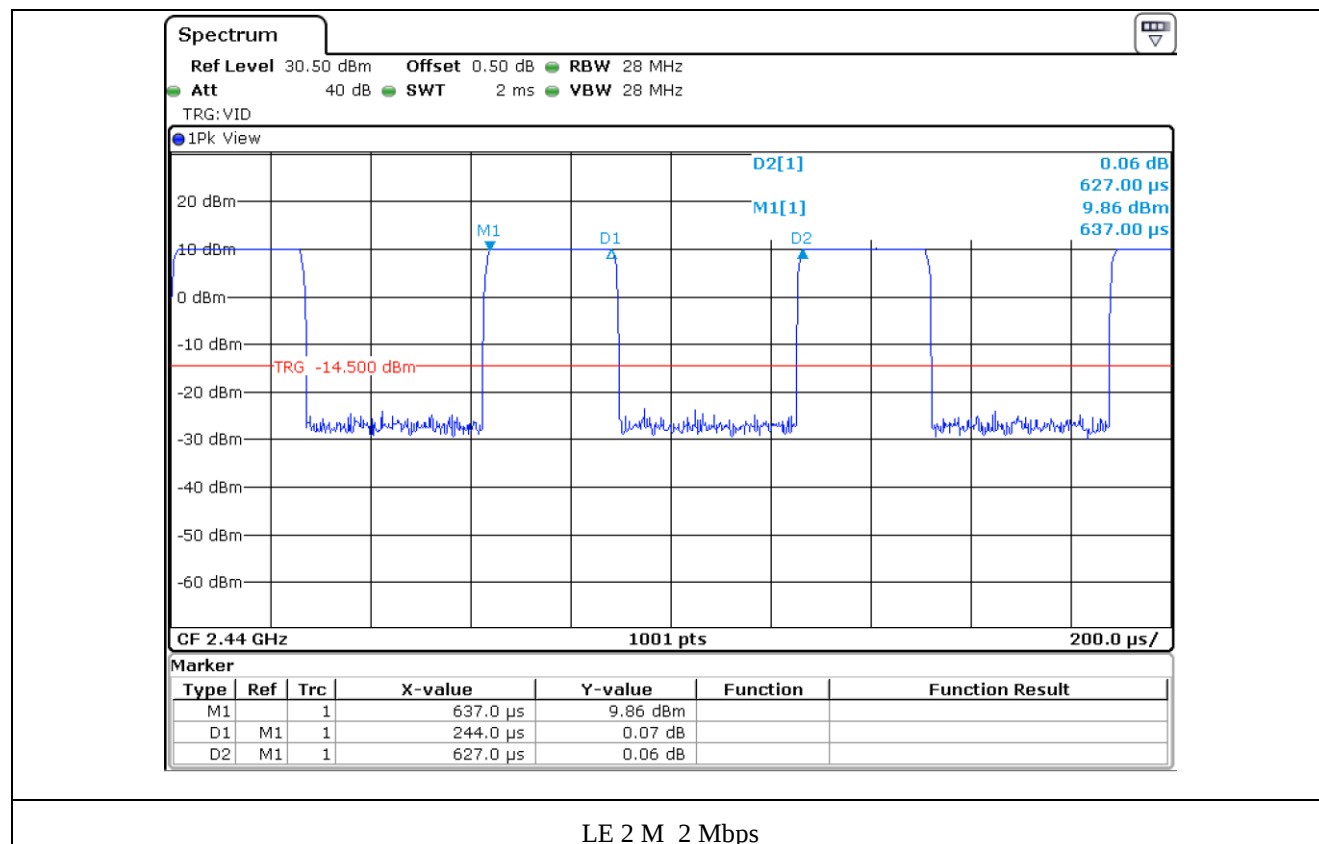




### LE Coded\_500 kbps



### LE 1 M\_1 Mbps



## 5.4 Configuration of Test System

**Line Conducted Test:** The EUT was connected to Jig Board and the power of USB was connected to Notebook PC. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions.

**Radiated Emission Test:** Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 meter Semi Anechoic Chamber.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

## 5.5 Antenna Requirement

For intentional device, according to section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

### Antenna Construction:

The antenna of the EUT is PCB Antenna on the main board in the EUT, so no consideration of replacement by the user.

## 6. PRELIMINARY TEST

### 6.1 AC Power line Conducted Emissions Tests

During Preliminary Test, the following operating mode was investigated.

| Operation Mode    | The Worse operating condition (Please check one only) |
|-------------------|-------------------------------------------------------|
| Transmitting Mode | X                                                     |

### 6.2 General Radiated Emissions Tests

During Preliminary Test, the following operating mode was investigated.

| Operation Mode    | The Worse operating condition (Please check one only) |
|-------------------|-------------------------------------------------------|
| Transmitting Mode | X                                                     |

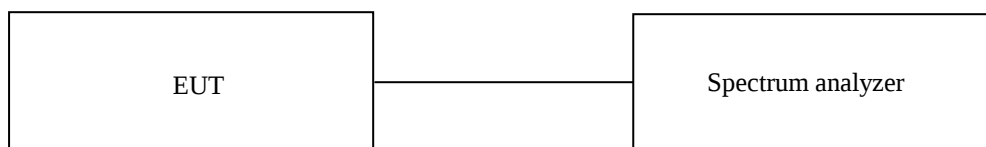
## 7. MINIMUM 6 dB BANDWIDTH

### 7.1 Operating environment

Temperature : 24.3 °C  
Relative humidity : 43.9 % R.H.

### 7.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz, and peak detection was used. The 6 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 6 dB.



### 7.3 Test equipment used

|     | Model Number | Manufacturer    | Description     | Serial Number | Last Cal.          |
|-----|--------------|-----------------|-----------------|---------------|--------------------|
| ■ - | FSV40        | Rohde & Schwarz | Signal Analyzer | 101009        | Mar. 11, 2019 (1Y) |

All test equipment used is calibrated on a regular basis.

## 7.4 Test data for LE Coded\_125 kbps

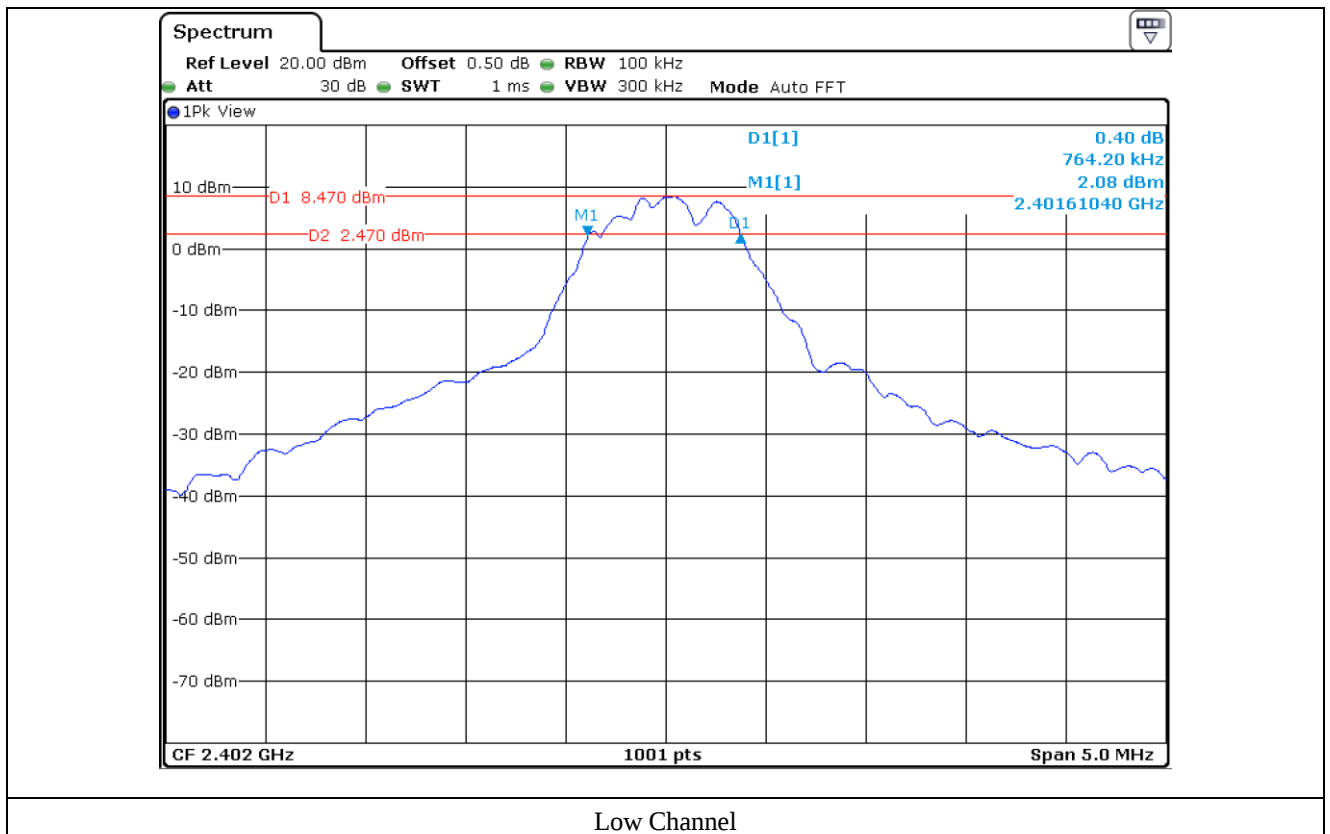
-. Test Date : June 05, 2019 ~ June 11, 2019

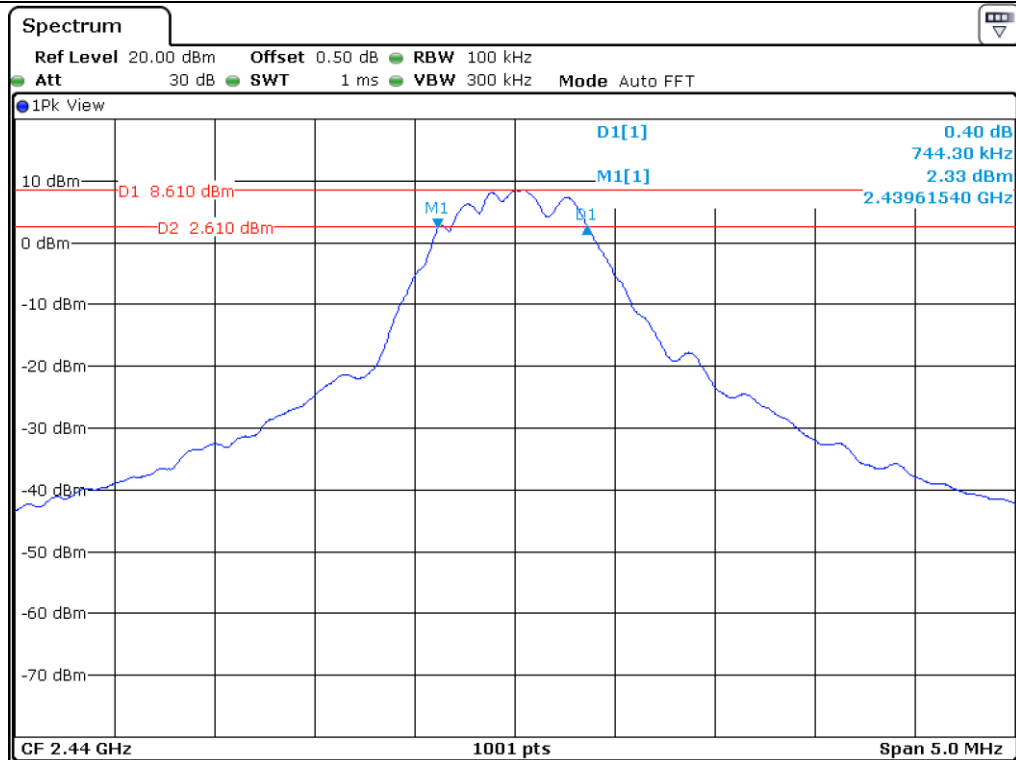
-. Test Result : Pass

| CHANNEL | FREQUENCY(MHz) | MEASURED VALUE (kHz) | LIMIT (kHz) | MARGIN (kHz) |
|---------|----------------|----------------------|-------------|--------------|
| Low     | 2 402.00       | 764.20               | 500.00      | 264.20       |
| Middle  | 2 440.00       | 744.30               | 500.00      | 244.30       |
| High    | 2 480.00       | 749.30               | 500.00      | 249.30       |

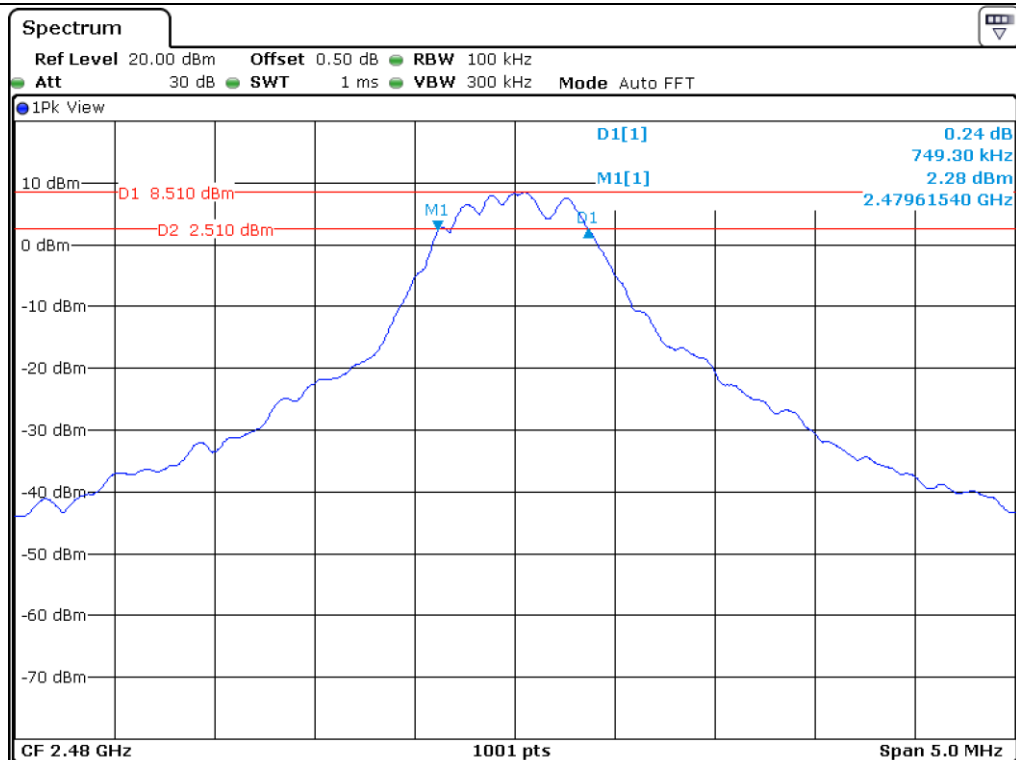
Remark. Margin = Measured Value – Limit

Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel

### 7.5 Test data for LE Coded\_500 kbps

-. Test Date : June 05, 2019 ~ June 11, 2019

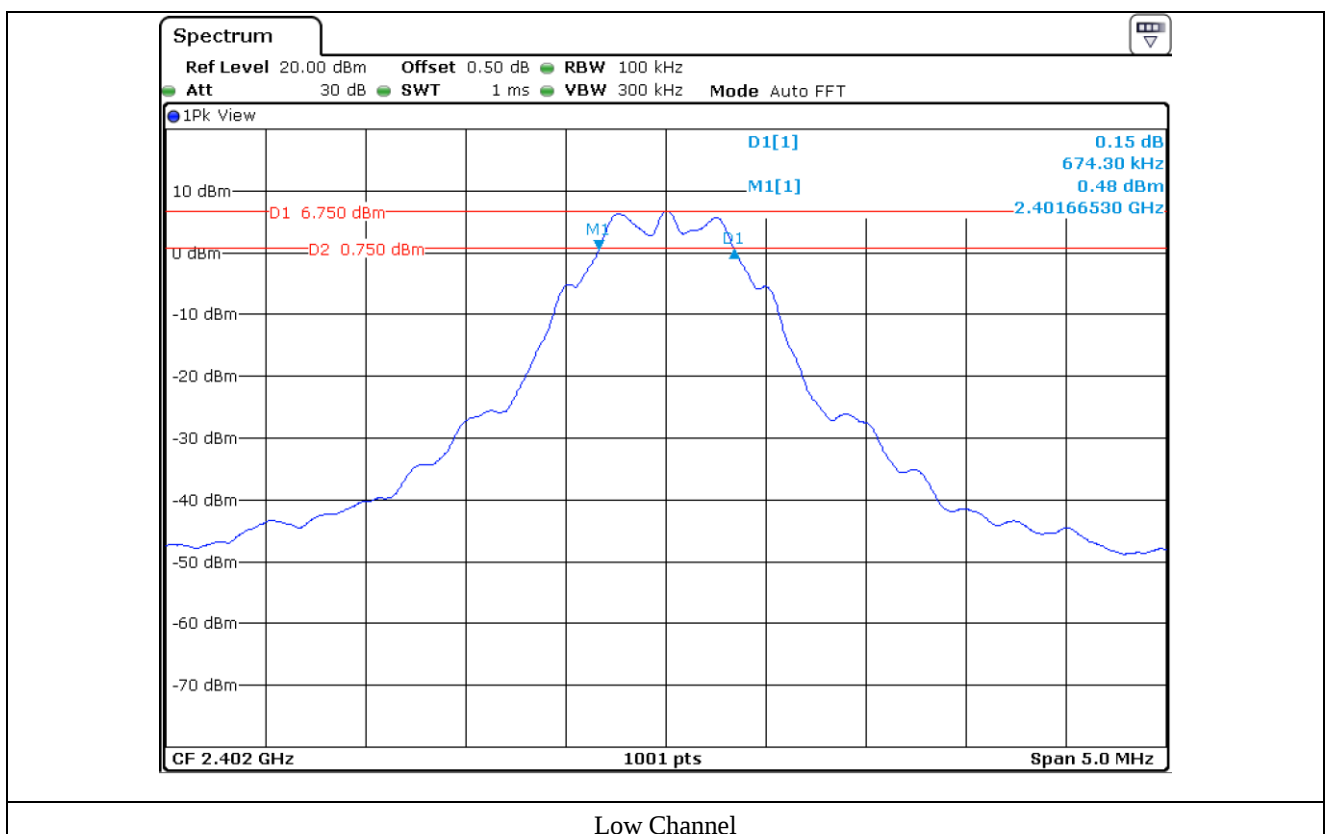
-. Test Result : Pass

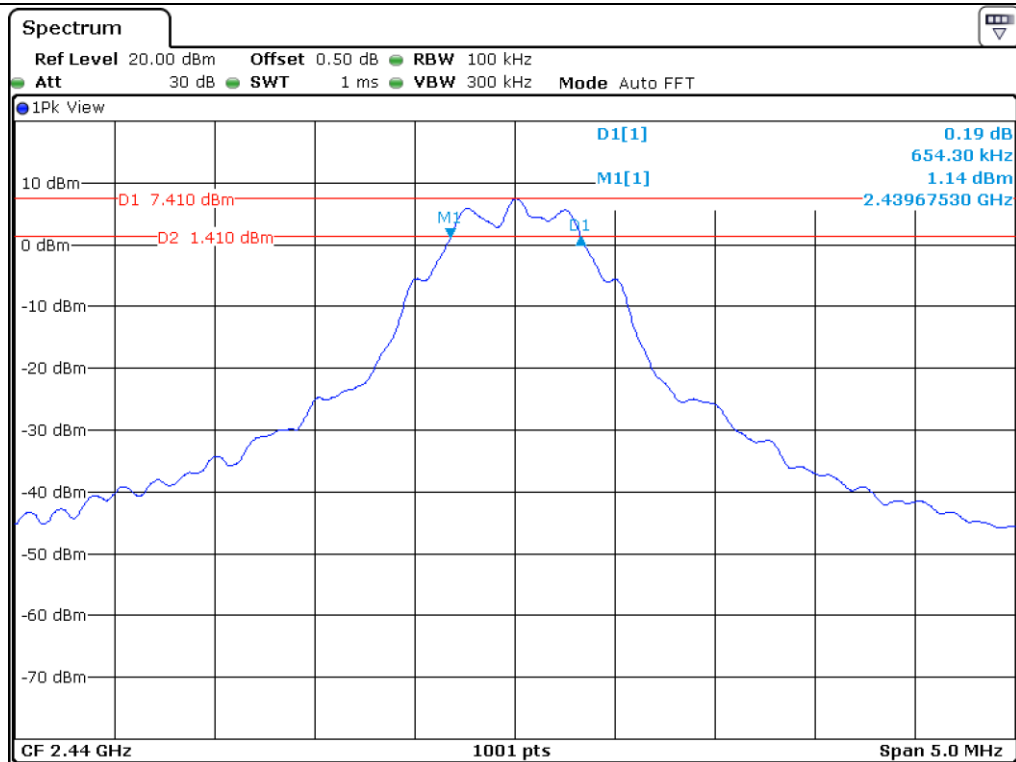
| CHANNEL | FREQUENCY(MHz) | MEASURED VALUE (kHz) | LIMIT (kHz) | MARGIN (kHz) |
|---------|----------------|----------------------|-------------|--------------|
| Low     | 2 402.00       | 674.30               | 500.00      | 174.30       |
| Middle  | 2 440.00       | 654.30               | 500.00      | 154.30       |
| High    | 2 480.00       | 674.30               | 500.00      | 174.30       |

Remark. Margin = Measured Value – Limit

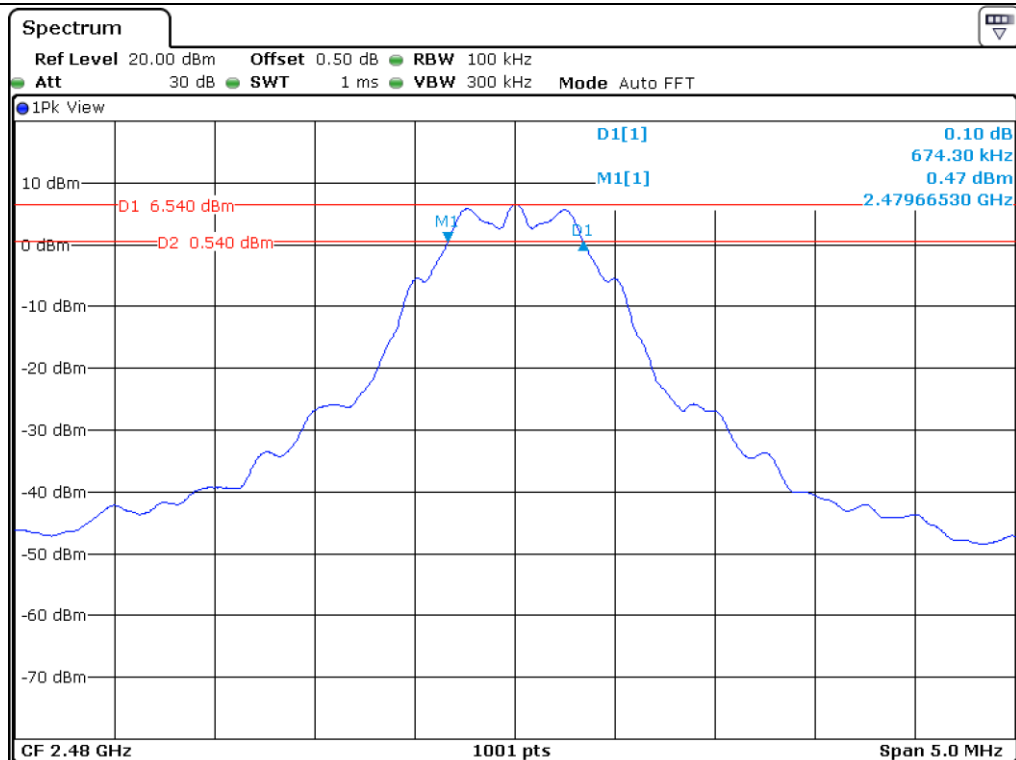


Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel

## 7.6 Test data for LE 1 M\_1 Mbps

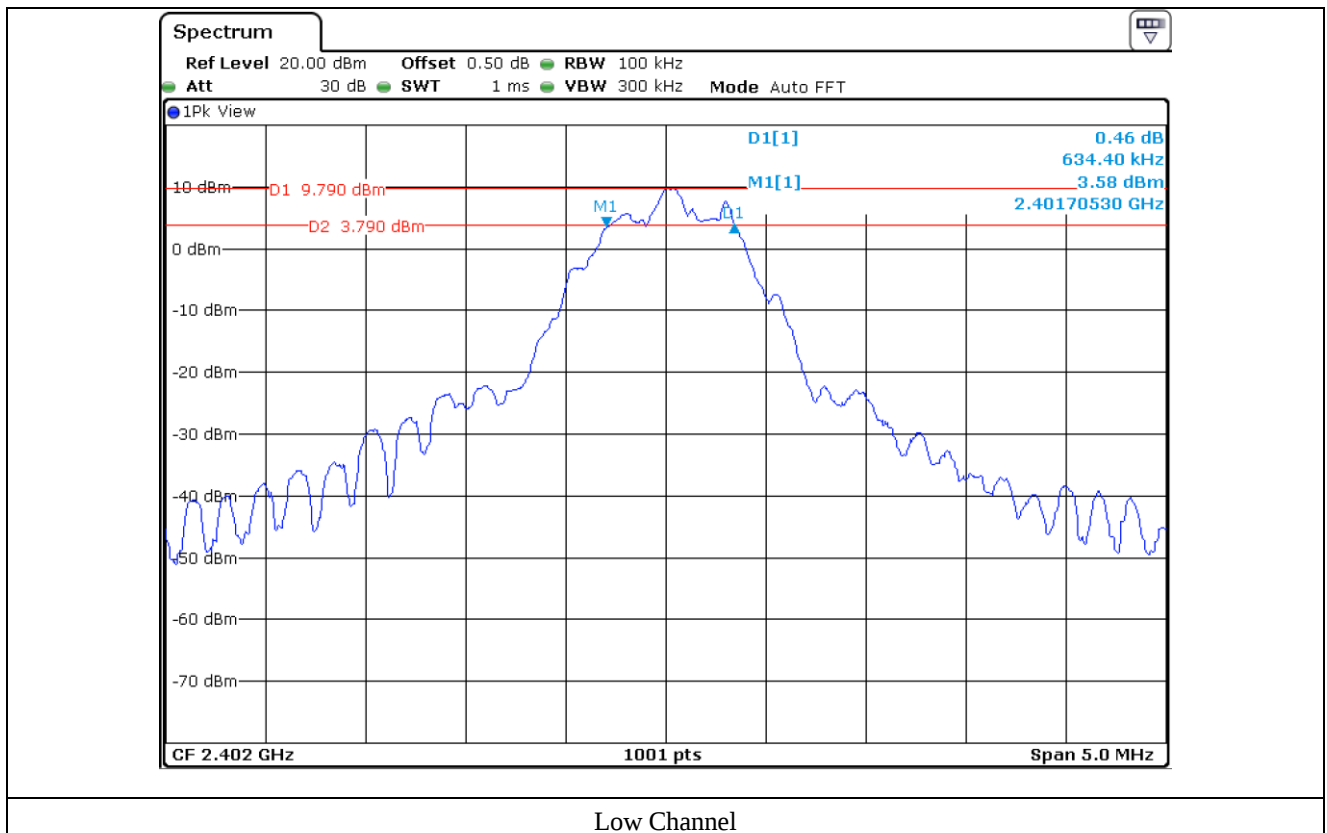
-. Test Date : June 05, 2019 ~ June 11, 2019

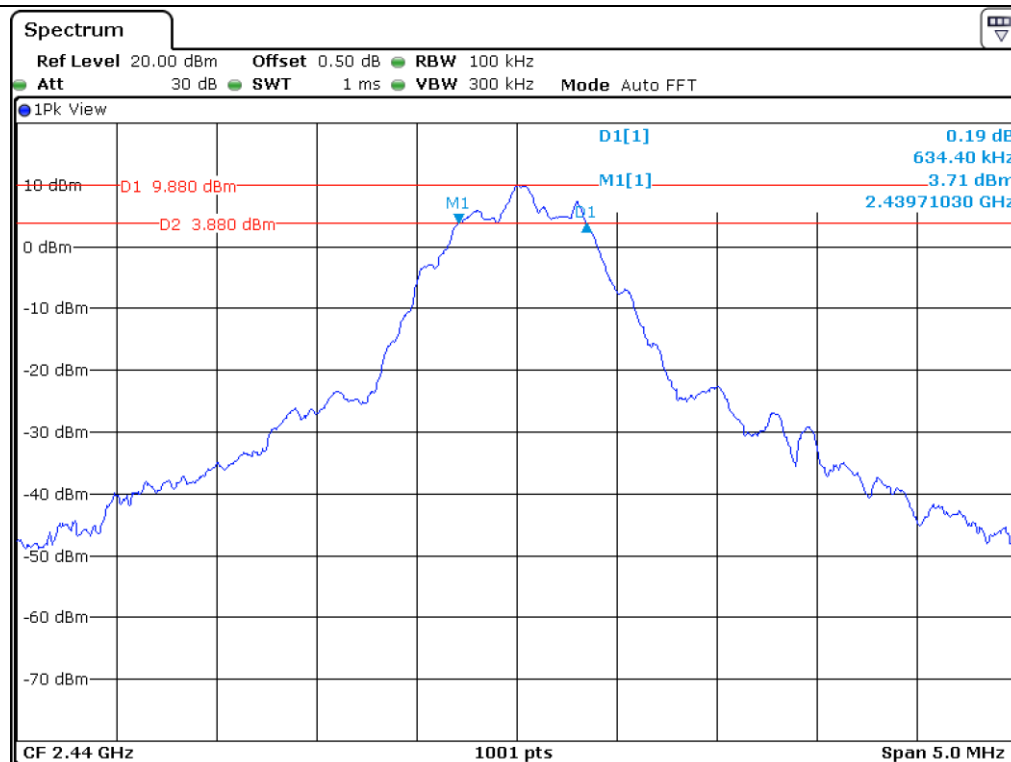
-. Test Result : Pass

| CHANNEL | FREQUENCY(MHz) | MEASURED VALUE (kHz) | LIMIT (kHz) | MARGIN (kHz) |
|---------|----------------|----------------------|-------------|--------------|
| Low     | 2 402.00       | 634.40               | 500.00      | 134.40       |
| Middle  | 2 440.00       | 634.40               | 500.00      | 134.40       |
| High    | 2 480.00       | 604.40               | 500.00      | 104.40       |

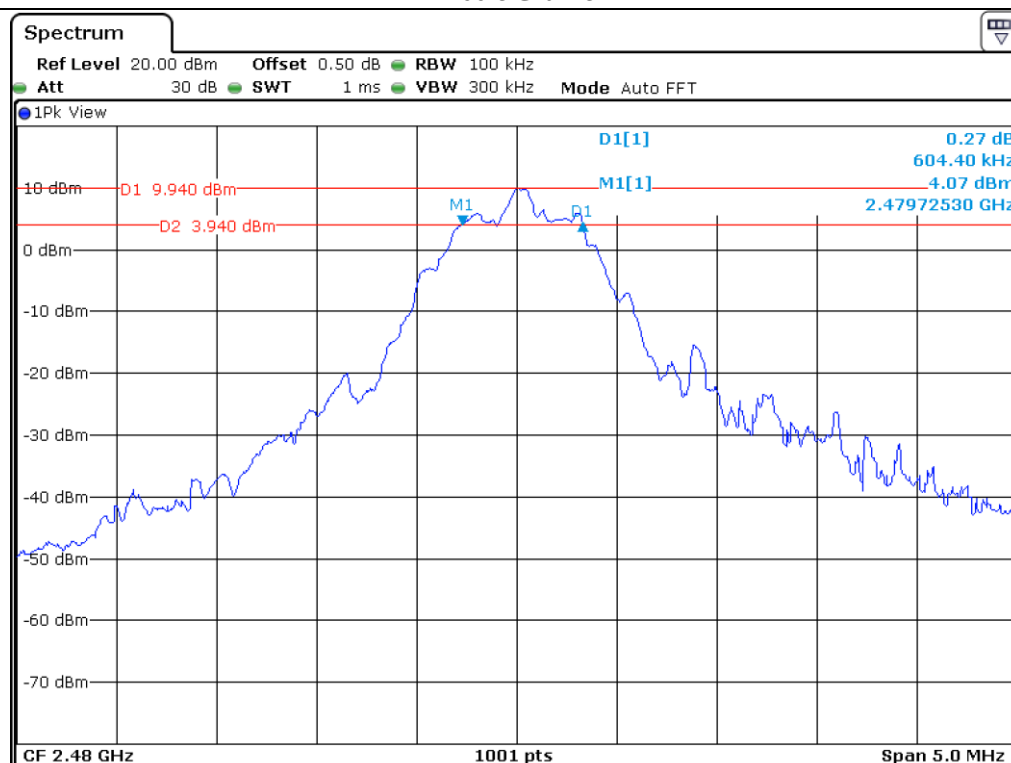
Remark. Margin = Measured Value – Limit

Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel

## 7.7 Test data for LE 2 M\_2 Mbps

-. Test Date : June 05, 2019 ~ June 11, 2019

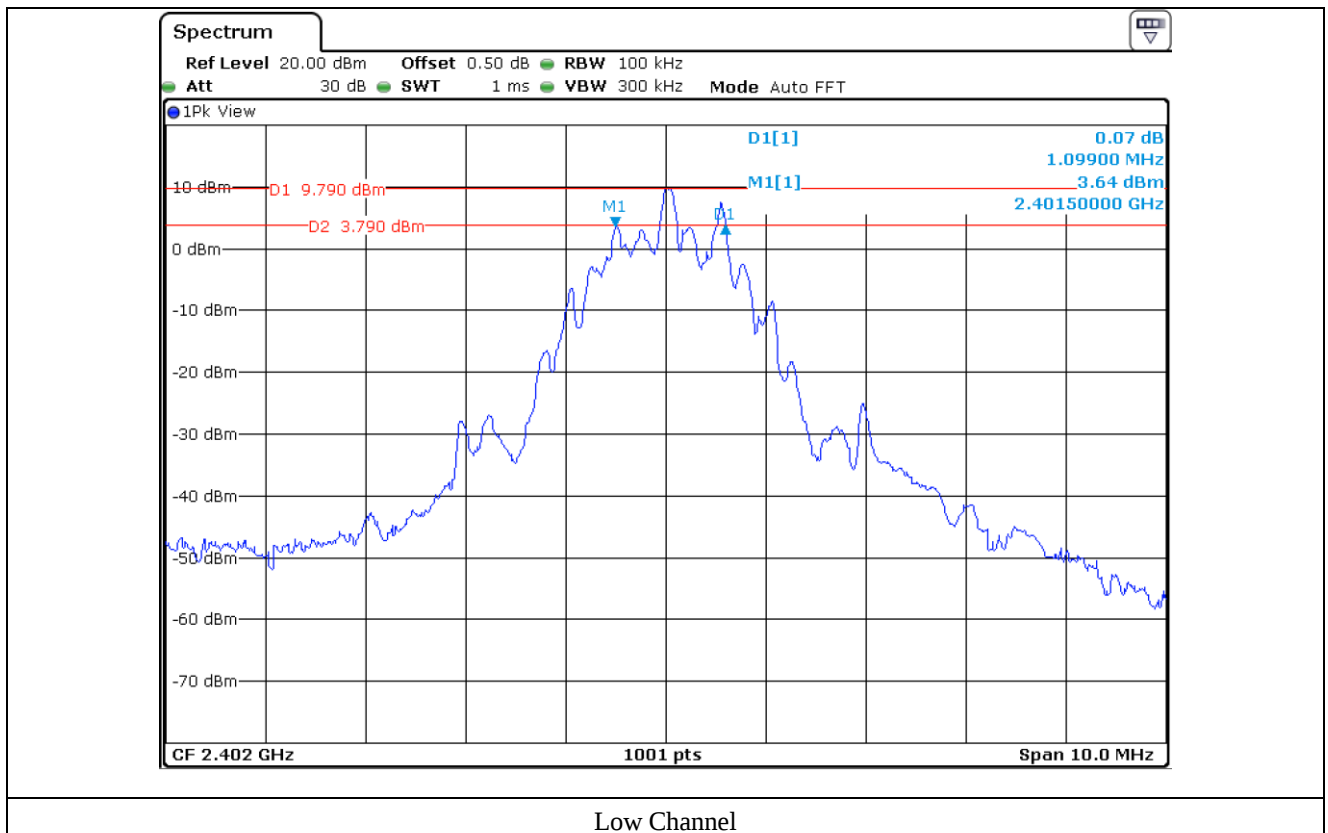
-. Test Result : Pass

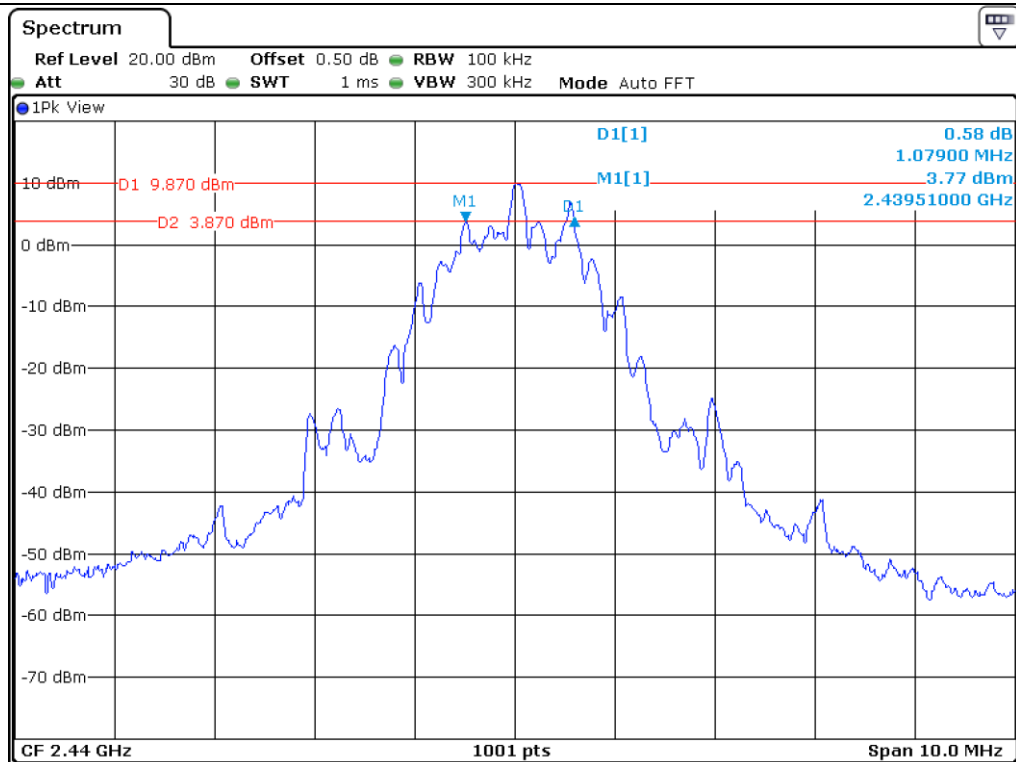
| CHANNEL | FREQUENCY(MHz) | MEASURED VALUE (MHz) | LIMIT (MHz) | MARGIN (MHz) |
|---------|----------------|----------------------|-------------|--------------|
| Low     | 2 402.00       | 1.10                 | 0.50        | 0.60         |
| Middle  | 2 440.00       | 1.08                 | 0.50        | 0.58         |
| High    | 2 480.00       | 1.09                 | 0.50        | 0.59         |

Remark. Margin = Measured Value – Limit

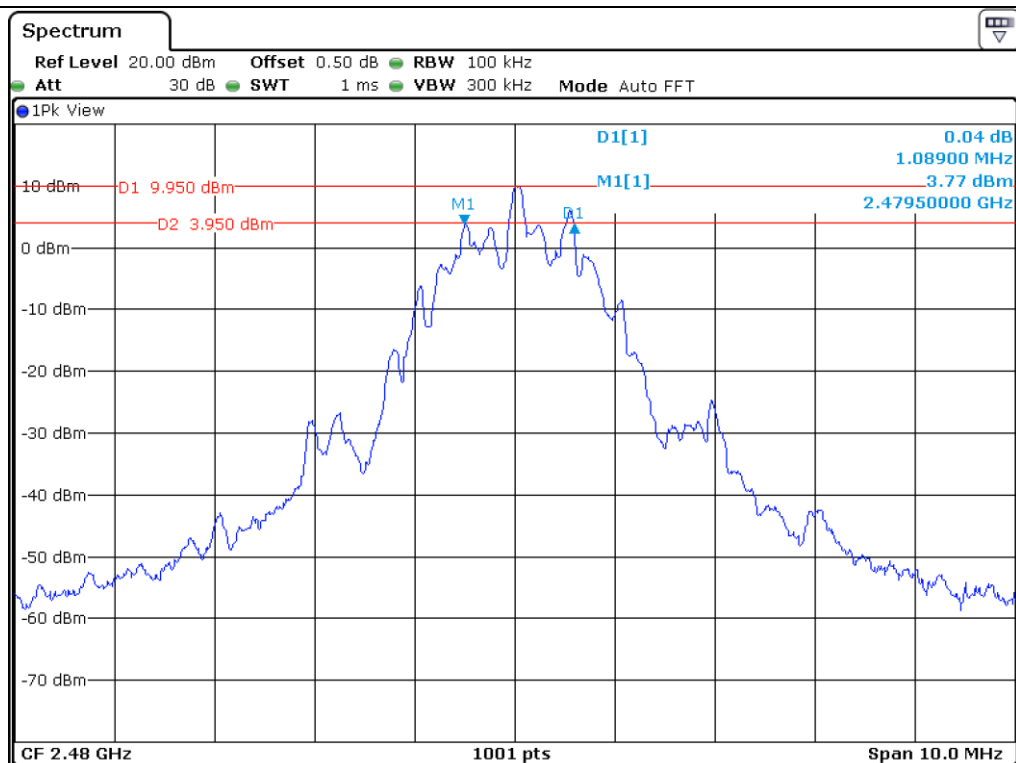


Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel

## 8. MAXIMUM PEAK OUTPUT POWER

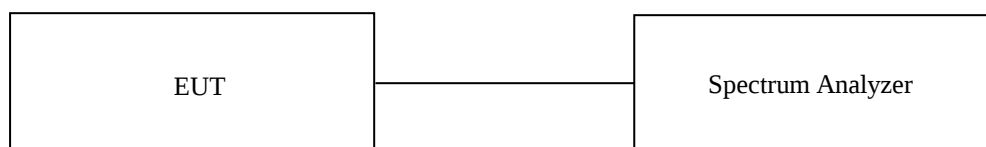
### 8.1 Operating environment

Temperature : 24.3 °C  
Relative humidity : 43.9 % R.H.

### 8.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer.

Uses trace averaging across ON and OFF times of the EUT transmissions, followed by duty cycle correction.



### 8.3 Test equipment used

|     | Model Number | Manufacturer    | Description     | Serial Number | Last Cal.          |
|-----|--------------|-----------------|-----------------|---------------|--------------------|
| ■ - | FSV40        | Rohde & Schwarz | Signal Analyzer | 101009        | Mar. 11, 2019 (1Y) |

All test equipment used is calibrated on a regular basis.

#### 8.4 Test data for LE Coded\_125 kbps

-. Test Date : June 05, 2019 ~ June 11, 2019

-. Test Result : Pass

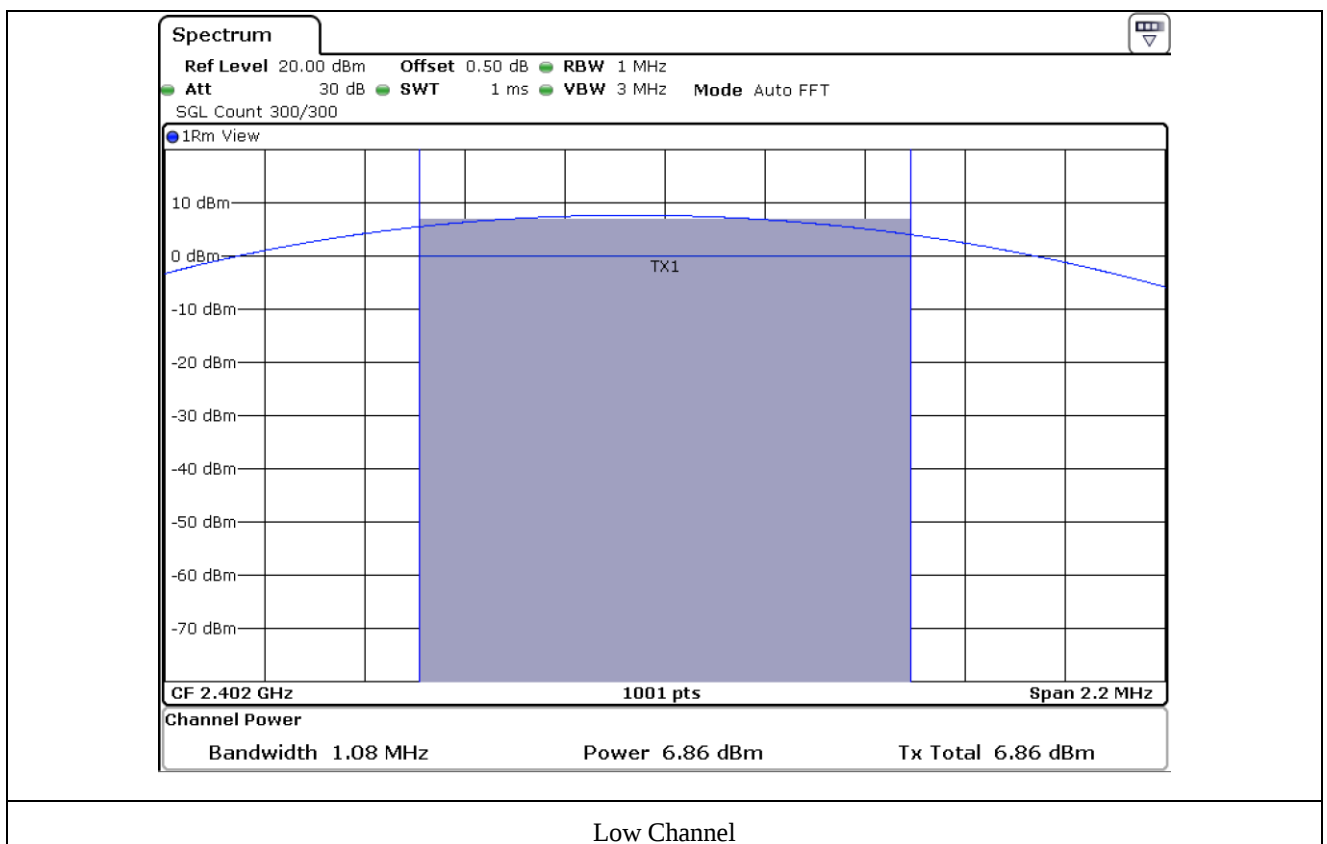
-. Duty Cycle : 67.20 %

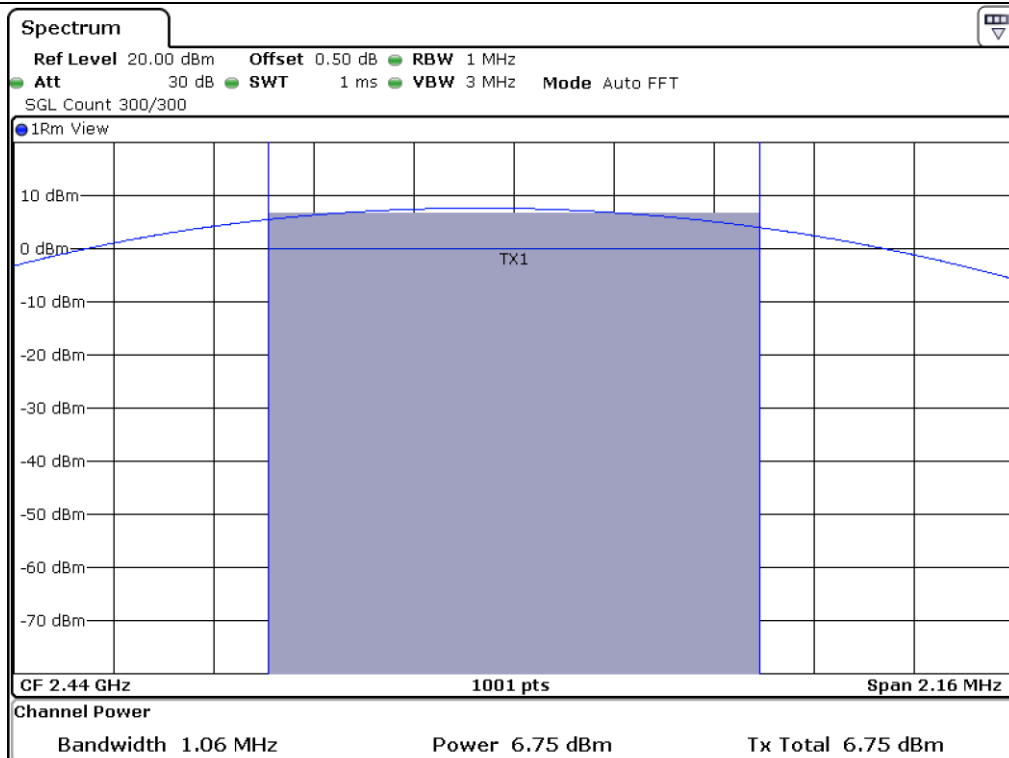
| CHANNEL | FREQUENCY<br>(MHz) | MEASURED<br>VALUE (dBm) | CORRECTION<br>FACTOR (dB) | RESULT<br>(dBm) | LIMIT<br>(dBm) | MARGIN<br>(dB) |
|---------|--------------------|-------------------------|---------------------------|-----------------|----------------|----------------|
| LOW     | 2 402.00           | 6.86                    | 1.73                      | 8.59            | 30.00          | 21.41          |
| MIDDLE  | 2 440.00           | 6.75                    | 1.73                      | 8.48            | 30.00          | 21.52          |
| HIGH    | 2 480.00           | 7.02                    | 1.73                      | 8.75            | 30.00          | 21.25          |

Remark : Margin = Limit – Result (= Measured Value + Correction Factor)

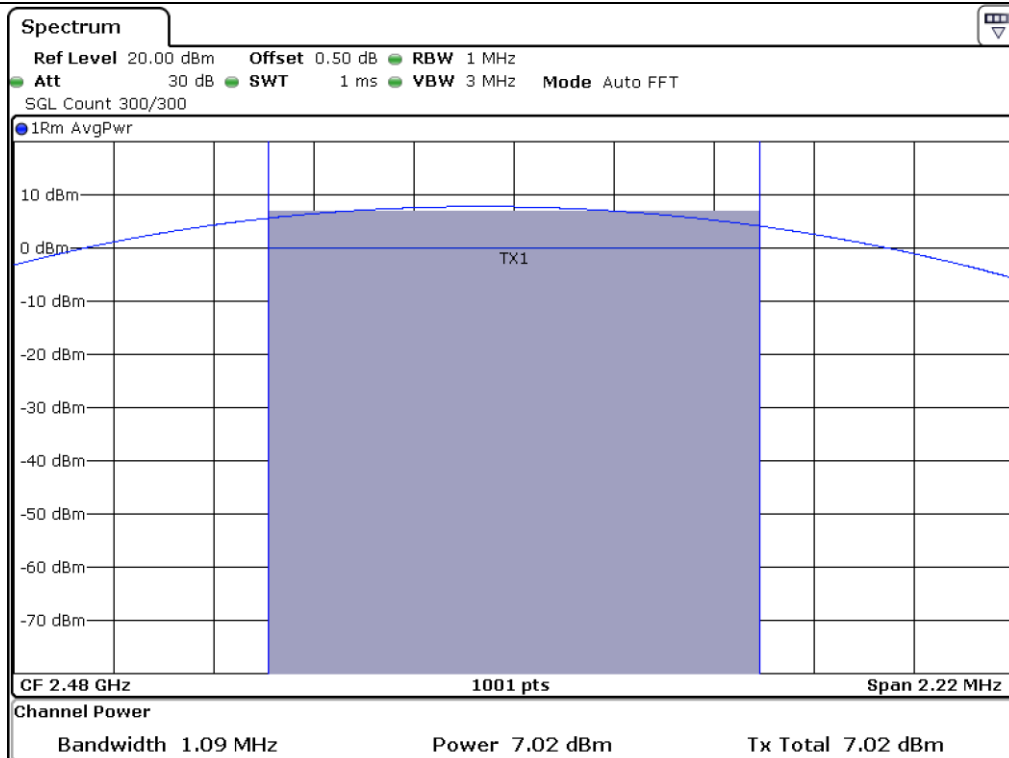


Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel

### 8.5 Test data for LE Coded\_500 kbps

-. Test Date : June 05, 2019 ~ June 11, 2019

-. Test Result : Pass

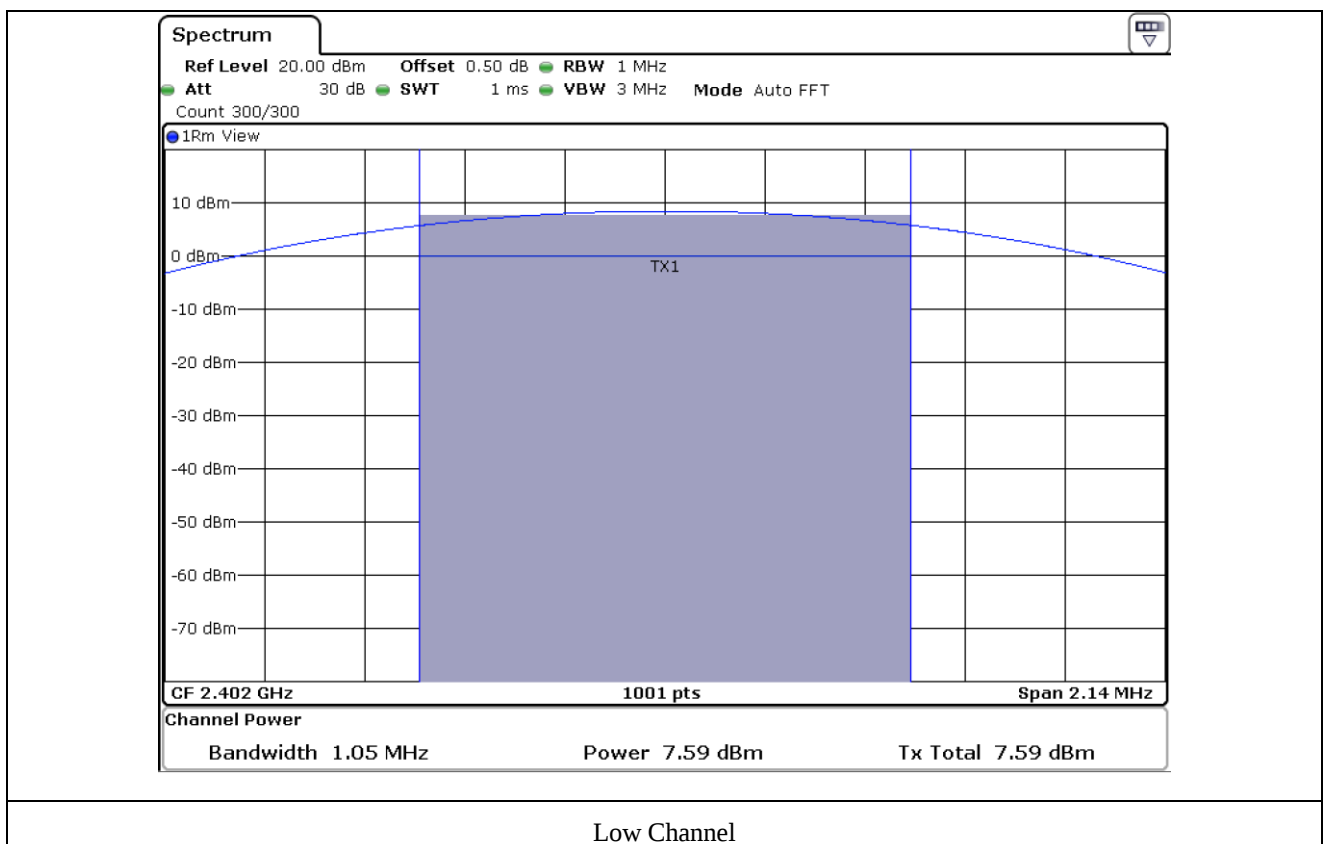
-. Duty Cycle : 86.70 %

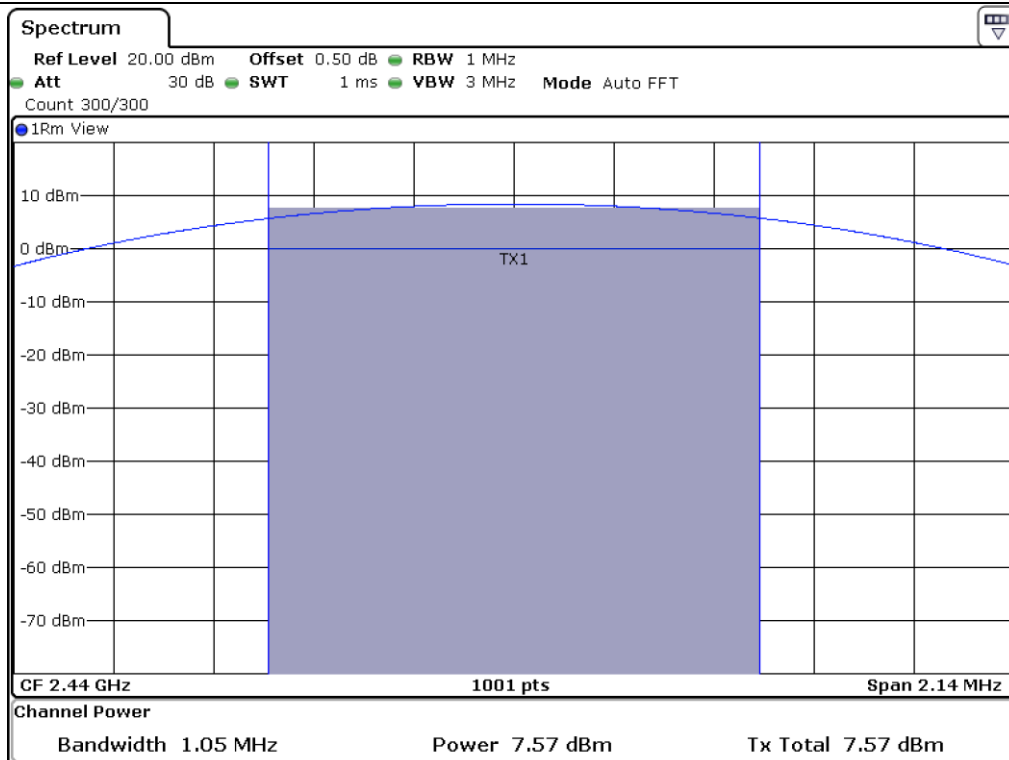
| CHANNEL | FREQUENCY<br>(MHz) | MEASURED<br>VALUE (dBm) | CORRECTION<br>FACTOR (dB) | RESULT<br>(dBm) | LIMIT<br>(dBm) | MARGIN<br>(dB) |
|---------|--------------------|-------------------------|---------------------------|-----------------|----------------|----------------|
| LOW     | 2 402.00           | 7.59                    | 0.62                      | 8.21            | 30.00          | 21.79          |
| MIDDLE  | 2 440.00           | 7.57                    | 0.62                      | 8.19            | 30.00          | 21.81          |
| HIGH    | 2 480.00           | 7.88                    | 0.62                      | 8.50            | 30.00          | 21.50          |

Remark : Margin = Limit – Result (= Measured Value + Correction Factor)

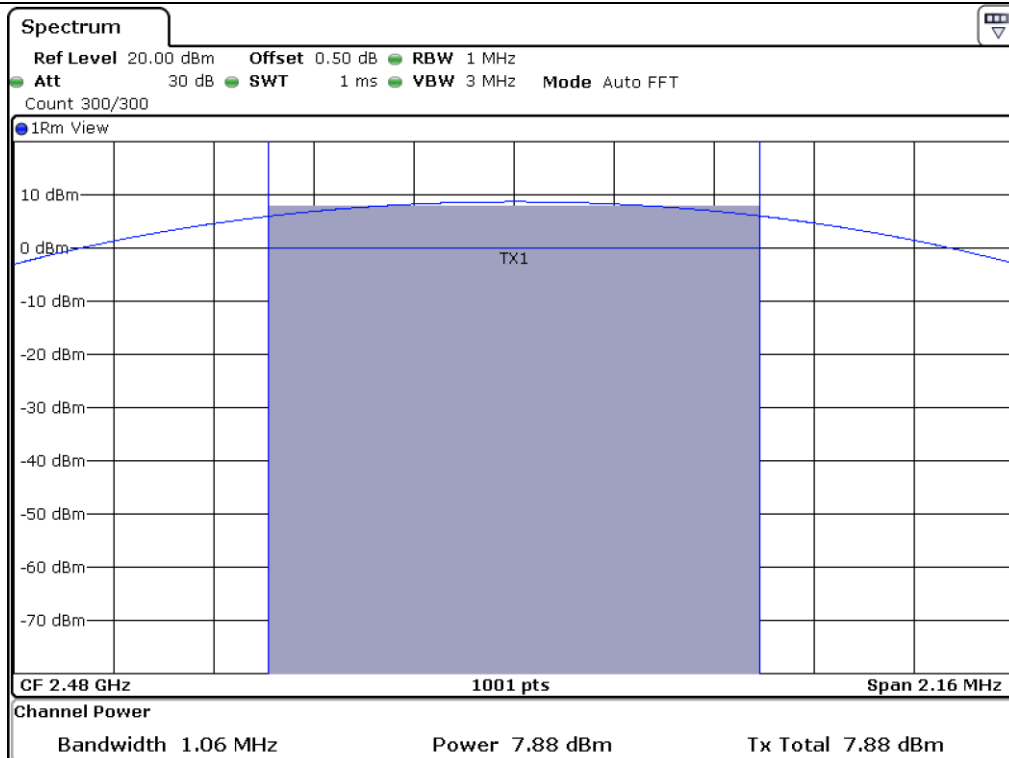


Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel

## 8.6 Test data for LE 1 M\_1 Mbps

-. Test Date : June 05, 2019 ~ June 11, 2019

-. Test Result : Pass

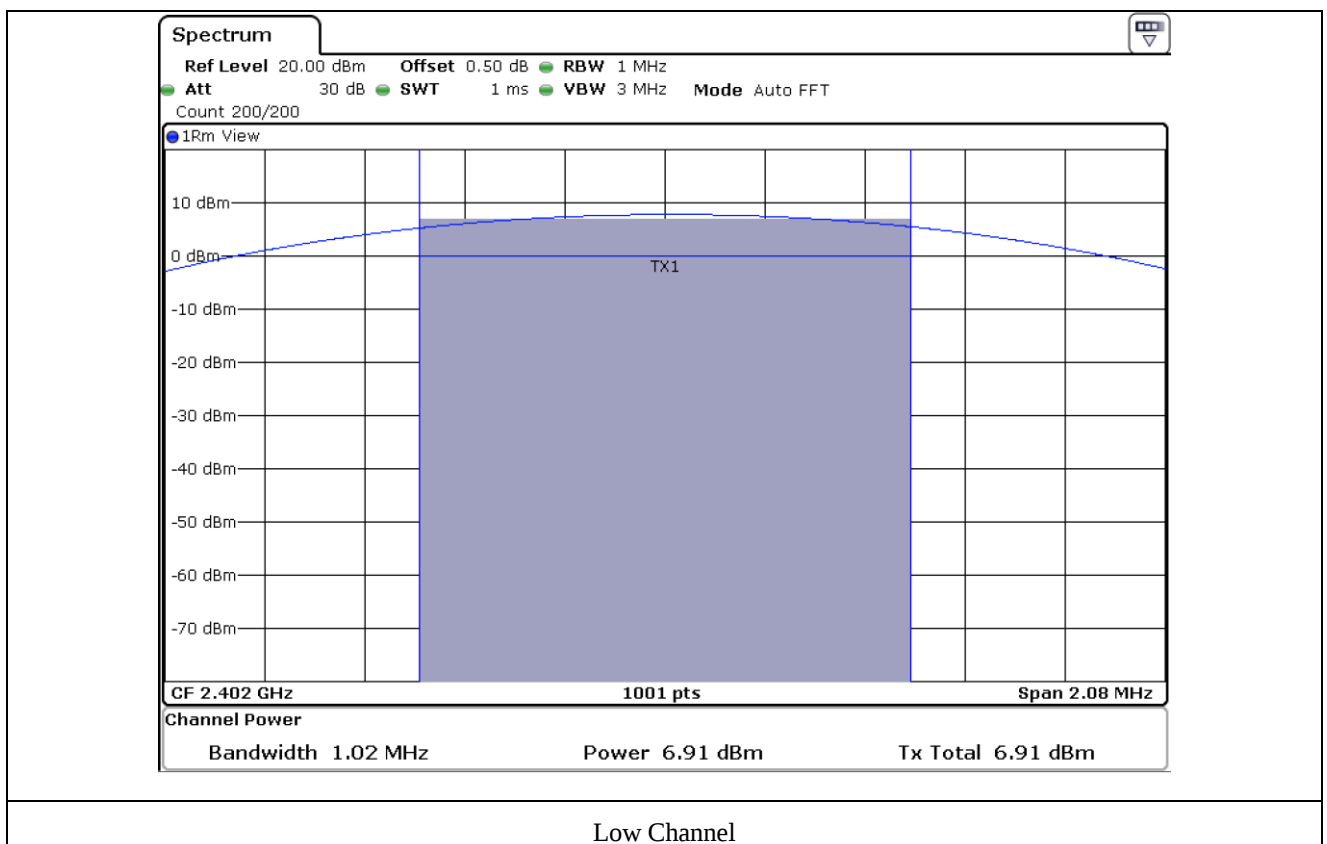
-. Duty Cycle : 68.42 %

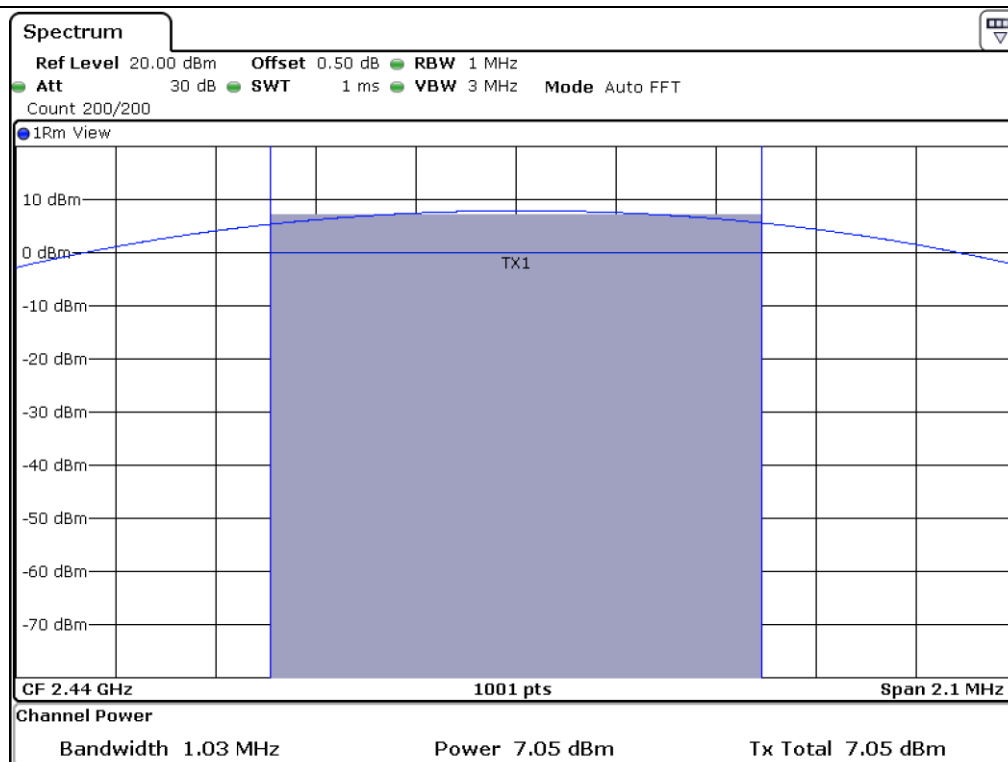
| CHANNEL | FREQUENCY<br>(MHz) | MEASURED<br>VALUE (dBm) | CORRECTION<br>FACTOR (dB) | RESULT<br>(dBm) | LIMIT<br>(dBm) | MARGIN<br>(dB) |
|---------|--------------------|-------------------------|---------------------------|-----------------|----------------|----------------|
| LOW     | 2 402.00           | 6.91                    | 1.65                      | 8.56            | 30.00          | 21.44          |
| MIDDLE  | 2 440.00           | 7.05                    | 1.65                      | 8.70            | 30.00          | 21.30          |
| HIGH    | 2 480.00           | 7.10                    | 1.65                      | 8.75            | 30.00          | 21.25          |

Remark : Margin = Limit – Result (= Measured Value + Correction Factor)

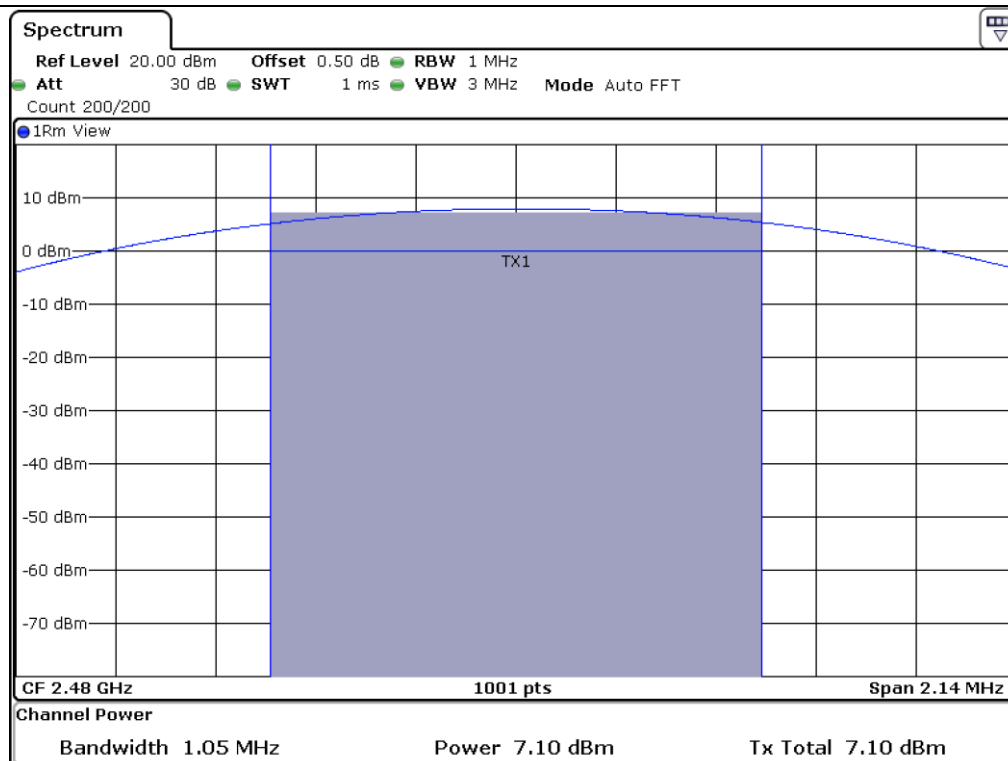


Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel

## 8.7 Test data for LE 2 M\_2 Mbps

-. Test Date : June 05, 2019 ~ June 11, 2019

-. Test Result : Pass

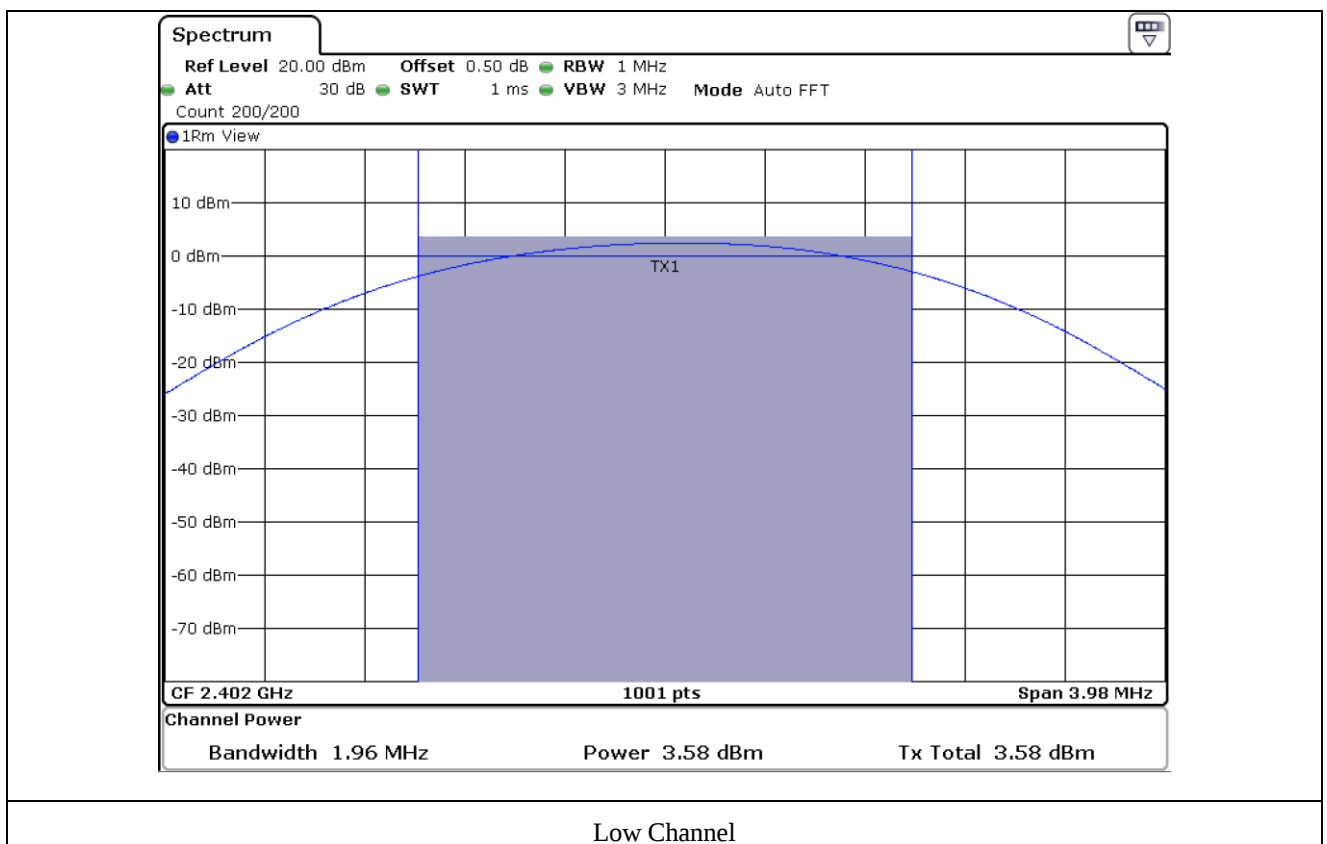
-. Duty Cycle : 38.92 %

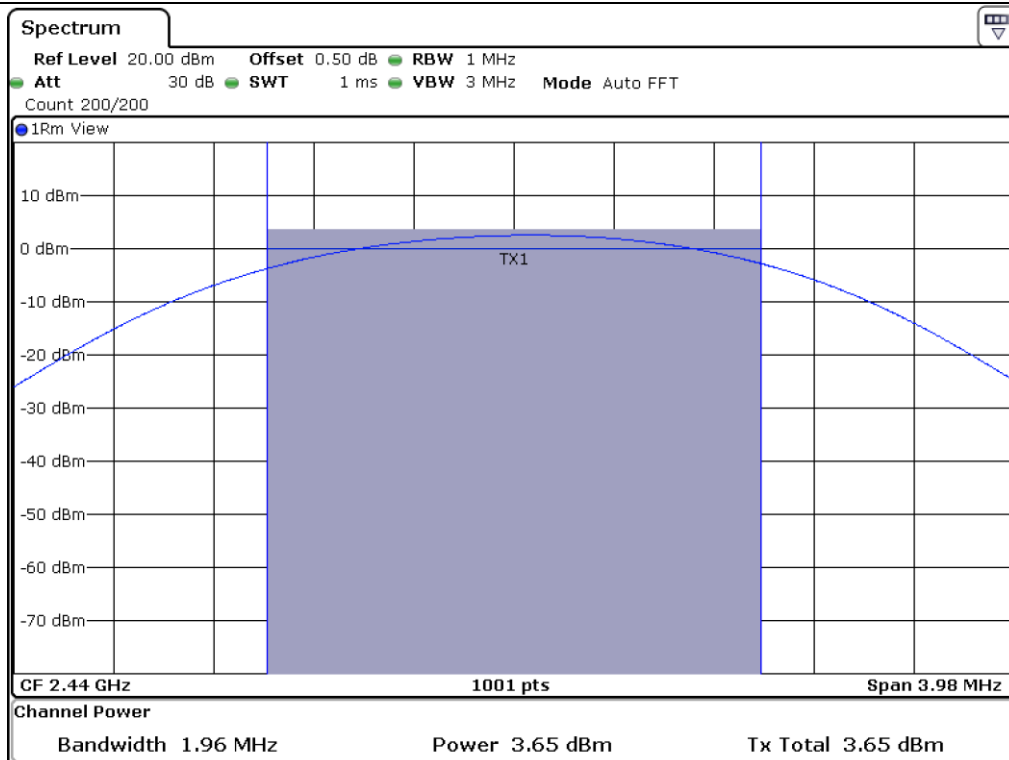
| CHANNEL | FREQUENCY<br>(MHz) | MEASURED<br>VALUE (dBm) | CORRECTION<br>FACTOR (dB) | RESULT<br>(dBm) | LIMIT<br>(dBm) | MARGIN<br>(dB) |
|---------|--------------------|-------------------------|---------------------------|-----------------|----------------|----------------|
| LOW     | 2 402.00           | 3.58                    | 4.10                      | 7.68            | 30.00          | 22.32          |
| MIDDLE  | 2 440.00           | 3.65                    | 4.10                      | 7.75            | 30.00          | 22.25          |
| HIGH    | 2 480.00           | 3.75                    | 4.10                      | 7.85            | 30.00          | 22.15          |

Remark : Margin = Limit – Result (= Measured Value + Correction Factor)

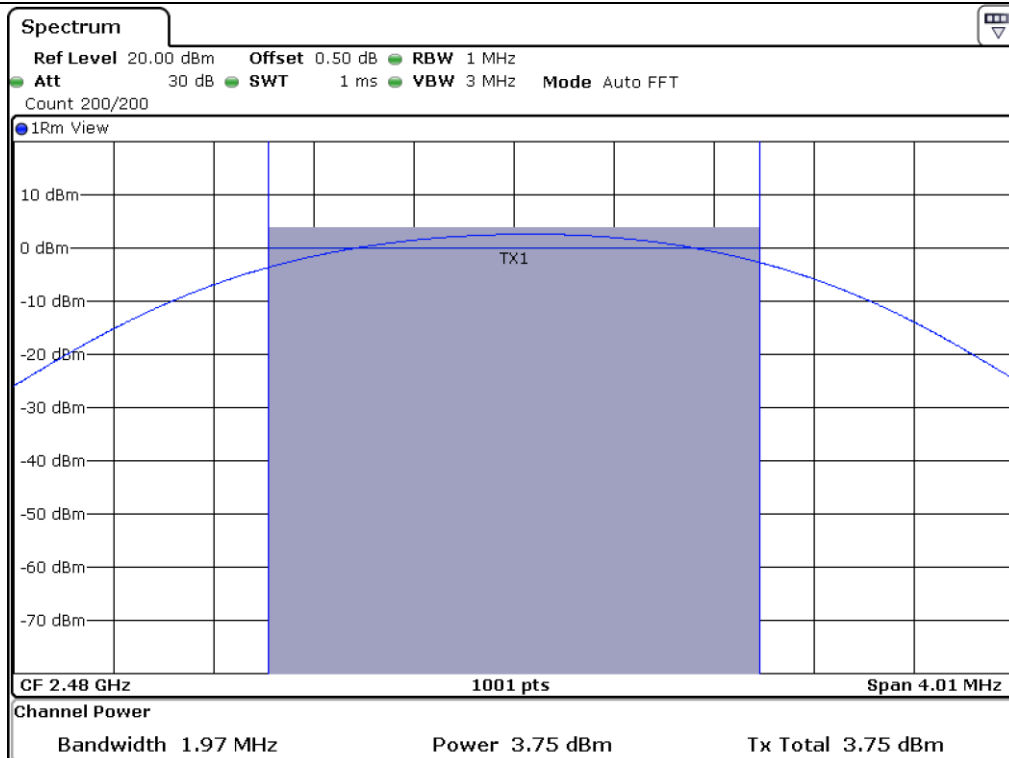


Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel