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**FCC CFR47 PART 15 SUBPART C & IC RSS-247**

**TEST REPORT**

**For**

**Pointer Telocation, Inc.**

**CELLOTRACK 10Y LTE C1  
Model Number: GC9773001-000**

**FCC ID: 2AG69CTLL  
IC: 9975A-CTLL**

**Report Number: 0048-180515-01-FCC-IC**

*Prepared for*  
**Pointer Telocation, Inc.  
14Hamelacha St.  
Rosh Ha'ayin, 48091, Israel**

*Prepared by*  
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**Date: 05/25/2018**

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## 1. TEST RESULT CERTIFICATION

**COMPANY NAME:** Pointer Telocation, Inc.  
14Hamelacha St.  
Rosh Ha'ayin, 48091, Israel

**EUT DESCRIPTION:** CELLOTRACK 10Y LTE C1

**MODEL:** GC9773001-000

**DATE TESTED:** 05/15/2018 to 05/25/2018

| APPLICABLE STANDARDS                                    |                         |
|---|-------------------------|
| STANDARD  | TEST RESULTS            |
| FCC Part 15.247 & IC RSS-247:Issue 2 & RSS-GEN: Issue 5 | NO NON-COMPLIANCE NOTED |

### Test Summary

| Testing Items Per FCC Part 2/ Part 15.247 & IC RSS-247 /RSS-Gen Standard Requirements for DTS Modulation | Section                          | Limit                                       | Result   |
|--|----------------------------------|---|----------|
| DTS Bandwidth  | 15.247(a) (2)<br>RSS-247, 5.2(1) | $\geq 500\text{KHz}$                        | Complies |
| Peak Power Limit   | 15.247(b) (3)<br>RSS-247, 5.4(4) | Conducted: 1W (30dBm)<br>e.i.r.p. 4W(36dBm) | Complies |
| Peak Power Spectral Density  | 15.247(e)<br>RSS-247, 5.2(2)     | 8dBm/3KHz                                   | Complies |
| Emissions ( Conducted)   | 15.247(d)<br>RSS-247, 5.5        | -20dB/-30dB                                 | Complies |
| Spurious ( Radiated)   | 15.205(a)<br>RSS-247, 5.5        | 15.209/RSS-Gen                              | Complies |
| RF Safety*   | 1.1310/RSS-102                   | 1.0/5.0 mW/cm <sup>2</sup>                  | Complies |

NOTE: \* For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

Advanced Compliance Laboratory, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** This document reports conditions under which testing was conducted and results of tests performed. This document may not be altered or revised in any way unless done so by Advanced Compliance Laboratory, Inc. (ACL) and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by ACL, Advanced Compliance Laboratory, Inc. will constitute fraud and shall nullify the document.

Approved & Released For ACL By:

Tested By:



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Wei Li

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David Tu

Manager  
Advanced Compliance Laboratory, Inc.

EMC Engineer

## 2. EUT DESCRIPTION

The EUT for this certification is a low power transmitter, using digital modulation & operating in the 2400-2483.5 MHz band.

The transmitter has a maximum conducted output power as follows:

| Frequency Range (MHz) | Rated Power | Measured Max. Conducted Output Power (dBm/W) |  |
|-----------------------|-------------|--|--|
| 2402.0 - 2480.0       | 7dBm        | 6.5dBm/ 0.005                                |  |
|                       |             |  |  |

The EUT can use a Embedded 2.4GHz WiFi/ISM/BT/Zigbee Antenna, P/N 1001312, Made by ETHERTRONICS , 1.72 dBi peak, Surface Mount Chip.

Max. e.i.r.p is 8.22dBm, i.e. 0.008W. With this antenna, both conducted output power and e.r.i.p are under FCC & IC limit.

EUT Specification:

|   |                                 |
|---|---------------------------------|
| Operation Frequency & Channel Number        | 2402MHz to 2480MHz. 40 Channels |
| Channel Separation                          | 2MHz                            |
| Modulation                                  | BLE-GFSK                        |
| Rated Transmitting Power (after SAW filter) | 7dBm                            |
| Modulation BW:                              |                                 |
| Antennal Type and Gain                      | Chip, 1.72dBi max.              |
| Power Supply                                | 3.6 Vdc Battery                 |

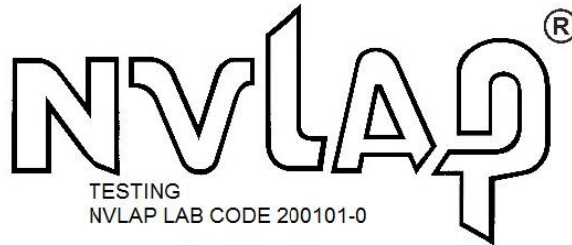
### 3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4(2014)/C63.10(2013), FCC CFR 47 Part 2 & 15 and IC RSS-247(Issue 2) & RSS-GEN (Issue 5). Test procedure described in FCC “KDB 558074 D01 DTS Measurement Guidance v04 (2017)” is used in this report.

### 4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at Hillsborough, New Jersey, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication. All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods”

ACL is accredited by NVLAP, Laboratory Code 200101-0. The full accreditation can be viewed at <http://www.ac-lab.com>



No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government.

## 5. CALIBRATION AND UNCERTAINTY

### 5.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 5.2. MEASUREMENT UNCERTAINTY

The estimated uncertainty of the test result is given as following. The method of uncertainty calculation is provided in Advanced Compliance Lab. Doc. No. 0048-01-01.

|                                 | Prob. Dist. | Uncertainty(dB) | Uncertainty(dB) | Uncertainty(dB) |
|---------------------------------|-------------|-----------------|-----------------|-----------------|
|                                 |             | 30-1000MHz      | 1-6.5GHz        | Conducted       |
| Combined Std. Uncertainty $u_c$ | norm.       | $\pm 2.36$      | $\pm 2.99$      | $\pm 1.83$      |

### 5.3. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

| Manufacturer     | Model               | Serial No.  | Description                      | Cal Due<br>mm/dd/<br>yy |
|------------------|---------------------|-------------|----------------------------------|-------------------------|
| Agilent          | E4440A              | US40420700  | 3Hz-26.5GHz Spec. Analyzer       | 6/17/18                 |
| R & S            | ESPI                | 100018      | 9KHz-7GHz EMI Receiver           | 8/25/18                 |
| HP               | HP8546A             | 3448A00290  | 9kHz to 6.5GHz EMI Receiver      | 9/25/18                 |
| EMCO             | 3104C               | 9307-4396   | 20-300MHz Biconical Antenna      | 11/12/18                |
| EMCO             | 3146                | 9008-2860   | 200-1000MHz Log-Periodic Antenna | 11/13/18                |
| Electro-Meterics | ALR-25M/30          | 289         | 10KHz-30MHz Active Loop Antenna  | 5/28/18                 |
| EMCO             | 3115                | 4945        | Double Ridge Guide Horn Antenna  | 11/28/18                |
| ARA              | MWH-1826/B          | 1013        | 18-26GHZ Horn Antena             | 10/2/18                 |
| R&S              | SMH                 | 8942280/010 | Signal Generator                 |                         |
| RES-NET          | RFA500NFF<br>30     | 0108        | 30dB in-line Power Attenuator    |                         |
| Lorch Microwave  | 5NF-800/10<br>00-S  | AC3         | Notch Filter                     |                         |
| Lorch Microwave  | 5NF-1800/2<br>200-S | AE10        | Notch Filter                     |                         |
| Narda            | 3022                | 80986       | Directional Coupler              |                         |
| Lorch Microwave  | 5NF-800/10<br>00-S  | AC3         | Notch Filter                     |                         |

All Test Equipment Used is Calibrated, Traceable to NIST Standards. Calibration interval: 2 years



## 6. SETUP OF EQUIPMENT UNDER TEST

### SUPPORT EQUIPMENT

None.

### TEST SETUP

Testing Frequency/Channel/Port Selection:

- **L**(owest), **M**(iddle), **H**(ighest) Channels of 2.4 GHz Band selected to perform the test
- Conducted measurement performed at EUT's antenna connector.
- Modulation: BLE-GFSK
- EUT was set in continuous transmitting mode with modulation
- 3.6V DC power provided by Fresh Battery pack with large capacity for testing.

Frequency settings:

|                     |          |  |
|---------------------|----------|--|
| Modulation          | BLE-GFSK |  |
| Lowest Channel (L)  | 2402MHz  |  |
| Middle Channel (M)  | 2440MHz  |  |
| Highest Channel (H) | 2480MHz  |  |

Worst case Scenario:

Via pre-scan, the following mode(s) were found representing the “worst case” data:

Duty cycle was set for 100% with max. power setting for all modulation(s).

| Mode No. | Mode Modulation & Data Rate                    |
|----------|--|
| 1        | BLE-GFSK testing mode<br>provided by Applicant |
| 2        |  |
| 3        |  |
| 4        |  |

## 7. APPLICABLE LIMITS AND TEST RESULTS

### 7.1 6dB &99% BANDWIDTH

#### LIMIT

§15.247 (a) (2) & RSS-247 Sec. 5.2(1): Min. 6dB DTS bandwidth should be no less than 500KHz.

#### TEST PROCEDURE *per FCC KDB 558074D01v04*

| Measurement Procedure for Emission Bandwidth (DTS Bandwidth) | Applicable to this EUT              |
|--|-------------------------------------|
| 8.1 DTS BW Measurement Procedure: Option 1 (manual)          | <input type="checkbox"/>            |
| 8.2 DTS BW Measurement Procedure: Option 2 (automatic)       | <input checked="" type="checkbox"/> |

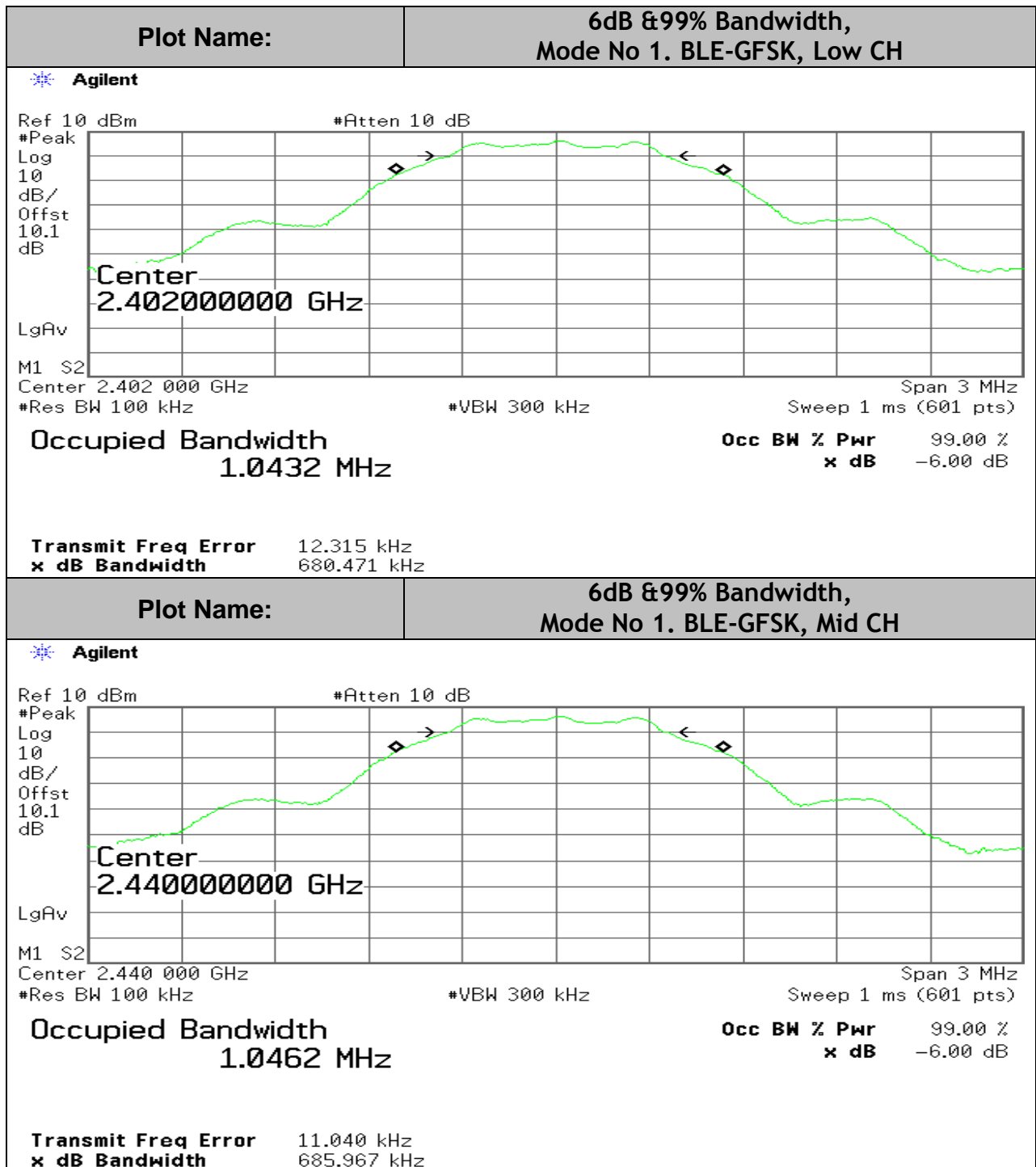
#### RESULTS

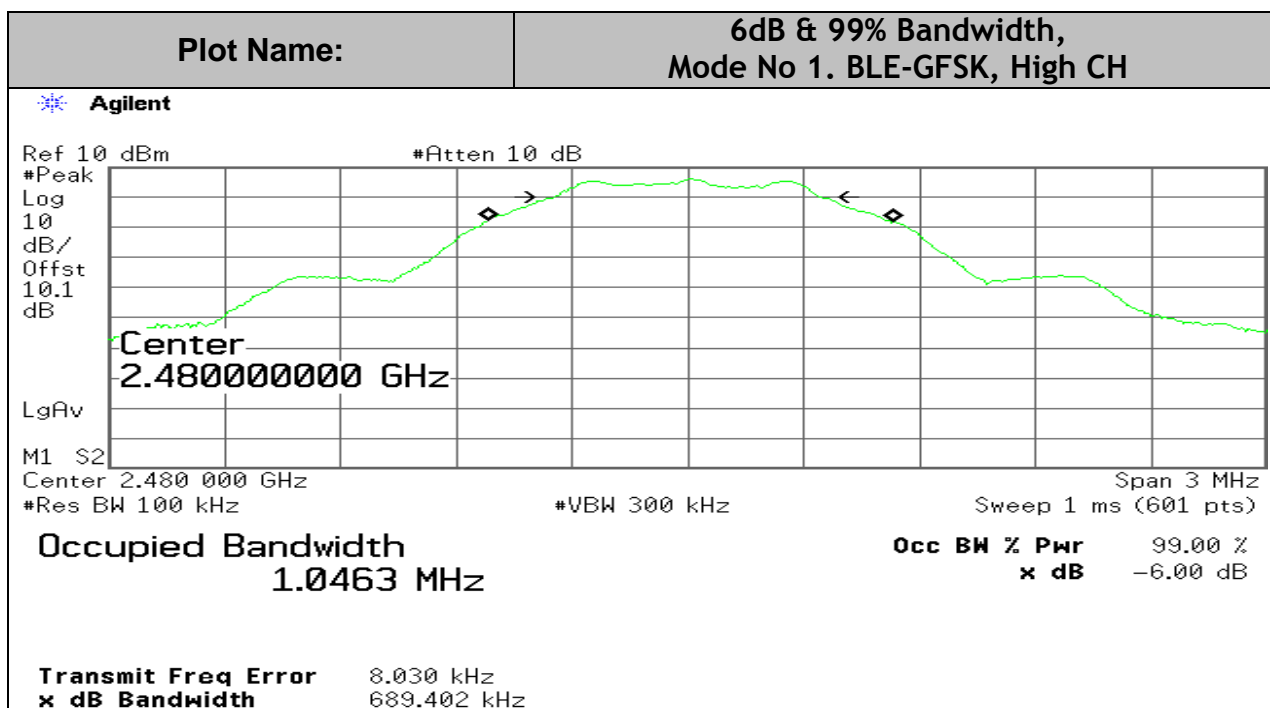
No non-compliance noted.

Mode No.1: BLE-GFSK

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | 99% Bandwidth (MHz) |
|---------|-----------------|---------------------|---------------------|
| Low     | 2402            | 1.0432              | 680.471             |
| Middle  | 2440            | 1.0462              | 685.967             |
| High    | 2480            | 1.0463              | 689.402             |

6dB & 99% BANDWIDTH





## 7.2 MAXIMUM OUTPUT POWER

### PEAK POWER LIMIT

§15.247 (b)(3) & RSS-247 Sec. 5.4.(4)

The maximum peak conducted output power of the intentional radiator shall not exceed the following:  
For systems using digital modulation in the 2400-2483.5 MHz band: 1 Watt.

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi.

b(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Therefore, the applicable output power limit shall be calculated as follows:

$$P_{out} = 30 - (G_{tx} - 6) \text{ for antenna gain } \leq 6 \text{ dBi or}$$

$$P_{out} = 30 - \text{Floor}[(G_{tx} - 6)/3]$$

$G_{Tx}$  = the maximum transmitting antenna directional gain in dBi.

### TEST PROCEDURE *per FCC KDB 558074D01v04*

| Measurement Procedure for Fundamental Emission Output Power  | Applicable to this EUT                               |
|--|--|
| 9.1.1 Maximum Peak Conducted Output Power Level Measurement Procedure Option 1 (RBW ≥ DTS BW) using SA   | <input checked="" type="checkbox"/> <b>preferred</b> |
| 9.1.2 Maximum Peak Conducted Output Power Level Measurement Procedure Option 2 (RBW < DTS BW) using Broadband Peak RF power meter)--- <b>PKPM1</b>   | <input type="checkbox"/>                             |
| 9.2.2.2 Maximum Average Conducted Output Power Level Measurement Procedure using SA: Method <b>AVGSA-1</b> (trace averaging with the EUT transmitting at full power throughout each sweep)   | <input type="checkbox"/>                             |
| 9.2.2.3 Maximum Average Conducted Output Power Level Measurement Procedure using SA: Method <b>AVGSA-1 Alternative</b> (RMS detection with slow sweep and EUT transmitting continuously at full power)   | <input type="checkbox"/>                             |
| 9.2.2.4 Maximum Average Conducted Output Power Level Measurement Procedure using SA: Method <b>AVGSA-2</b> (trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction)   | <input type="checkbox"/>                             |
| 9.2.2.5 Maximum Average Conducted Output Power Level Measurement Procedure using SA: Method <b>AVGSA-2 Alternative</b> (RMS detection with slow sweep with spectrum bin averaging across on and off times of the EUT transmissions, followed by duty cycle correction) | <input type="checkbox"/>                             |
| 9.2.2.6 Maximum Average Conducted Output Power Level Measurement Procedure using SA: Method <b>AVGSA-3</b> (RMS detection across on and off times of the EUT with max hold)  | <input type="checkbox"/>                             |
| 9.2.2.7 Maximum Average Conducted Output Power Level Measurement   | <input type="checkbox"/>                             |

|   |                          |
|---|--------------------------|
| Procedure using SA: Method <b>AVGSA-3 Alternative</b> (reduced VBW averaging across on and off times of the EUT with max hold)                                |                          |
| 9.2.3.1 Maximum Average Conducted Output Power Level Measurement Procedure using PM: Method <b>AVGPM</b> (Measurement using an RF average power meter)        | <input type="checkbox"/> |
| 9.2.3.2 Maximum Average Conducted Output Power Level Measurement Procedure using PM: Method <b>AVGPM-G</b> (Measurement using a gated RF average power meter) | <input type="checkbox"/> |

\* SA=Spectrum Analyser, PM= Powe Meter

### ALTERNATIVE METHOD

(Ref: FCC KDB 558074D01v03r05)

The measurement procedures described herein are based on the use of an antenna-port conducted test configuration. However, if antenna-port conducted tests cannot be performed on an EUT (*e.g.*, portable or handheld devices with integral antenna), then radiated tests are acceptable for demonstrating compliance to the conducted emission requirements. The guidance provided herein is applicable to either antenna-port conducted or radiated compliance measurements.

If a radiated test configuration is used, then the measured power or field strength levels shall be converted to equivalent conducted power levels for comparison to the applicable output power limit. This may be accomplished by first measuring the radiated field strength or power levels using a methodology for maximum peak conducted power or maximum conducted (average) power as applicable and peak or average power spectral density as applicable. The radiated field strength or power level can then be converted to EIRP (see ANSI C63.10 for guidance). Therefore, the applicable output power limit shall be calculated as follows:

$$\text{EIRP (dBm)} = \text{E (dBuV/m)} - 95.2$$

### TEST RESULT

No non-compliance noted.

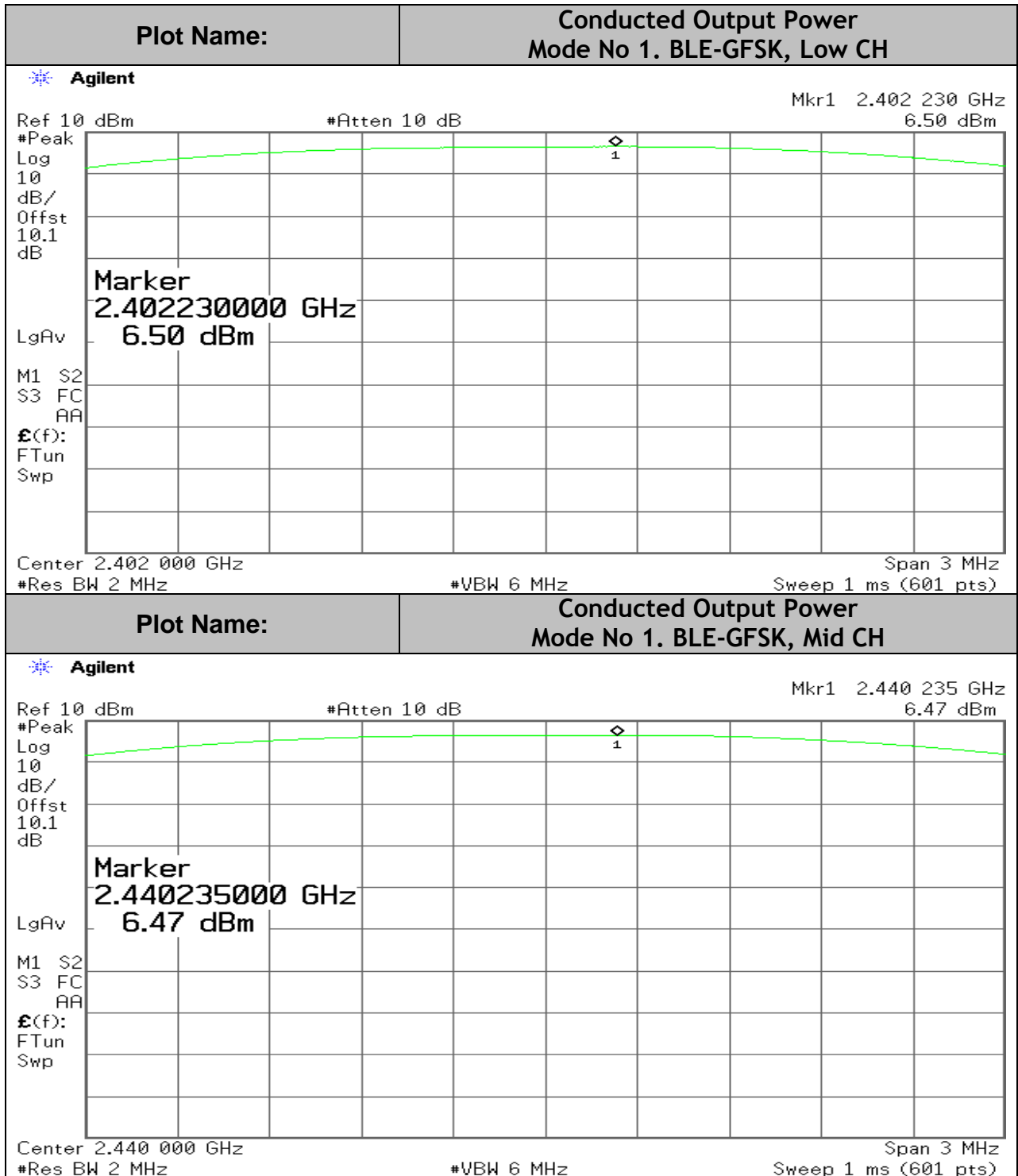
Max. Conducted output power is 6.5dBm/ 0.005W.

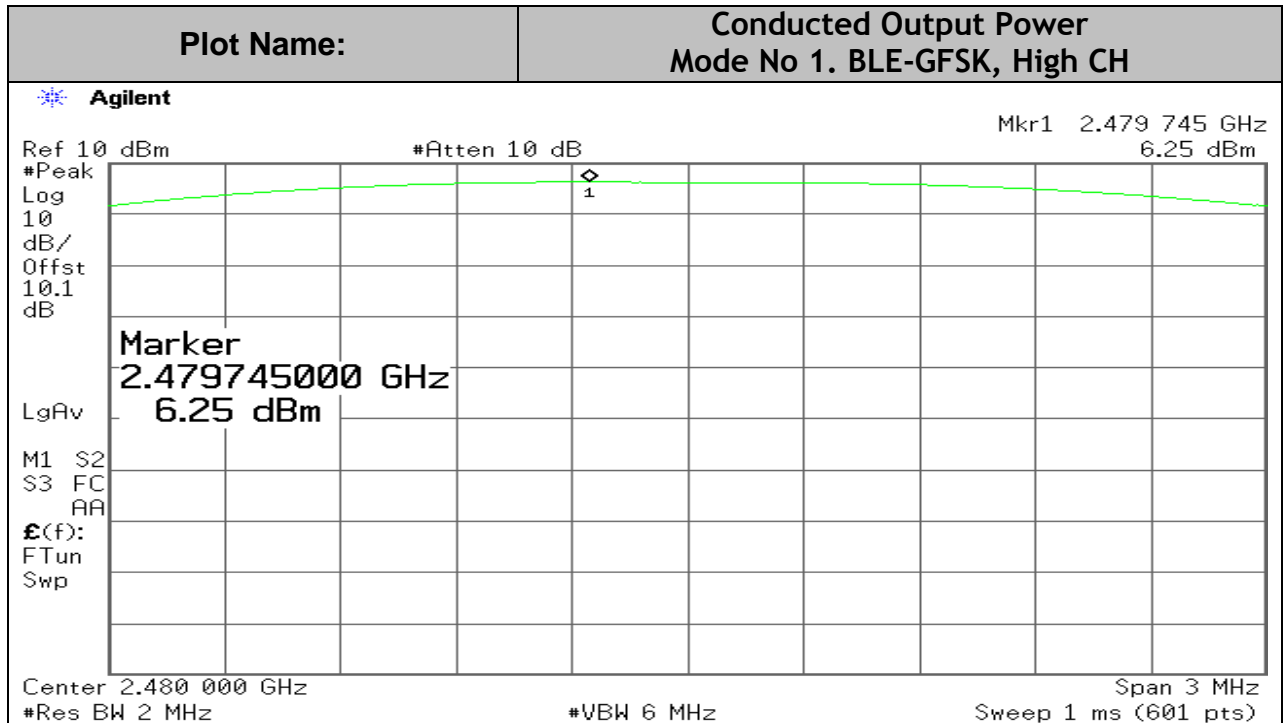
Max. e.i.r.p is 8.22dBm/ 0.007W with 1.72dBi gain antenna.

Both conducted output power and e.i.p are under FCC & IC limit.

Mode No.1 BLE-GFSK

| Channel | Frequency (MHz) | Output Power* (dBm) | Limit (dBm) | Margin (dB) |
|---------|-----------------|---------------------|-------------|-------------|
| Low     | 2402            | 6.50 (0.005W)       | 30          | -23.50      |
| Middle  | 2440            | 6.47                | 30          | -23.53      |
| High    | 2480            | 6.25                | 30          | -23.75      |







### **7.3 MAXIMUM PERMISSIBLE EXPOSURE**

See Separate MPE report.

## 7.4 MAXIMUM POWER SPECTRAL DENSITY

### LIMIT

§15.247 (e) & RSS-247 Sec. 5.2(2)

For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### TEST PROCEDURE *per FCC KDB 558074D01v04*

| Measurement Procedure for Maximum Power Spectral Density in the Fundamental Emission*   | Applicable to this EUT                               |
|---|--|
| 10.2 Measurement Procedure for Peak PSD--- Method <b>PKPSD(peak PSD)</b>  | <input checked="" type="checkbox"/> <b>preferred</b> |
| 10.3 Measurement Procedure for Average PSD--- Method <b>AVGPSD-1</b> (trace averaging with EUT transmitting at full power throughout each sweep)  | <input type="checkbox"/>                             |
| 10.4 Measurement Procedure for Average PSD---Method <b>AVGPSD-1 Alternative</b> (RMS detection with slow sweep speed and EUT transmitting continuously at full power)   | <input type="checkbox"/>                             |
| 10.5 Measurement Procedure for Average PSD---Method <b>AVGPSD-2</b> (trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction)   | <input type="checkbox"/>                             |
| 10.6 Measurement Procedure for Average PSD---Method <b>AVGPSD-2 Alternative</b> (RMS detection with slow sweep speed with spectrum bin averaging across on and off times of the EUT transmissions, followed by duty cycle correction) | <input type="checkbox"/>                             |
| 10.7 Measurement Procedure for Average PSD---Method <b>AVGPSD-3</b> (RMS detection across on and off times of the EUT with max hold)  | <input type="checkbox"/>                             |
| 10.8 Measurement Procedure for Average PSD---Method <b>AVGPSD-3 Alternative</b> (reduced VBW averaging across on and off times of the EUT with max hold)  | <input type="checkbox"/>                             |

\* Same measurement method as used to determine the maximum fundamental power.

\*\* EUT shall be configured to transmit continuously (min. 98% duty cycle at full power) or use video triggering/signal gating. The spectrum analyzer shall be set for bin-to-bin spacing  $\leq$  RBW/2.

### RESULTS

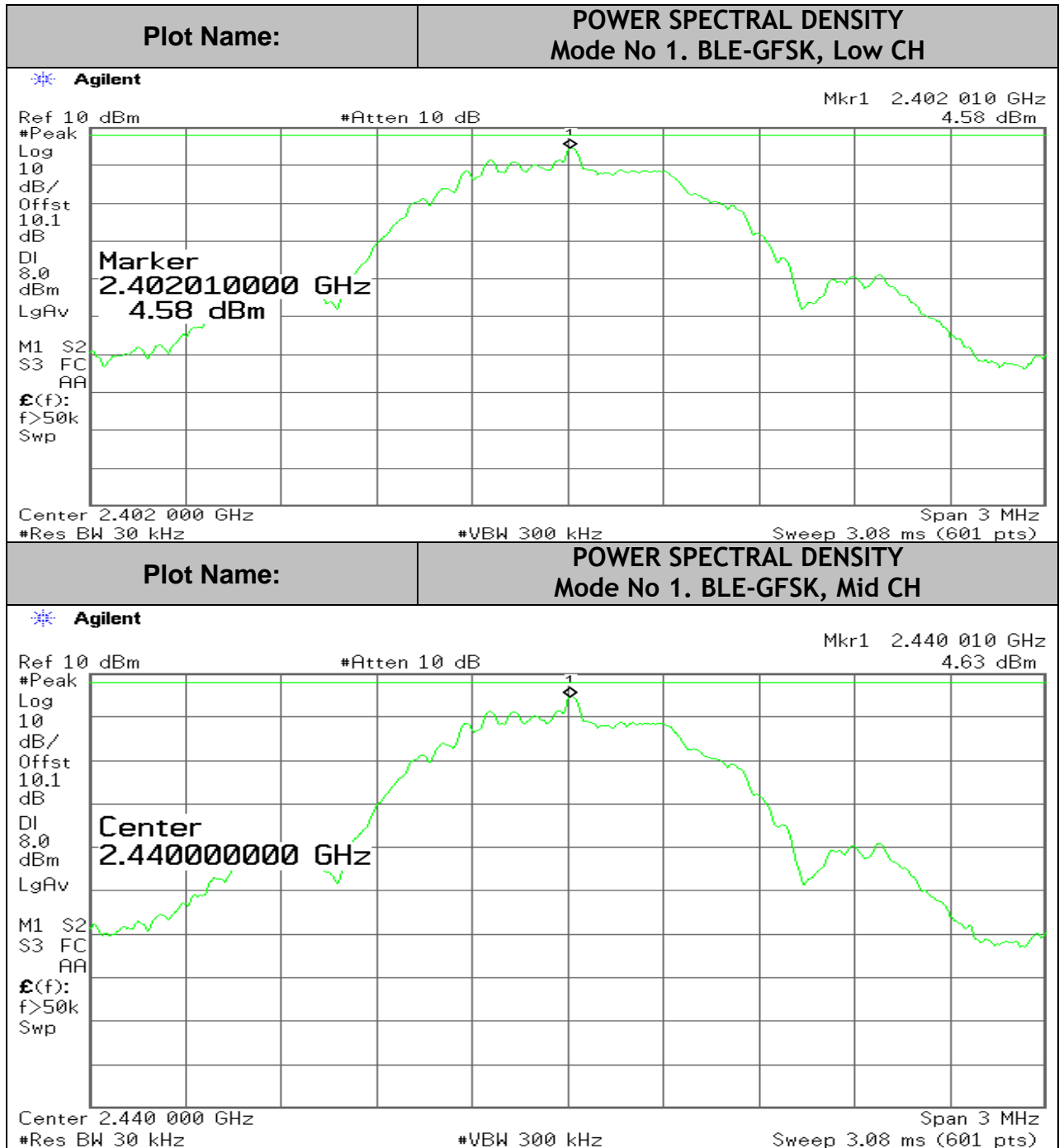
No non-compliance noted:

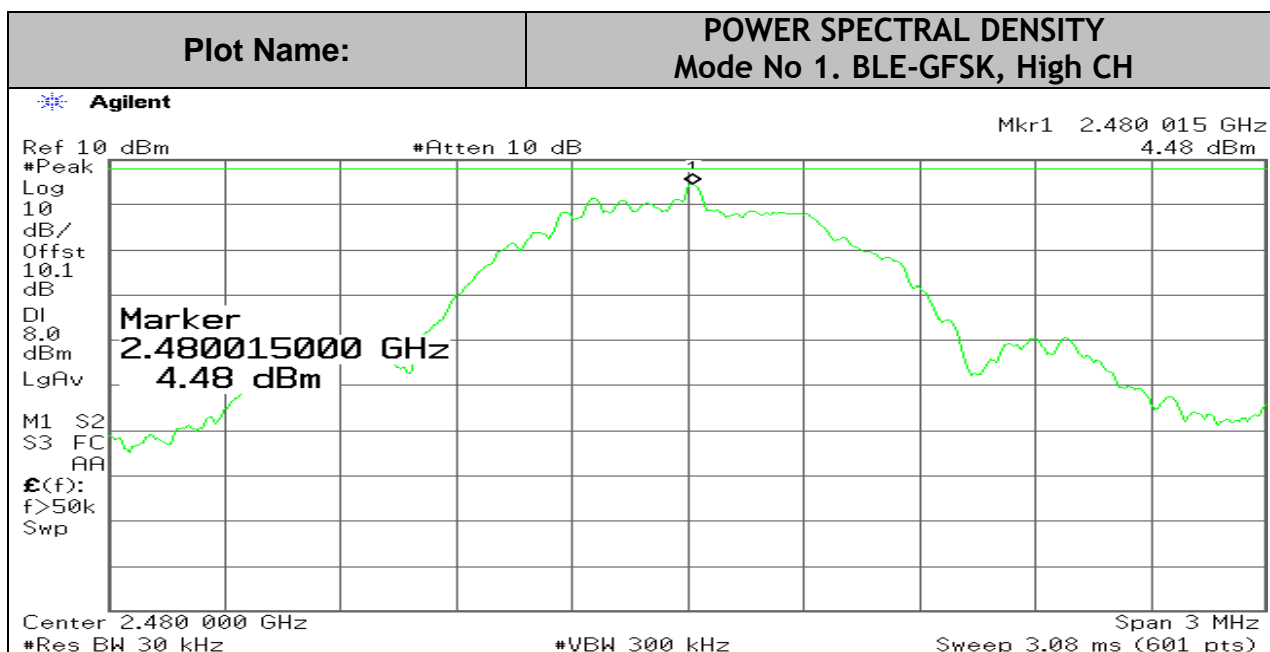
### Summary of PPSD Testing Data:

Mode No.1 BLE-GFSK

| Channel | Frequency (MHz) | PPSD (dBm/30KHz) | Limit (dBm/3KHz) | Margin (dB) |
|---------|-----------------|------------------|------------------|-------------|
| Low     | 2402            | 4.58             | 8                | -3.42       |
| Middle  | 2440            | 4.63             | 8                | -3.37       |
| High    | 2480            | 4.48             | 8                | -3.52       |

PEAK POWER SPECTRAL DENSITY





## 7.6 CONDUCTED SPURIOUS EMISSIONS

### LIMITS

§15.247 (d) & RSS- 247 Sec. 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205 (a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### TEST PROCEDURE *per FCC KDB 558074D01v04*

(Report the three highest emissions relative to the limit)

| Conducted Measurement Procedure for Maximum Unwanted Emissions into Non-Restricted Frequency Bands | Applicable to this EUT                        |                              |
|--|---|------------------------------|
|  | Peak Power limit: (-20dB)                     | Average Power Limit: (-30dB) |
| 11.1-11.2 Measurement Procedure-Reference Level (RBW=100KHz, VBW=300KHz)                           | <input checked="" type="checkbox"/> preferred | <input type="checkbox"/>     |
| 11.3 Measurement Procedure-Unwanted Emission Level*  | <input checked="" type="checkbox"/> preferred | <input type="checkbox"/>     |

\* Different attenuation limit shall be used based on the measurement method of fundamental emission power and PSD.

| Antenna-Port Conducted Measurement Procedure for Maximum Unwanted Emissions into Restricted Frequency Bands** | Applicable to this EUT   |
|---|--------------------------|
| 12.2.3 CISPR Quasi-Peak Measurement (CISPR 16)  | <input type="checkbox"/> |
| 12.2.4 Peak Power Measurement (Table 1 for RBW setting)   | <input type="checkbox"/> |
| 12.2.5 Average Power Measurement (three options)***   | <input type="checkbox"/> |
| 13.2 Band-Edge Marker-Delta Method (ANSI C63.10) (within 2MHz)  | <input type="checkbox"/> |
| 13.3 Band-Edge Integration Method (peak / average) (within 2MHz)  | <input type="checkbox"/> |

\*\* To use this conducted testing method, per 12.2.2-12.2.6, the followings shall be taken as consideration:

1. Proper RBW and detector, per 15.35 a/b, shall be chosen in different frequency ranges;
2. **Maximum transmitter antenna gain ( no less than 2dBi), G, shall be added to the measured power level to determine the EIRP;**
3. **Appropriate factor, A, shall be added to model worst case ground reflections: 6.0dB (f≤30MHz ) and 4.7dB ( f≤30 to 1000MHz)**
4. **Electric field strength can be obtained from the equation:  $E = \text{EIRP} - 20\log(d) + 104.8 + G$  (or 2.0) + A; Then compare to applicable limit;**
5. Unwanted emissions from EUT cabinet or casing shall be measured via radiated emission test method per C63.10 ( in this case, the antenna port may be terminated properly).
6. Absolute peak power limit of -21.2dBm within the unwanted emission bandwidth shall be used for meeting 15.35(b) requirement;
7. Per 15.35(c), for pulse operation, Duty Cycle factor reduction can be applied for unwanted emissions that have the same pulse characteristics as does the fundamental emissions ( such as harmonics) pulse operation

\*\*\* EUT shall be configured to transmit continuously (min. 98% duty cycle at full power). The spectrum analyzer shall be set for bin-to-bin spacing ≤RBW/2.

## RESULTS

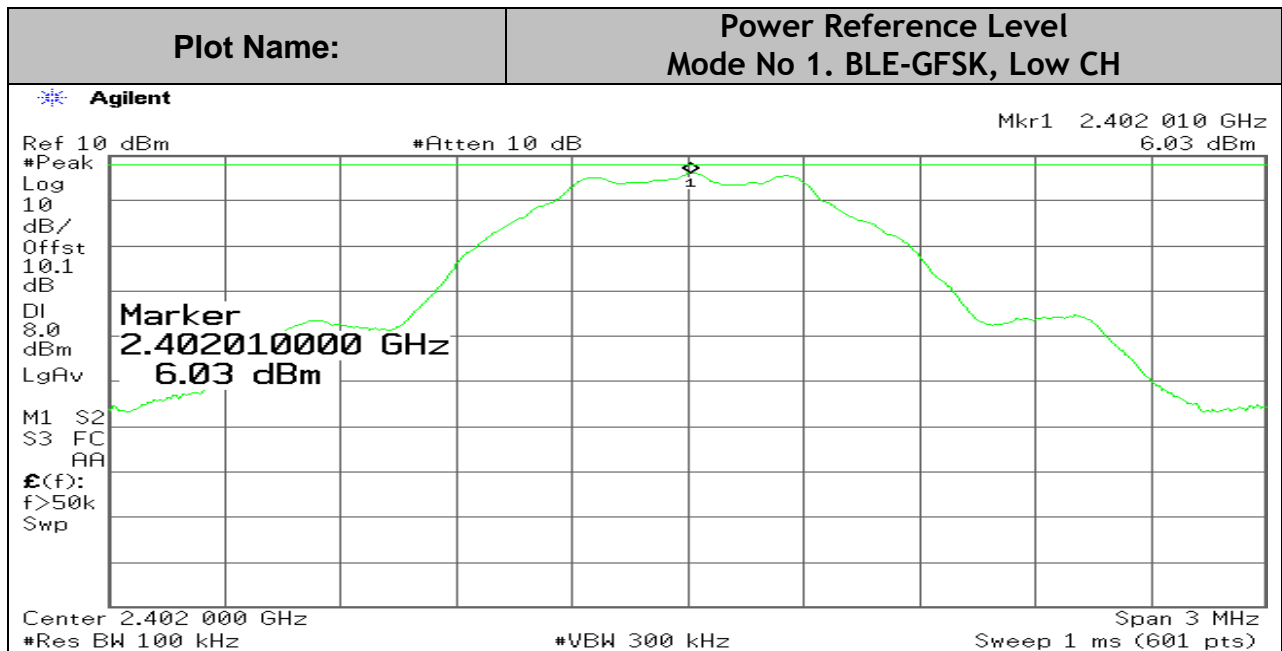
Complied with 20dBc attenuation requirement.

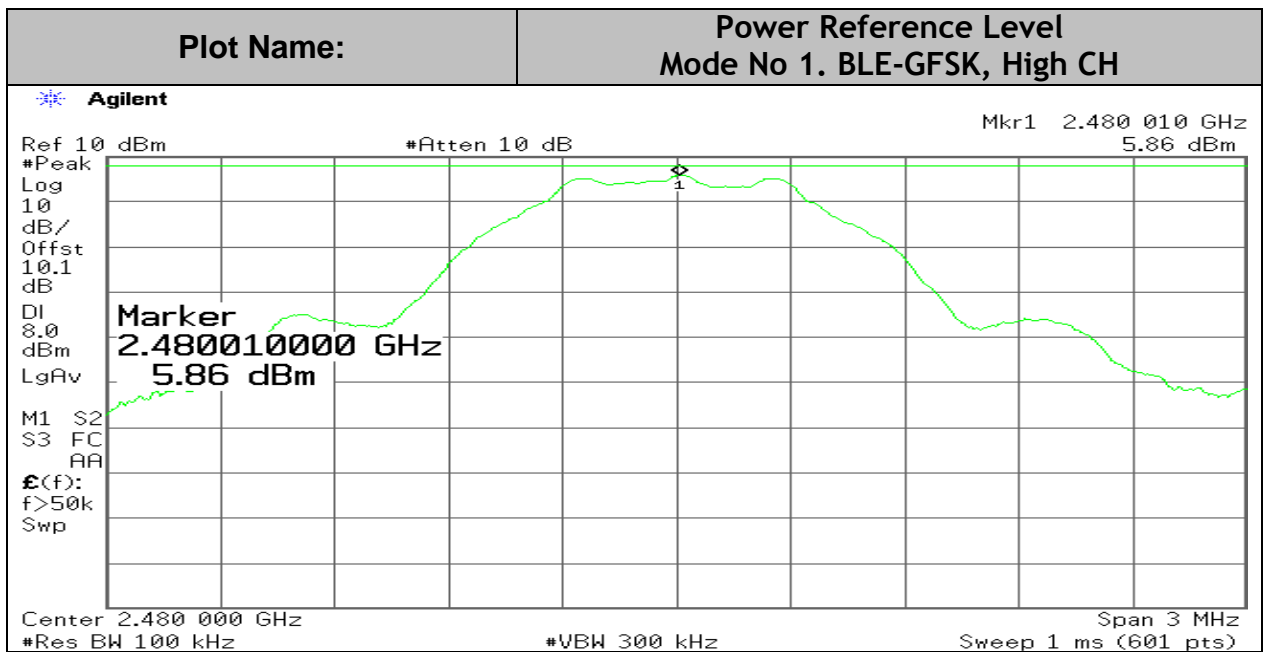
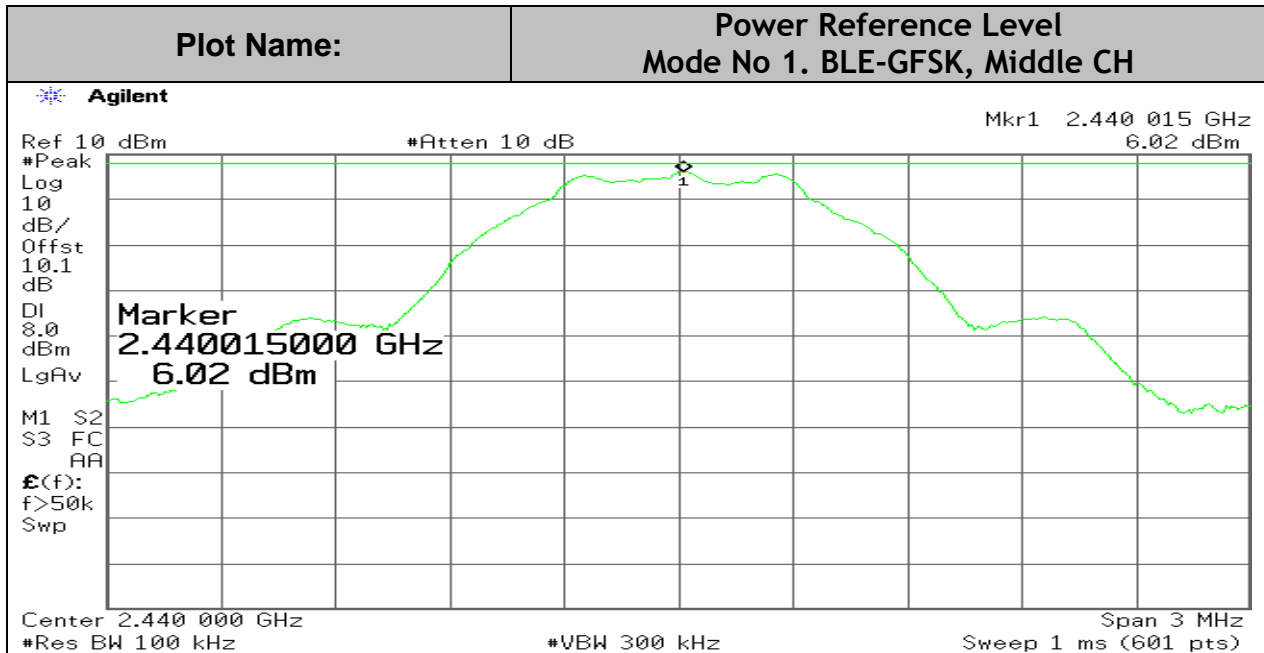
Data Summary:

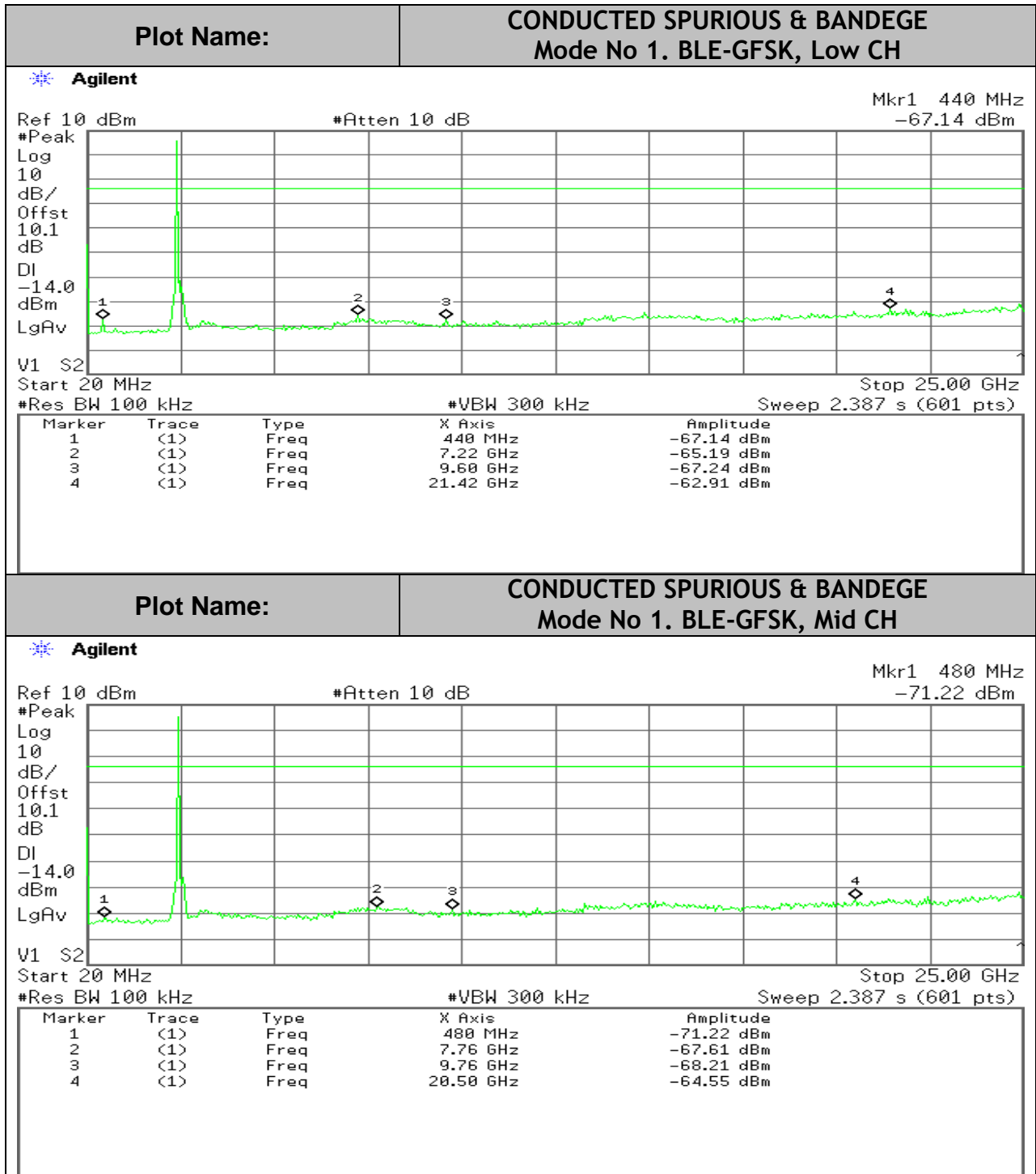
Mode No.1 BLE-GFSK

| Channel | Frequency (MHz) | Power Reference Level (dBm) | Attenuation (dBc) to max. Spurious Emission Level |
|---------|-----------------|-----------------------------|---|
| Low     | 2402            | 6.03                        | -13.97  |
| Middle  | 2440            | 6.02                        | -13.98  |
| High    | 2480            | 5.86                        | -14.14  |

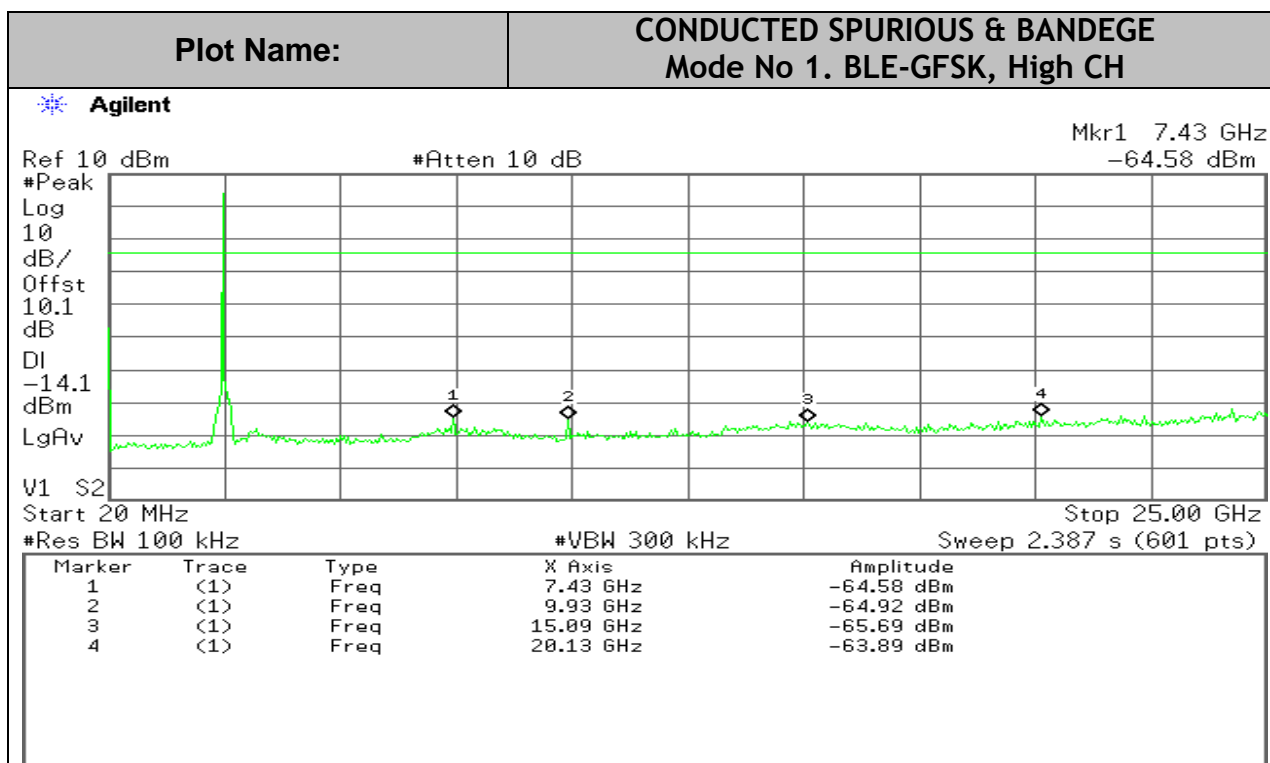
## PEAK POWER REFERENCE LEVEL



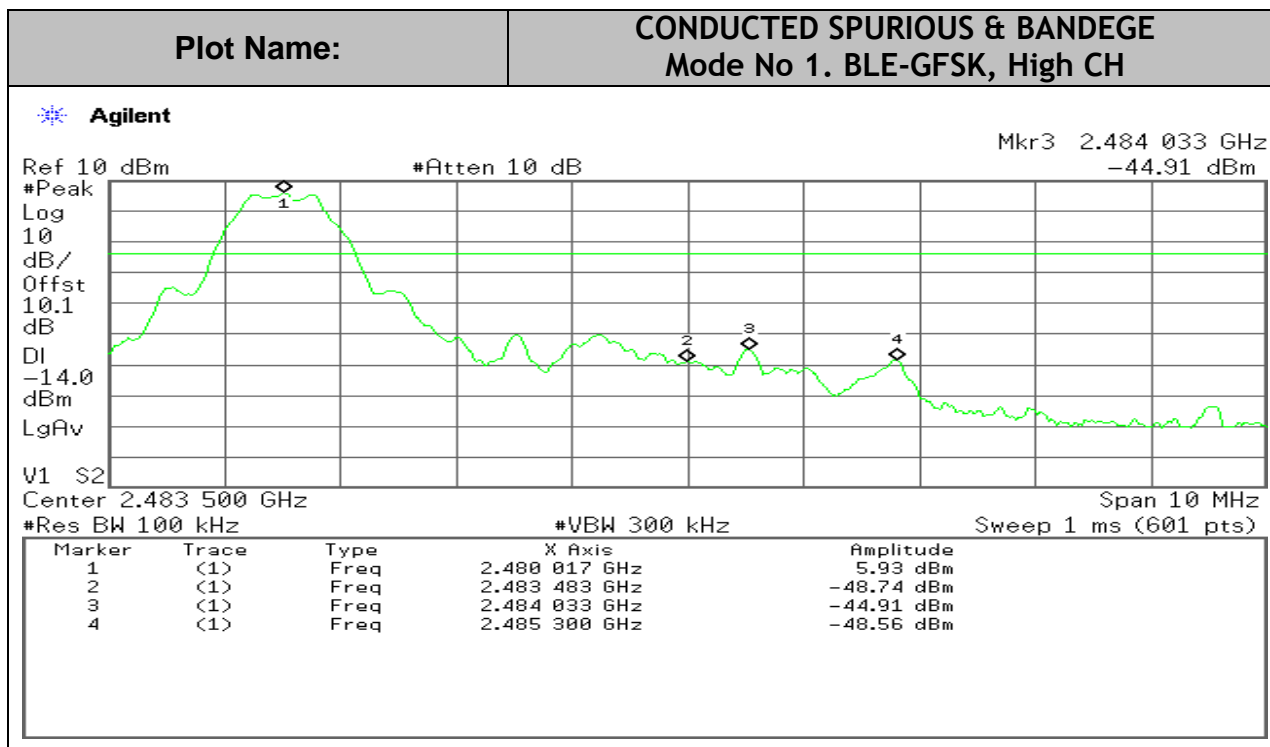
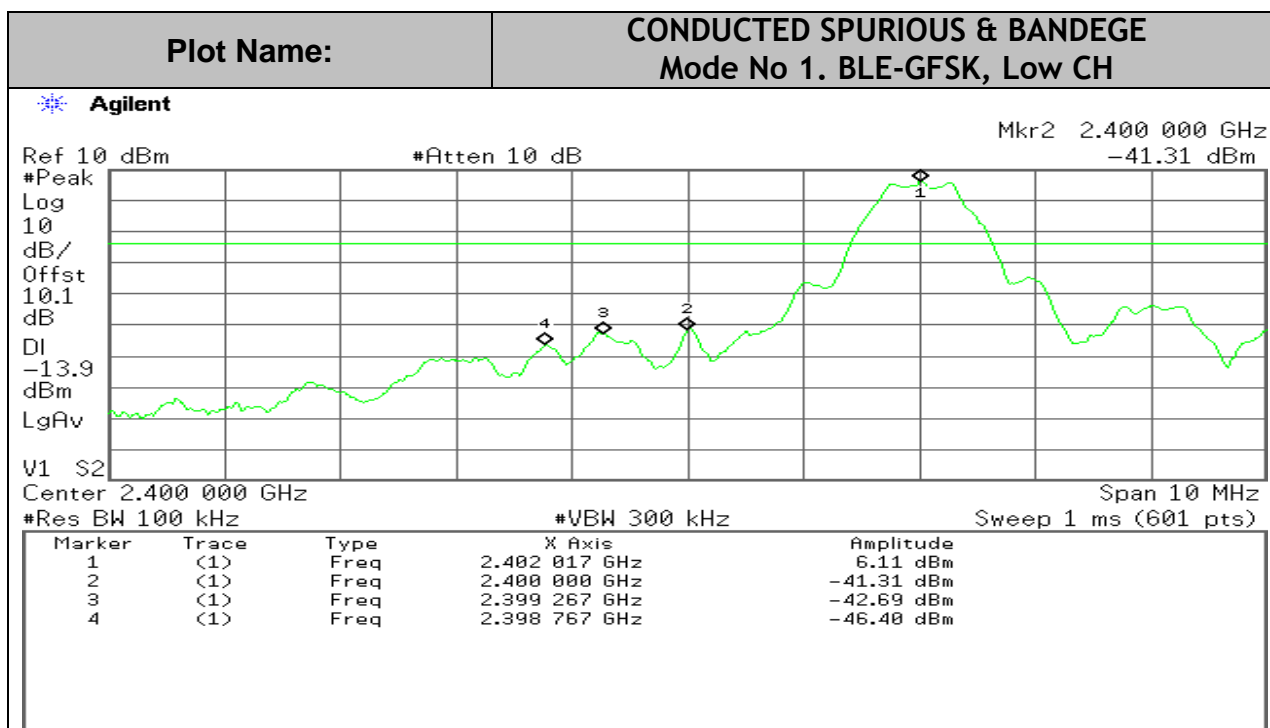








Band-Edge via Conducted Measurement:



## 7.7 RADIATED EMISSIONS

### 7.7.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS

#### LIMITS

§15.205 (a) RSS-102 Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz                      | MHz                 | MHz           | GHz              |
|--------------------------|---------------------|---------------|------------------|
| 0.090-0.110              | 16.42-16.423        | 399.9-410     | 4.5-5.15         |
| <sup>1</sup> 0.495-0.505 | 16.69475-16.69525   | 608-614       | 5.35-5.46        |
| 2.1735-2.1905            | 16.80425-16.80475   | 960-1240      | 7.25-7.75        |
| 4.125-4.128              | 25.5-25.67          | 1300-1427     | 8.025-8.5        |
| 4.17725-4.17775          | 37.5-38.25          | 1435-1626.5   | 9.0-9.2          |
| 4.20725-4.20775          | 73-74.6             | 1645.5-1646.5 | 9.3-9.5          |
| 6.215-6.218              | 74.8-75.2           | 1660-1710     | 10.6-12.7        |
| 6.26775-6.26825          | 108-121.94          | 1718.8-1722.2 | 13.25-13.4       |
| 6.31175-6.31225          | 123-138             | 2200-2300     | 14.47-14.5       |
| 8.291-8.294              | 149.9-150.05        | 2310-2390     | 15.35-16.2       |
| 8.362-8.366              | 156.52475-156.52525 | 2483.5-2500   | 17.7-21.4        |
| 8.37625-8.38675          | 156.7-156.9         | 2690-2900     | 22.01-23.12      |
| 8.41425-8.41475          | 162.0125-167.17     | 3260-3267     | 23.6-24.0        |
| 12.29-12.293             | 167.72-173.2        | 3332-3339     | 31.2-31.8        |
| 12.51975-12.52025        | 240-285             | 3345.8-3358   | 36.43-36.5       |
| 12.57675-12.57725        | 322-335.4           | 3600-4400     | ( <sup>2</sup> ) |
| 13.36-13.41              |                     |               |                  |

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> Above 38.6

§15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| <b>Frequency<br/>(MHz)</b> | <b>Field Strength<br/>(microvolts /meter)</b> | <b>Measurement Distance<br/>(meters)</b> |
|----------------------------|---|--|
| 30 – 88                    | 100   | 3  |
| 88 – 216                   | 150   | 3  |
| 216 – 960                  | 200   | 3  |
| Above 960                  | 500   | 3  |

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

## TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode. Established procedures in C63.10 for performing radiated measurements shall be used. For cabinet emission measurements, the EUT transmit antenna may be replaced with a termination matching the nominal impedance of the antenna. EUT was tested with applicable orientations.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak. For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The radio spectrum was investigated from the lowest frequency generated within the device (without going below 9 kHz) up to the 10<sup>th</sup> harmonic of the rated transmitted emission. The emissions are investigated with the transmitter set to the lowest, middle, and highest channels.

The emissions are investigated with the transmitter set to the lowest, middle, and highest channels, if applicable. The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

## RESULTS

No non-compliance noted.

## 7.7.2. TRANSMITTER RADIATED EMISSIONS DATA

**(HARMONICS & SPURIOUS falling in restricted bands listed in Sec.15.205 and non-restricted bands \*)**

Operation Mode: BLE-GFSK

**EUT with Chip Antenna: Low Channel(2402MHz) Harmonics/Spurious**

| Freq. (MHz) | Worst H/V | Dist. (m) | D Corr (dB) | Peak@3m (dBuV/m) | QP/Avg @3m (dBuV/m) | PK Lim (dBuV/m) | QP/Avg. Lim (dBuV/m) | PK Mar (dBuV/m) | QP /Avg.Mar. (dBuV/m) |
|-------------|-----------|-----------|-------------|------------------|---------------------|-----------------|----------------------|-----------------|-----------------------|
| 646         | H         | 3         | -           |                  | 37.3                |                 | 46.5                 |                 | -9.2                  |
| 682         | V         | 3         | -           |                  | 37.9                |                 | 46.5                 |                 | -8.6                  |
| 936         | H         | 3         | -           |                  | 41.8                |                 | 46.5                 |                 | -4.7                  |
| 900         | V         | 3         |             |                  | 41.1                |                 | 46.5                 |                 | -5.4                  |
| 4804        | H         | 3         |             | 47.6             | 37.7                | 74              | 54                   | -26.4           | -16.3                 |
| 7206        | H         | 3         |             | 50.4             | 42.5                | 74              | 54                   | -23.6           | -11.5                 |
| 9608        | H         | 3         | -           | 52.3             | 44.0                | 74              | 54                   | -21.7           | -10                   |
| 4804        | V         | 3         | -           | 47.9             | 37.8                | 74              | 54                   | -26.1           | -16.2                 |
| 7206        | V         | 3         | -           | 53.7             | 47.2                | 74              | 54                   | -20.3           | -6.8                  |
| 9608        | V         | 3         | -           | 52.1             | 43.6                | 74              | 54                   | -21.9           | -10.4                 |

**EUT with Chip Antenna: Middle Channel(2440MHz) Harmonics/Spurious**

| Freq. (MHz) | Worst H/V | Dist. (m) | D Corr (dB) | Peak@3m (dBuV/m) | QP/Avg @3m (dBuV/m) | PK Lim (dBuV/m) | QP/Avg. Lim (dBuV/m) | PK Mar (dBuV/m) | QP /Avg.Mar. (dBuV/m) |
|-------------|-----------|-----------|-------------|------------------|---------------------|-----------------|----------------------|-----------------|-----------------------|
| 586         | H         | 3         | -           |                  | 36.3                |                 | 46.5                 |                 | -10.2                 |
| 646         | V         | 3         | -           |                  | 38.1                |                 | 46.5                 |                 | -8.4                  |
| 680         | H         | 3         | -           |                  | 38.0                |                 | 46.5                 |                 | -8.5                  |
| 774         | V         | 3         |             |                  | 38.8                |                 | 46.5                 |                 | -7.7                  |
| 4880        | H         | 3         |             | 50.2             | 38.9                | 74              | 54                   | -23.8           | -15.1                 |
| 7230        | H         | 3         |             | 52.9             | 43.8                | 74              | 54                   | -21.1           | -10.2                 |
| 9760        | H         | 3         | -           | 54.5             | 46.9                | 74              | 54                   | -19.5           | -7.1                  |
| 4880        | V         | 3         | -           | 49.4             | 38.3                | 74              | 54                   | -24.6           | -15.7                 |
| 7230        | V         | 3         | -           | 55.2             | 49.1                | 74              | 54                   | -18.8           | -4.9                  |
| 9760        | V         | 3         | -           | 55.1             | 45.5                | 74              | 54                   | -18.9           | -8.5                  |

### EUT with Chip Antenna: High Channel(2480MHz) Harmonics/Spurious

| Freq.<br>(MHz) | Worst<br>H/V | Dist.<br>(m) | D<br>Corr<br>(dB) | Peak@3m<br>(dBuV/m) | QP/Avg<br>@3m<br>(dBuV/m) | PK Lim<br>(dBuV/m) | QP /Avg.<br>Lim<br>(dBuV/m) | PK Mar<br>(dBuV/m) | QP<br>/Avg.Mar.<br>(dBuV/m) |
|----------------|--------------|--------------|-------------------|---------------------|---------------------------|--------------------|-----------------------------|--------------------|-----------------------------|
| 586            | H            | 3            | -                 |                     | 37.0                      |                    | 46.5                        |                    | -9.5                        |
| 646            | V            | 3            | -                 |                     | 38.5                      |                    | 46.5                        |                    | -8                          |
| 680            | H            | 3            | -                 |                     | 37.7                      |                    | 46.5                        |                    | -8.8                        |
| 900            | V            | 3            |                   |                     | 41.3                      |                    | 46.5                        |                    | -5.2                        |
| 4960           | H            | 3            |                   | 48.1                | 37.9                      | 74                 | 54                          | -25.9              | -16.1                       |
| 7440           | H            | 3            |                   | 52.0                | 42.0                      | 74                 | 54                          | -22                | -12                         |
| 9920           | H            | 3            | -                 | 54.5                | 47.5                      | 74                 | 54                          | -19.5              | -6.5                        |
| 4960           | V            | 3            | -                 | 48.0                | 37.9                      | 74                 | 54                          | -26                | -16.1                       |
| 7440           | V            | 3            | -                 | 52.4                | 44.7                      | 74                 | 54                          | -21.6              | -9.3                        |
| 9920           | V            | 3            | -                 | 54.0                | 47.1                      | 74                 | 54                          | -20                | -6.9                        |

\* Data shown above represents the worst case in all EUT orientations. No other significant emissions were found in the rest frequency range. For spurious in restricted band, the limit is per 15.209.

### **Band Edge Data for EUT**

In addition, the band-edge requirements are also verified.

*Testing procedure per KDB 558074D01:*

The measurement of unwanted emissions at the edge of the authorized frequency bands can be complicated by the capture of RF energy from the fundamental emission within the RBW passband. The following techniques are permitted for use in performing a measurement of the unwanted emission level at the band edges.

#### **10.2.5.1 Marker-Delta Method**

The marker-delta method, as described in KDB 913591 and in C63.10, can be used to perform measurements of the unwanted emissions level at the band-edges.

#### **10.2.5.2 Integrated Power Measurement**

A narrower resolution bandwidth can be used at the band edge to improve the measurement accuracy provided that the measurement is subsequently integrated to the relevant bandwidth specification (e.g., 100 kHz within non-restricted bands and 1 MHz within restricted frequency bands).

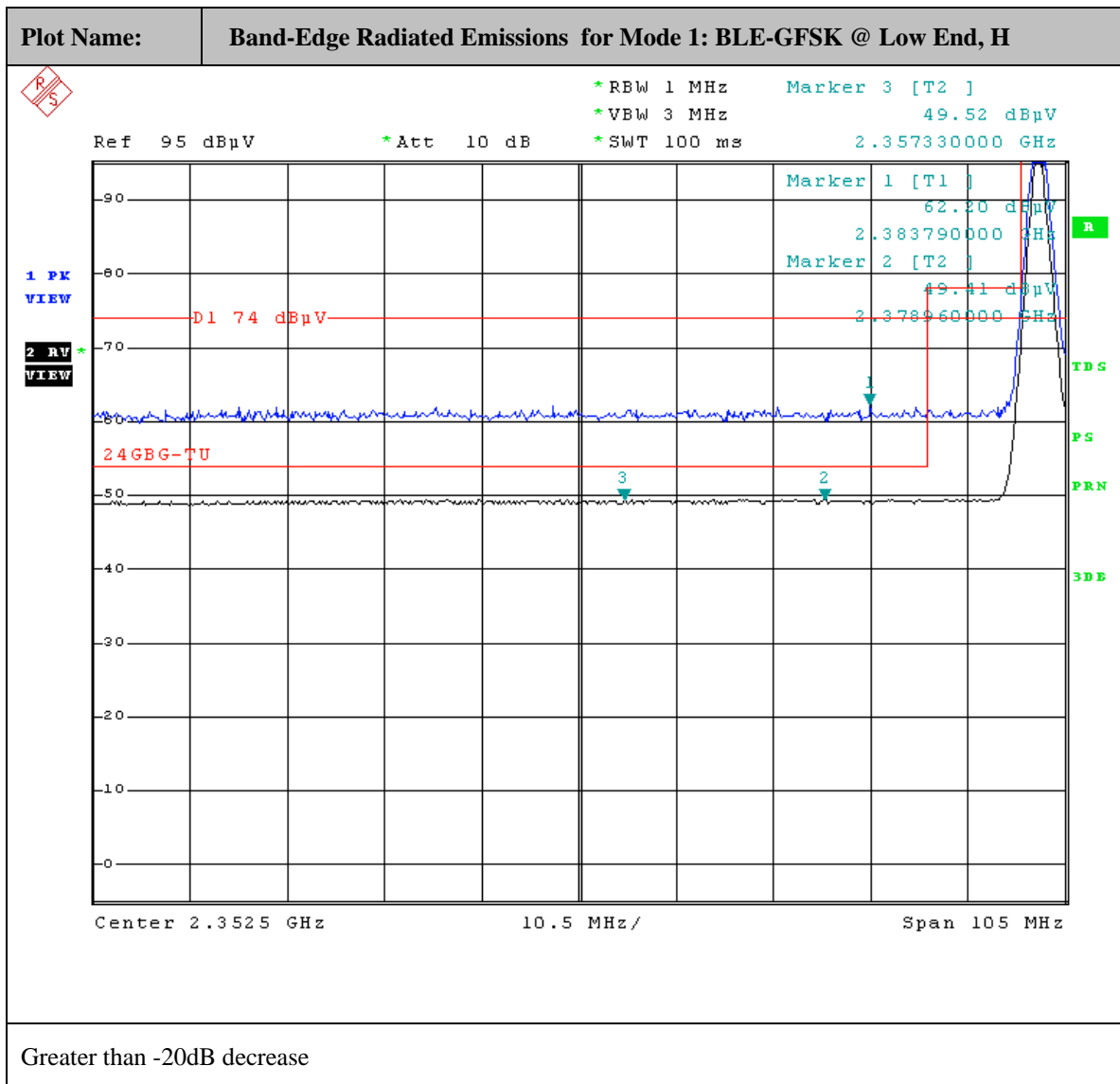
#### **Results:**

The testing results for worst case based on pretesting results are shown as following and comply with the band-edge requirements for 2400-2483.5MHz DTS per FCC Part 15.247. EUT antenna with max gain was used for this testing.

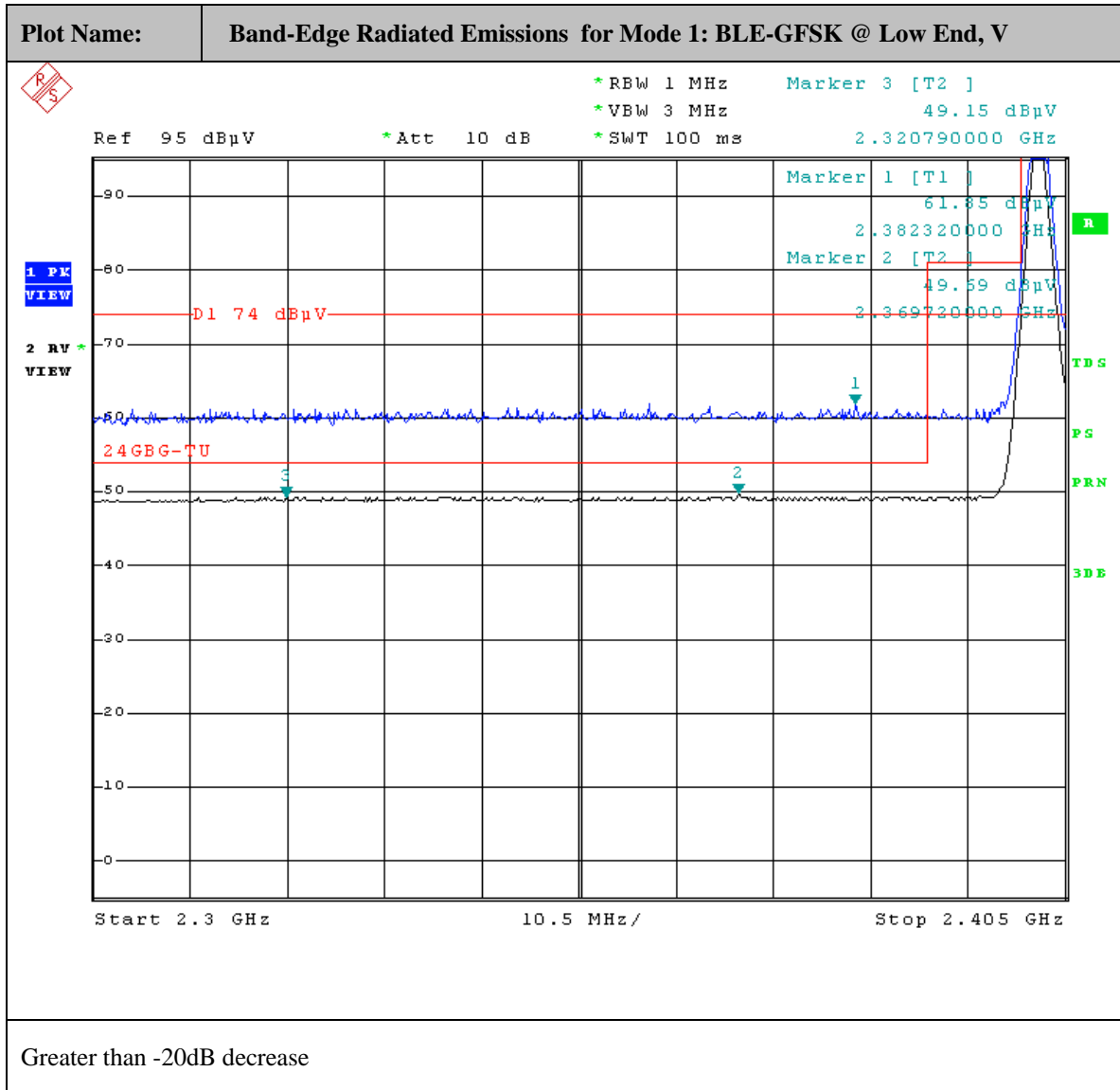
- H=Measurement antenna horizontal position
- V= Measurement antenna vertical position
- Using conventional manner for measuring the radiated emissions that are removed by more than two measurement bandwidths from band-edge, such as the emissions in the restricted band 2310-2390MHz & 2483.5-2500MHz, etc.
- Using conventional manner or if needed, using “delta” measurement technique for measuring the radiated emissions that are up to two measurement bandwidths removed from band-edge, such as the restricted band that begins at 2483.5MHz.
- The worst case for different EUT orientations was chosen for final data collection based on pre-scan testing results.

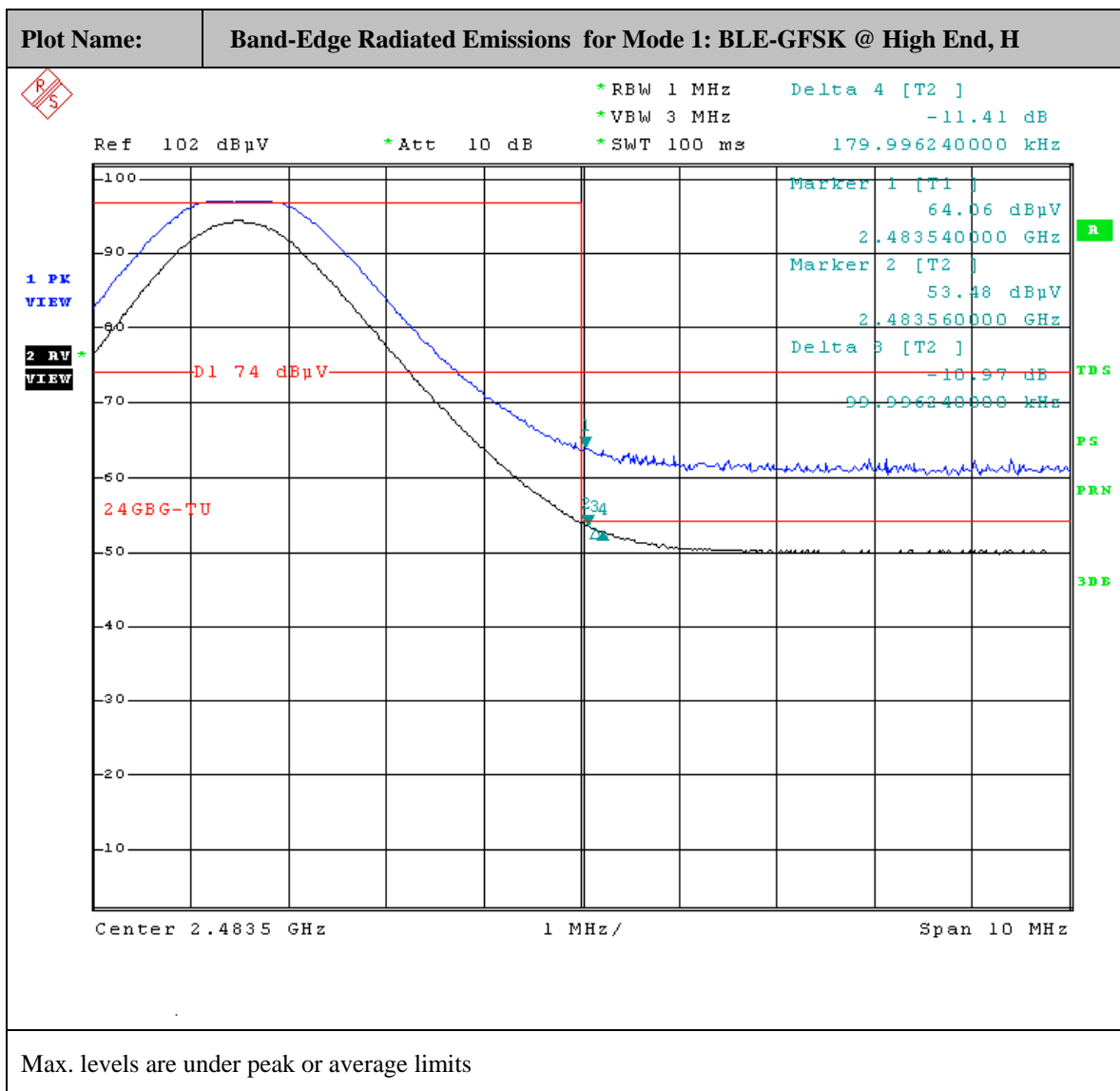
#### **EUT Duty Cycle Factor:**

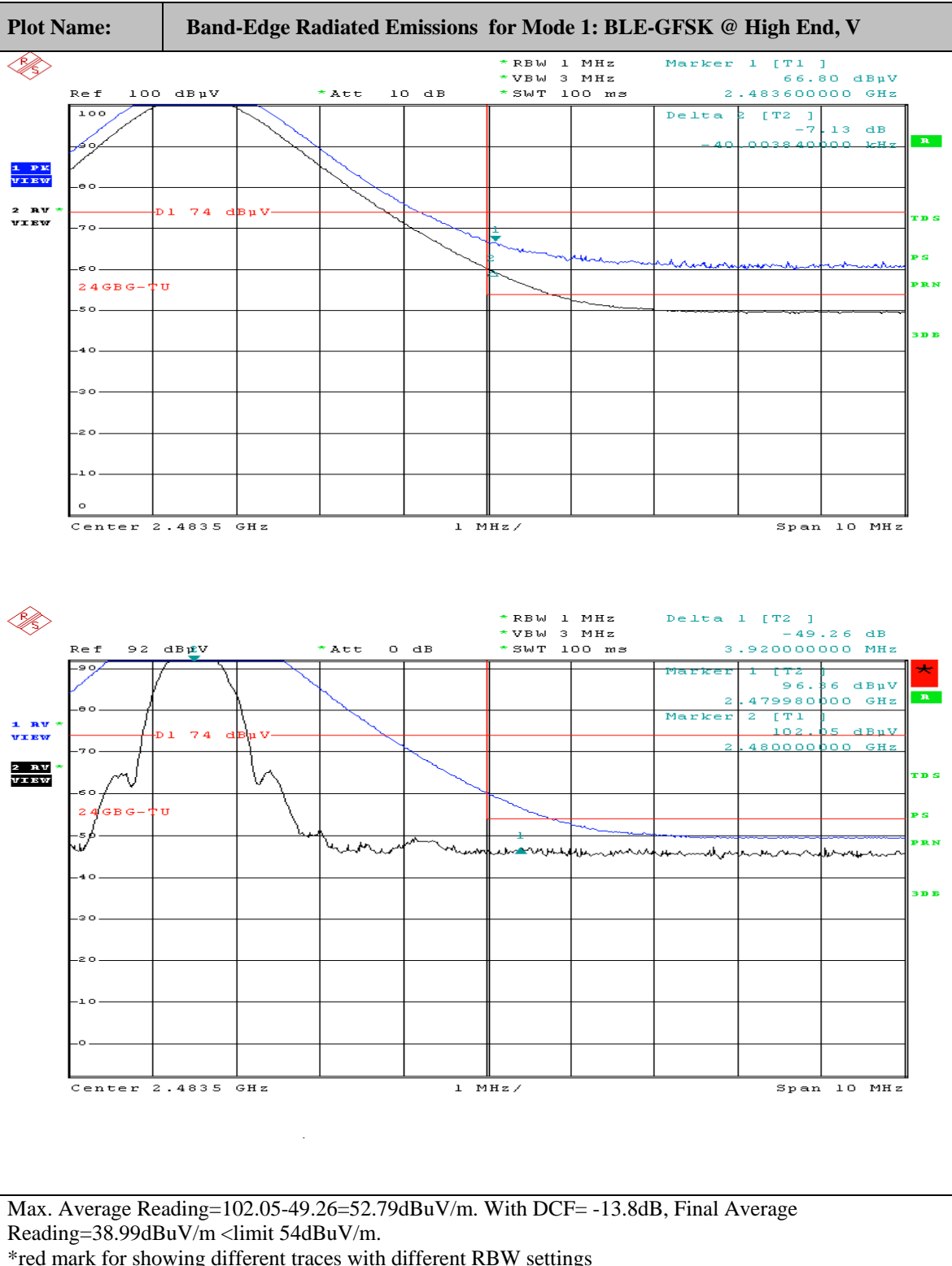
With current design (up to 4v63), while transmitting advertisements, it has a 1.25mS pulse every 30ms. Its duty cycle factor (DCF) is 4.17%, i.e. -13.8dB for peaking/average reading calculation, where applicable.











## 7.8 CONDUCTED EMISSION

### 7.8.1 Test Methods and Conditions

The EUT was under normal operational mode during the conducted emission test. EMI Receiver was scanned from 150KHz to 30MHz with maximum hold mode for maximum emission. Recorded data was sent to the plotter to generate output in linear format. At the input of the spectrum analyzer, a HP transient limiter is inserted for protective purpose. This limiter has a 10 dB attenuation in the range of 150KHZ to 30MHZ. That factor was automatically compensated by the receiver, so the readings are the corrected readings. The reference of the plot is the CISPR 22 Class B limit in following plots.

| Conducted Emission Technical Requirements |                 |              |                 |              |
|---|-----------------|--------------|-----------------|--------------|
|   | Class A         |              | Class B         |              |
| Frequency Range                           | Quasi-Peak dBuV | Average dBuV | Quasi-Peak DBuV | Average dBuV |
| 150kHz -0.5MHz                            | 79 (8912uV)     | 66 (1995uV)  | 66-56           | 56-46        |
| 0.5MHz-30MHz                              | 73 (4467uV)     | 60 (1000uV)  | ---             | ---          |
| 0.5MHz- 5MHz                              | ---             | ---          | 56              | 46 (250uV)   |
| 5MHz-30MHz                                | ---             | ---          | 60              | 50           |

Emissions that have peak values close to the specification limit (if any) are also measured in the quasi-peak/average mode to determine compliance.

### 7.8.2 Test Data

The following plots show the neutral and line conducted emissions for the standard operation.

| Highest Data for AC Line Conducted Emissions |  |  |  |  |  |  |
|--|--|--|--|--|--|--|
| Frequency (MHz)                              |  |  |  |  |  |  |
| Peak Reading (dBuV)                          |  |  |  |  |  |  |
| Average Reading (dBuV*)                      |  |  |  |  |  |  |

\* no need to show the average reading if the peak value is under average limit.

Test Personnel:

Tester Signature: \_\_\_\_\_

Typed/Printed Name: \_\_\_\_\_

Date: \_\_\_\_\_

**NOT APPLICABLE TO THIS EUT**