HCT CO.,LTD.
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383.Rep. of KOREA
**TEL: +82-31-645-6300** **FAX: +82-31-645-6401**

# FCC / IC BT LE REPORT

## Certification

**Applicant Name:**
EGEN Inc.

**Address:**
61,Dongtangiheung-ro, Dongtan-myeon, Hwaseong-si, Gyeonggi-do, KOREA

**Date of Issue:**
August 08, 2018

**Test Site/Location:**
HCT CO., LTD., 74,Seoicheon-ro 578beon-gil,Majang-myeo,Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA

**Report No.:** HCT-RF-1807-FI009-R2

**IC Registration Number :** 5944A-6

| | |
|---|---|
| **FCC ID:** | **2AQUV-B124-NEO6** |
| **IC:** | **24117-B124NEO6** |
| **APPLICANT:** | **EGEN Inc.** |

| | |
|---|---|
| **Model:** | B-124 |
| **Additional Model:** | CELLINK NEO6 |
| **EUT Type:** | Rechargeable Li-ion Battery |
| **RF Peak Output Power:** | 2.742 dBm (1.88 mW) |
| **Frequency Range:** | 2402 MHz -2480 MHz |
| **Modulation type** | GFSK |
| **FCC Classification:** | Digital Transmission System(DTS) |
| **FCC Rule Part(s):** | Part 15.247 |
| **IC Rule Part(s):** | RSS-247 Issue 2 (February 2017), RSS-Gen Issue 5(April 2018) |

Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

**HCT CO., LTD.** Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998,21 U.S. C.853(a)

**Report prepared by : Jung Ki Lim**
**Engineer of Telecommunication testing center**

**Approved by : Jong Seok Lee**
**Manager of Telecommunication testing center**

This report only responds to the tested sample and may not be reproduced, except in full, without written approval of the HCT Co., Ltd.

# Version

| TEST REPORT NO. | DATE | DESCRIPTION |
|---|---|---|
| HCT-RF-1807-FI009 | July 18, 2018 | - First Approval Report |
| HCT-RF-1807-FI009-R1 | July 31, 2018 | - Revised the FCC ID, IC |
| HCT-RF-1807-FI009-R2 | August 08, 2018 | - Revised the FCC ID |
| | | |

# Table of Contents

1. GENERAL INFORMATION ..... 4
2. EUT DESCRIPTION ..... 4
3. TEST METHODOLOGY ..... 5
3.1 EUT CONFIGURATION ..... 5
3.2 EUT EXERCISE ..... 5
3.3 GENERAL TEST PROCEDURES ..... 5
3.4 DESCRIPTION OF TEST MODES ..... 5
4. INSTRUMENT CALIBRATION ..... 6
5. FACILITIES AND ACCREDITATIONS ..... 6
5.1 FACILITIES ..... 6
5.2 EQUIPMENT ..... 6
6. ANTENNA REQUIREMENTS ..... 6
7. MEASUREMENT UNCERTAINTY ..... 7
8. SUMMARY TEST OF RESULTS ..... 8
8.1 FCC Part ..... 8
8.2 IC Part ..... 9
9. TEST RESULT ..... 10
9.1 DUTY CYCLE ..... 10
9.2 6 dB BANDWIDTH MEASUREMENT ..... 12
9.3 99% BANDWIDTH ..... 15
9.4 OUTPUT POWER MEASUREMENT ..... 18
9.5 POWER SPECTRAL DENSITY ..... 25
9.6 OUT OF BAND EMISSIONS AT THE BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS ..... 29
9.7 RADIATED MEASUREMENT. ..... 40
9.7.1 RADIATED SPURIOUS EMISSIONS. ..... 40
9.7.2 RADIATED RESTRICTED BAND EDGES ..... 51
9.7.3 RECEIVER SPURIOUS EMISSIONS ..... 54
9.8 POWERLINE CONDUCTED EMISSIONS ..... 55
10. LIST OF TEST EQUIPMENT ..... 56
10.1 LIST OF TEST EQUIPMENT(Conducted Test) ..... 56
10.2 LIST OF TEST EQUIPMENT(Radiated Test) ..... 57
11. APPENDIX A_TEST SETUP PHOTO ..... 58

# 1. GENERAL INFORMATION

| | |
|---|---|
| **Applicant:** | EGEN Inc. |
| **Address:** | 61,Dongtangiheung-ro, Dongtan-myeon, Hwaseong-si, Gyeonggi-do, KOREA |
| **FCC ID:** | 2AQUV-B124-NEO6 |
| **IC:** | 24117-B124NEO6 |
| **EUT Type:** | Rechargeable Li-ion Battery |
| **Model:** | B-124 |
| **Additional Model:** | CELLINK NEO6 |
| **Date(s) of Tests:** | June 27, 2018 ~ July 03, 2018 |
| **Place of Tests:** | HCT Co., Ltd.<br>74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea |

# 2. EUT DESCRIPTION

| | | |
|---|---|---|
| **Model** | B-124 | |
| **Additional Model** | CELLINK NEO6 | |
| **EUT Type** | Rechargeable Li-ion Battery | |
| **Power Supply** | DC 12.0 V | |
| **Frequency Range** | TX: 2402 MHz ~ 2480 MHz<br>RX: 2402 MHz ~ 2480 MHz | |
| **Max. RF Output Power** | Peak | 2.742 dBm (1.88 mW) |
| | Average | 2.570 dBm (1.81 mW) |
| **BT Operating Mode** | BT _Low Energy Mode | |
| **Modulation Type** | GFSK | |
| **Number of Channels** | 40 Channels | |
| **Antenna Specification** | Antenna type: Dielectric Chip Antenna<br>Peak Gain : 3.14 dBi | |

# 3. TEST METHODOLOGY

FCC KDB 558074 D01 DTS Meas Guidance v04 dated April 5, 2017 entitled "Guidance for Performing Compliance Measurements on Digital Transmission Systems(DTS) and the measurement procedure described in ANSI C63.10(Version : 2013) 'the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices'.

## 3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

## 3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C / the RSS-GEN issue 5, RSS-247 issue 2.

## 3.3 GENERAL TEST PROCEDURES

**Conducted Emissions**

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2 of ANSI C63.10. (Version :2013) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

**Radiated Emissions**

The EUT is placed on a turn table, which is 0.8 m above ground plane below 1GHz. Above 1GHz with 1.5m using absorbers between the EUT and receive antenna. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3.75 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 8 of ANSI C63.10. (Version: 2013)

**Conducted Antenna Terminal**

See Section from 9.1 to 9.2.(KDB 558074 v04)

## 3.4 DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel low, mid and high with highest data rate (worst case) is chosen for full testing.

# 4. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipments, which is traceable to recognized national standards.
Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2006).

# 5. FACILITIES AND ACCREDITATIONS

## 5.1 FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA. The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated April 02, 2018 (Registration Number: KR0032 ). For IC, test facility was accepted dated October 19, 2015(Registration Number: 5944A-6)

## 5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements. Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.
All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

# 6. ANTENNA REQUIREMENTS

**According to FCC 47 CFR §15.203:**

“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 antennas of this E.U.T are permanently attached.

*The E.U.T Complies with the requirement of §15.203

# 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of $k$ = 2 to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the $U_{CISPR}$ measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

| Parameter | Expanded Uncertainty (±dB) |
|---|---|
| Conducted Disturbance (150 kHz ~ 30 MHz) | 1.82 |
| Radiated Disturbance (9 kHz ~ 30 MHz) | 3.40 |
| Radiated Disturbance (30 MHz ~ 1 GHz) | 4.80 |
| Radiated Disturbance (1 GHz ~ 18 GHz) | 5.70 |
| Radiated Disturbance (18 GHz ~ 40 GHz) | 5.71 |

# 8. SUMMARY TEST OF RESULTS

## 8.1 FCC Part

| Test Description | FCC Part Section(s) | Test Limit | Test Condition | Test Result |
|---|---|---|---|---|
| 6 dB Bandwidth | §15.247(a)(2) | > 500 kHz | CONDUCTED | PASS |
| Conducted Maximum Peak Output Power | §15.247(b)(3) | < 1 Watt | | PASS |
| Power Spectral Density | §15.247(e) | < 8 dBm / 3 kHz Band | | PASS |
| Band Edge(Out of Band Emissions) | §15.247(d) | Conducted > 20 dBc | | PASS |
| AC Power line Conducted Emissions | §15.207 | cf. Section 9.8 | | PASS |
| Radiated Spurious Emissions | §15.205, 15.209 | cf. Section 9.7.1 | RADIATED | PASS |
| Radiated Restricted Band Edge | §15.247(d), 15.205, 15.209 | cf. Section 9.7.2 | | PASS |

## 8.2 IC Part

| Test Description | FCC Part Section(s) | Test Limit | Test Condition | Test Result |
|---|---|---|---|---|
| 6 dB Bandwidth | RSS-247, 5.2 | > 500 kHz | CONDUCTED | PASS |
| 99% Bandwidth | RSS-GEN, 6.7 | NA | | NA |
| Conducted Maximum Peak Output Power And e.i.r.p. | RSS-247, 5.4 | < 1 Watt<br><4 Watt(e.i.r.p.) | | PASS |
| Power Spectral Density | RSS-247, 5.2 | < 8 dBm / 3 kHz Band | | PASS |
| Band Edge(Out of Band Emissions) | RSS-247, 5.5 | Conducted > 20 dBc | | PASS |
| AC Power line Conducted Emissions | RSS-GEN, 8.8 | RSS-GEN section 8.8 table 4 | | PASS |
| Radiated Spurious Emissions | RSS-GEN, 8.9 | RSS-GEN section 8.9 table 5, 6 | RADIATED | PASS |
| Receiver Spurious Emissions | RSS-GEN, 5<br>RSS-GEN, 7.3 | RSS-GEN section 7.3 table 3 | | PASS |
| Radiated Restricted Band Edge | RSS-GEN, 8.10 | RSS-GEN section 8.10 table 7 | | PASS |

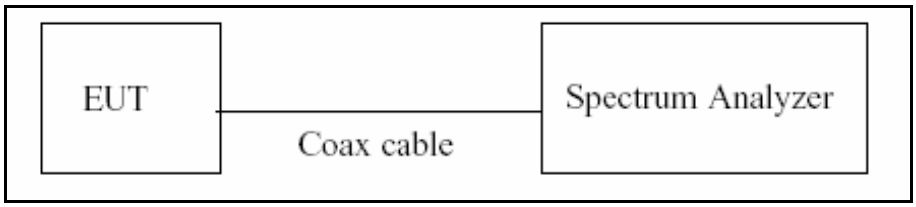
# 9. TEST RESULT

## 9.1 DUTY CYCLE

### ▣ TEST PROCEDURE

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

### ▣ TEST CONFIGURATION




### ▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer. We tested according to the zero-span measurement method, 6.0)b) in KDB 558074 v04.

The largest availble value of RBW is 8 MHz and VBW is 50 MHz. The zero-span method of measuring duty cycle shall not be used if T ≤ 6.25 microseconds. (50/6.25 = 8)

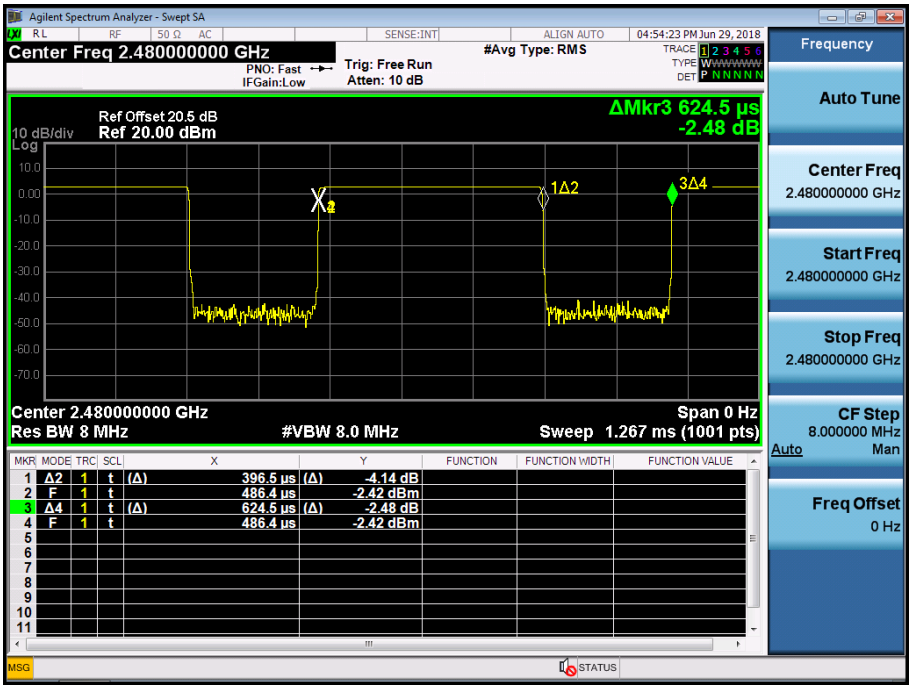
The zero-span method was used because all measured T data are > 6.25 microseconds and both RBW and VBW are > 50/*T*.

1. RBW = 8 MHz (the largest availble value)
2. VBW = 8 MHz (≥ RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure $T_{total}$ and $T_{on}$
8. Calculate Duty Cycle = $T_{on}$/ $T_{total}$ and Duty Cycle Factor = 10*log(1/Duty Cycle)

## ▣ TEST RESULT

| LE Mode | $T_{on}$ (ms) | $T_{total}$ (ms) | Duty Cycle | Duty Cycle Factor (dB) |
|---|---|---|---|---|
| | 0.3965 | 0.6245 | 0.6349 | 1.97 |

## ▣ Duty Cycle RESULT PLOTS



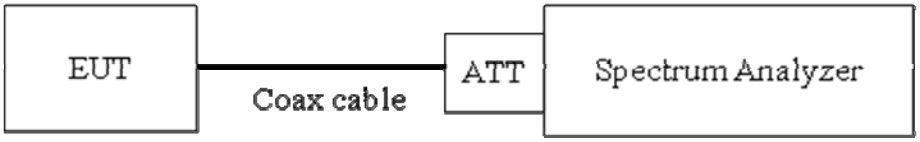
## 9.2 6 dB BANDWIDTH MEASUREMENT

**Test Requirements and limit, §15.247(a)(2) / RSS-247(Issue 2) Section 5.2.**

The bandwidth at 6 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequencies.

The minimum permissible 6 dB bandwidth is 500 kHz.

### ▣ TEST CONFIGURATION




### ▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer.

The Spectrum Analyzer is set to (Procedure 8.1 in KDB 558074 v04)

RBW = 100 kHz

VBW ≥ 3 x RBW

Detector = Peak

Trace mode = max hold

Sweep = auto couple

Allow the trace to stabilize

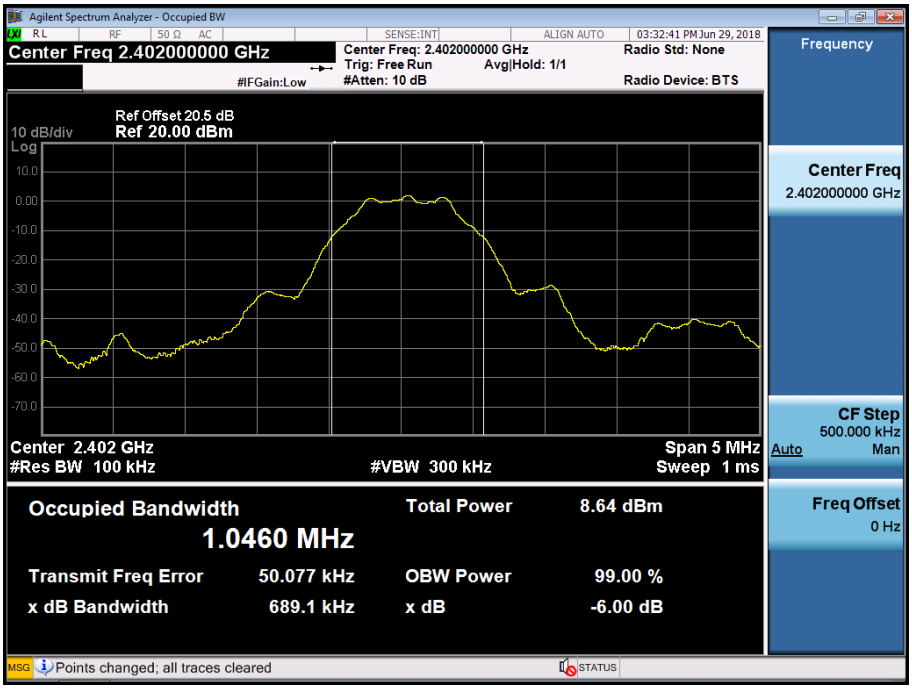
Note : We tested 6 dB bandwidth using the automatic bandwidth measurement capability of a spectrum analyzer. X dB is set 6 dB.

### ▣ TEST RESULT

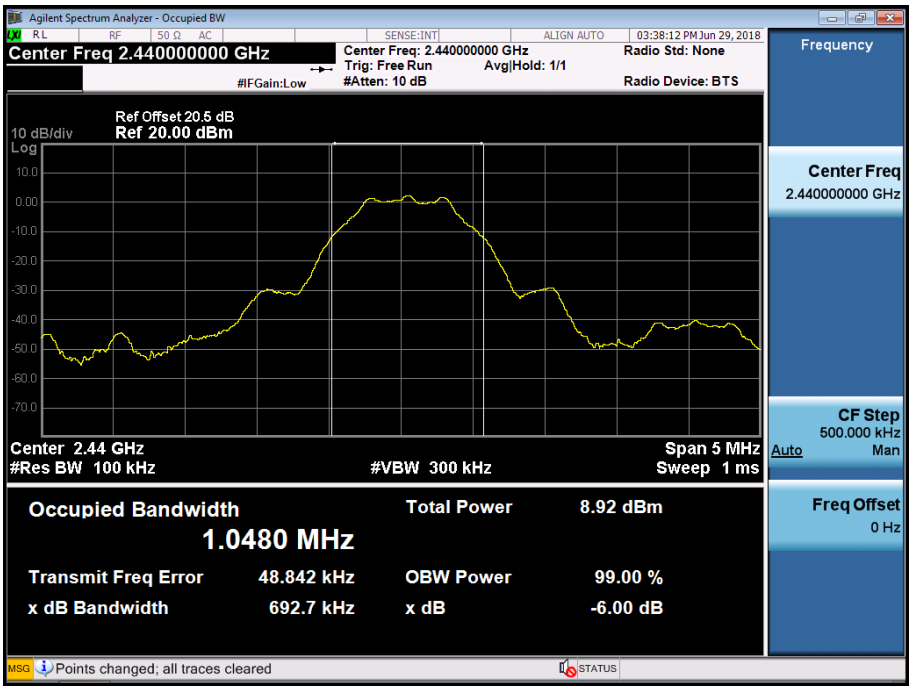
| Mode | Channel | 6 dB Bandwidth (kHz) | Limit (kHz) | Pass/Fail |
|---|---|---|---|---|
| BT LE | 0 | 689.1 | > 500 | Pass |
| | 19 | 692.7 | | Pass |
| | 39 | 698.4 | | Pass |

## ▣ RESULT PLOTS

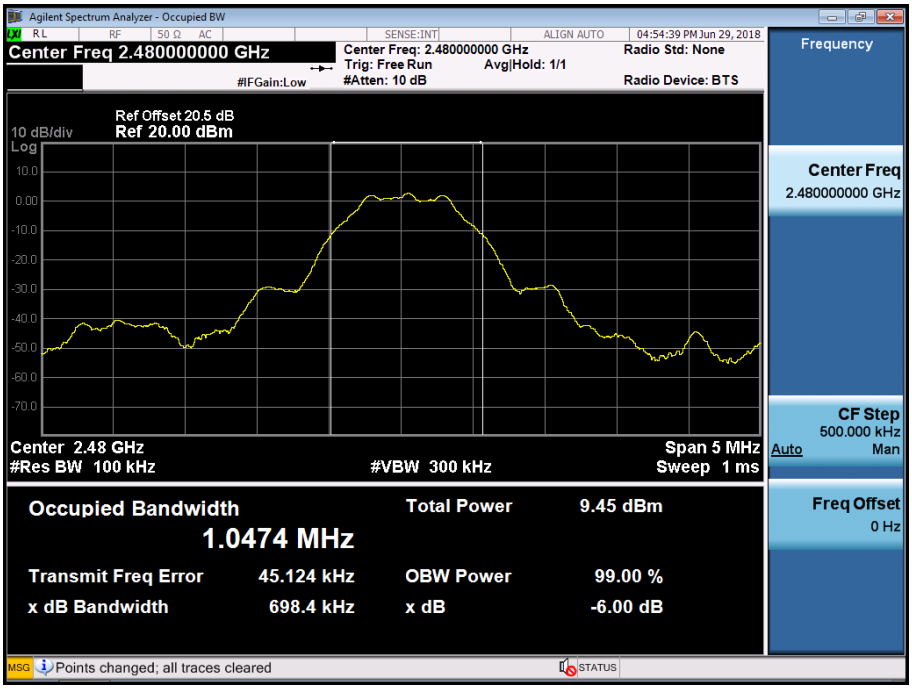
### 6 dB Bandwidth plot (Low-CH 0)




### 6 dB Bandwidth plot (Mid-CH 19)



## 6 dB Bandwidth plot (High-CH 39)

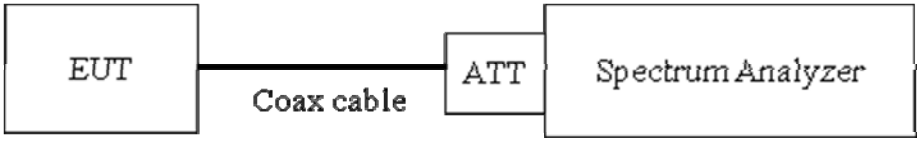


## 9.3 99% BANDWIDTH

**Limit, RSS-Gen(Issue 5) Section 6.7**

The 99 % bandwidth is used to determine the conducted power limits.

### ▣ TEST CONFIGURATION




### ▣ TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer.

RBW = 1% ~ 5% of the occupied bandwidth

VBW ≒ 3 x RBW

Detector = Peak

Trace mode = max hold

Sweep = auto couple

Allow the trace to stabilize

Note : We tested OBW using the automatic bandwidth measurement capability of a spectrum analyzer.

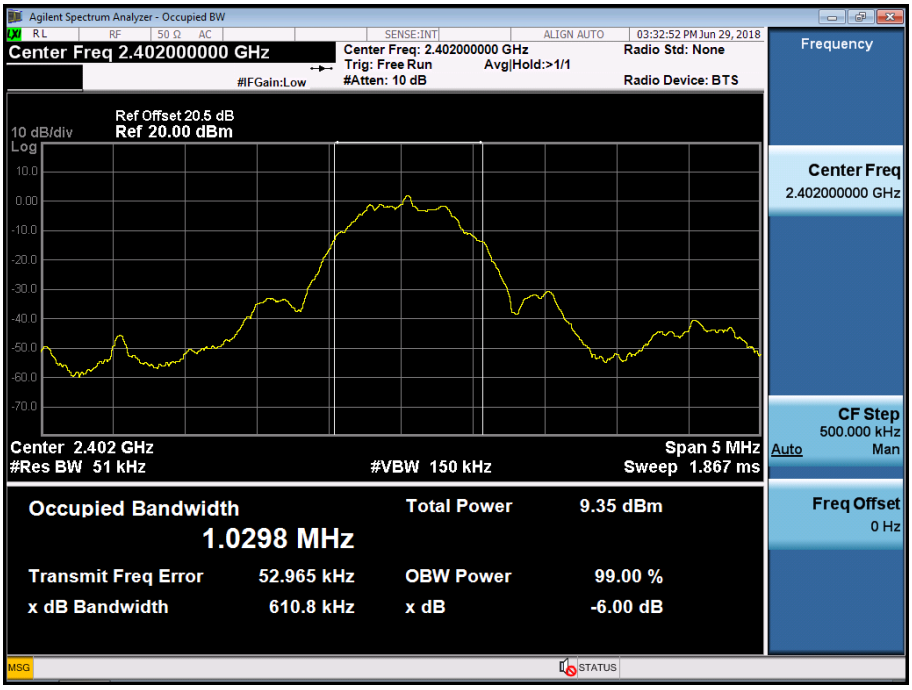
### ▣ TEST RESULTS

**Conducted 99% Bandwidth Measurements for LE Mode**

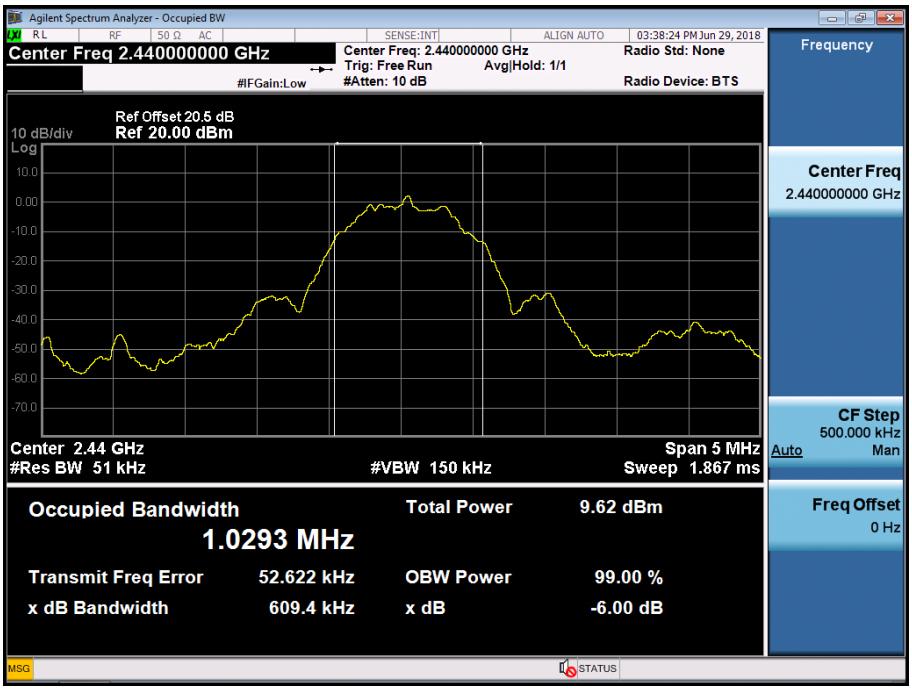
| LE Mode | | Measured Bandwidth [MHz] |
|---|---|---|
| Frequency [MHz] | Channel No. | |
| 2402 | 0 | 1.0298 |
| 2440 | 19 | 1.0293 |
| 2480 | 39 | 1.0296 |

## ▣ RESULT PLOTS

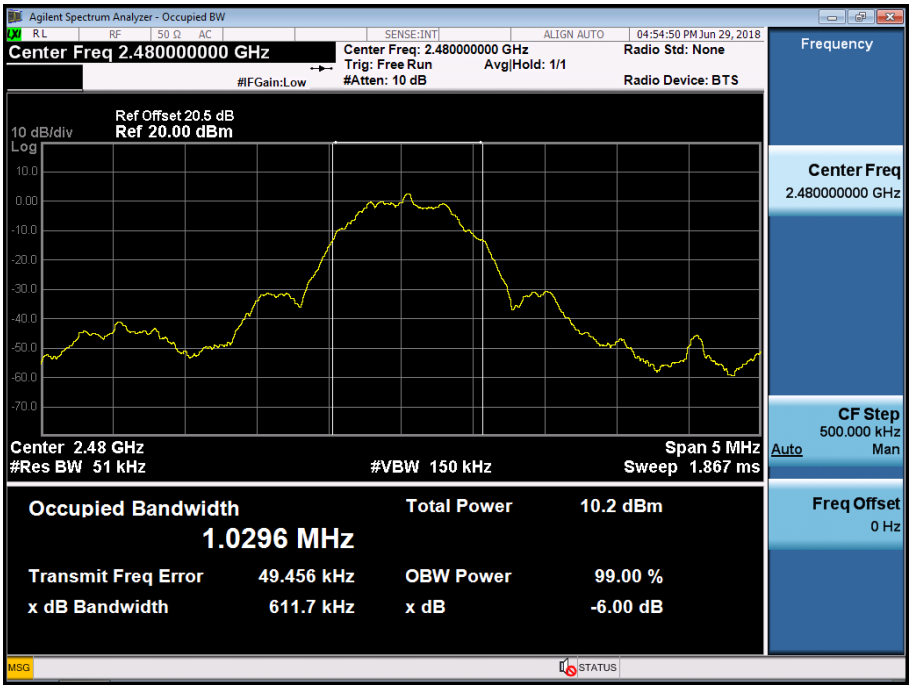
### 99% Bandwidth plot (Low-CH 0)




### 99% Bandwidth plot (Mid-CH 19)



## 99% Bandwidth plot (High-CH 39)



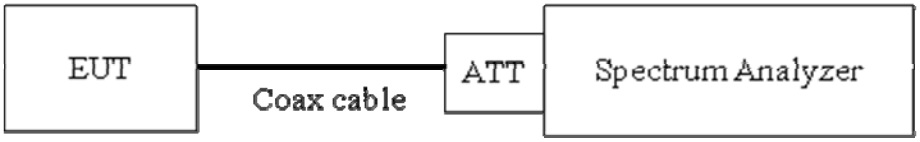
## 9.4 OUTPUT POWER MEASUREMENT

**Test Requirements and limit, §15.247(b)(3) / RSS-247(Issue2) Section 5.4.4.**

A transmitter antenna terminal of EUT is connected to the input of a Spectrum Analyzer. Measurement is made while the EUT is operating in transmission mode at the appropriate frequencies.

The maximum permissible conducted output power is 1 Watt.

### ▣ TEST CONFIGURATION




### ▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer. We use the spectrum analyzer's integrated band power measurement function.

This EUT TX condition is actual operating mode by BT LE mode test program.

The Spectrum Analyzer is set to

- Peak Power ( Procedure 9.1.1 in KDB 558074 v04)

  RBW ≥ DTS Bandwidth

  VBW ≥ 3 x RBW

  SPAN ≥ 3 x RBW

  Detector Mode = Peak

  Sweep = auto couple

  Trace Mode = max hold

  Allow trace to fully stabilize.

  Use peak marker function to determine the peak amplitude level

- Average Power ( Procedure 9.2.2.4 in KDB 558074 v04)

  Measure the duty cycle

  Set span to at least 1.5 times the OBW

  RBW = 1-5 % of the OBW, not to exceed 1 MHz.

  VBW ≥ 3 x RBW.

  Number of points in sweep ≥ 2 x span / RBW. (This gives bin-to-bin spacing ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)

  Sweep time = auto.

  Detector = RMS(i.e., power averaging)

  Do not use sweep triggering. Allow the sweep to "free run".

  Trace average at least 100 traces in power averaging(RMS) mode.

  Compute power by integrating the spectrum across the OBW of the signal using the instrument's band

power measurement function with band limits set equal to the OBW band edges.
Add 10 log (1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times.

### ▣ Sample Calculation

Output Power = Reading Value + ATT loss + Cable loss(1 ea) + Duty Cycle Factor
Output Power = 10 dBm + 10 dB + 0.8 dB + 0.2 dB = 21.0 dBm

Note :

1. The power results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset = Attenuator loss + Cable loss
3. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. So, 20.5 dB is offset for 2.4 GHz Band.

## ▣ TEST RESULTS-Peak

**Conducted Output Power Measurements**

| LE Mode | | Measured Power(dBm) | Limit (dBm) |
|---|---|---|---|
| Frequency[MHz] | Channel No. | | |
| 2402 | 0 | 2.006 | 30 |
| 2440 | 19 | 2.241 | 30 |
| 2480 | 39 | 2.742 | 30 |

## ▣ TEST RESULTS-Average

**Conducted Output Power Measurements**

| LE Mode | | Measured Power(dBm) | Duty Cycle Factor (dB) | Measured Power(dBm) + Duty Cycle Factor(dB) | Limit (dBm) |
|---|---|---|---|---|---|
| Frequency[MHz] | Channel No. | | | | |
| 2402 | 0 | -0.22 | 1.97 | 1.75 | 30 |
| 2440 | 19 | -0.06 | 1.97 | 1.92 | 30 |
| 2480 | 39 | 0.60 | 1.97 | 2.57 | 30 |

## ▣ RESULT PLOTS-Peak

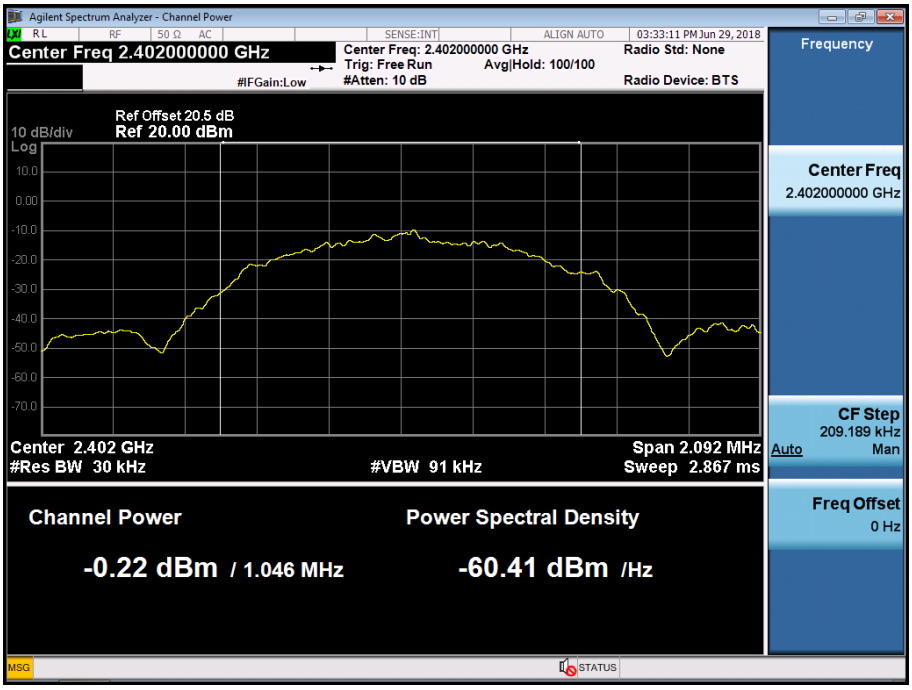
### Conducted Output Power (Low-CH 0)

### Conducted Output Power (Mid-CH 19)

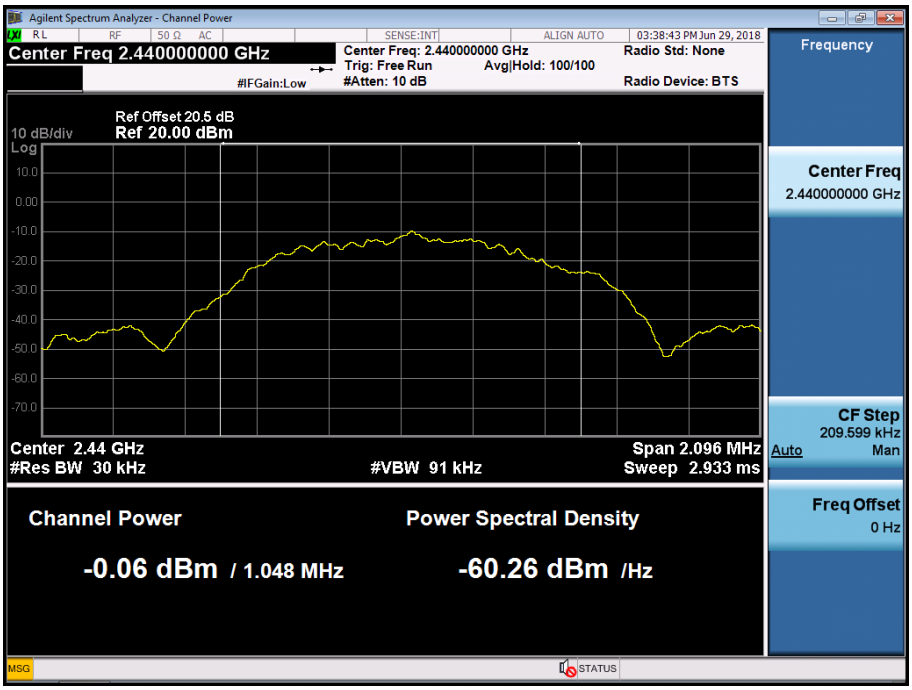
## Conducted Output Power (High-CH 39)

## ▣ RESULT PLOTS-Average

### Conducted Output Power (Low-CH 0)




### Conducted Output Power (Mid-CH 19)



## Conducted Output Power (High-CH 39)

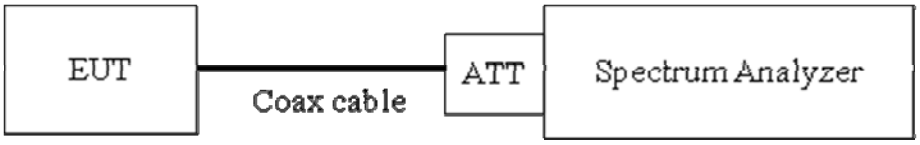
## 9.5 POWER SPECTRAL DENSITY

**Test Requirements and limit, §15.247(e) / RSS-247(Issue 2) Section 5.2.**

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

**Minimum Standard – The transmitter power density average over 1-second interval shall not be greater than 8dBm in any 3kHz BW.**

### ▣ TEST CONFIGURATION




### ▣ TEST PROCEDURE

We tested according to Procedure 10.2 in KDB 558074, issued 04/05/2017

The spectrum analyzer is set to :

Set analyzer center frequency to DTS channel center frequency.

Span = 1.5 times the DTS channel bandwidth.

RBW = 3 kHz ≤ RBW ≤ 100 kHz.

VBW ≥ 3 x RBW.

Sweep = auto couple

Detector = peak

Trace Mode = max hold

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

### ▣ Sample Calculation

PSD = Reading Value + ATT loss + Cable loss(1 ea)

Output Power = -5 dBm + 10 dB + 0.8 dB = 5.8 dBm

Note :

1. The PSD results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset = Attenuator loss + Cable loss
3. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. So, 20.5 dB is offset for 2.4 GHz Band.

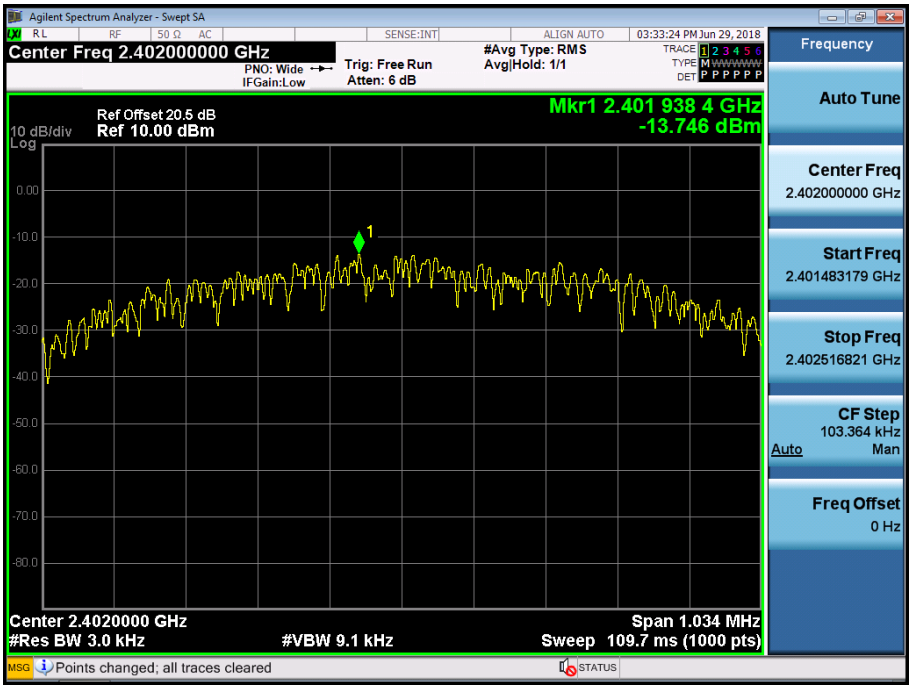
## ▣ TEST RESULTS

**Conducted Power Density Measurements**

| Frequency (MHz) | Channel No. | Mode | Test Result | | |
|---|---|---|---|---|---|
| | | | PSD (dBm) | Limit (dBm) | Pass/ Fail |
| 2402 | 0 | LE | -13.746 | 8 | Pass |
| 2440 | 19 | | -13.474 | 8 | Pass |
| 2480 | 39 | | -12.672 | 8 | Pass |

## ▣ RESULT PLOTS

### Power Spectral Density (Low-CH 0)




### Power Spectral Density (Mid-CH 19)

## Power Spectral Density (High-CH 39)

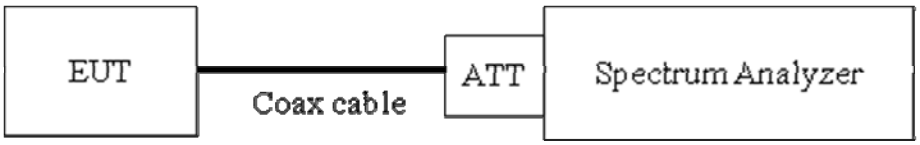
**9.6 OUT OF BAND EMISSIONS AT THE BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS**

**Test Requirements and limit, §15.247(d) / RSS-247(Issue 2) Section 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)).

**Limit : 20 dBc**

**▣ TEST CONFIGURATION**




**▣ TEST PROCEDURE**

The transmitter output is connected to the spectrum analyzer. (Procedure 11.0 in KDB 558074 v04)

RBW = 100 kHz

VBW ≥ 3 x RBW

Set span to encompass the spectrum to be examined

Detector = Peak

Trace Mode = max hold

Sweep time = auto couple

Ensure that the number of measurement points ≥ 2*Span/RBW

Allow trace to fully stabilize.

Use peak marker function to determine the maximum amplitude level.

Measurements are made over the 30 MHz to 10$^{th}$ harmonic range with the transmitter set to the lowest, middle, and highest channels.

Note :

1. The maximum peak conducted output power procedure was used to demonstrate compliance as described in 9.1(KDB558074 v04), so the peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 20 dBc).

2. The band edge results in plot is already including the actual values of loss for the attenuator and cable combination.
3. Spectrum offset = Attenuator loss + Cable loss
4. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. So, 20.5 dB is offset for 2.4 GHz Band.
5. In case of conducted spurious emissions test, please check factors blow table.
6. In order to simplify the report, attached plots were only the worst case channel and data rate.

## ▣ FACTORS FOR FREQUENCY

| Freq(MHz) | Factor(dB) |
|---|---|
| 30 | 21.30 |
| 100 | 19.83 |
| 200 | 20.19 |
| 300 | 20.13 |
| 400 | 20.23 |
| 500 | 20.25 |
| 600 | 20.32 |
| 700 | 20.35 |
| 800 | 20.35 |
| 900 | 20.34 |
| 1000 | 20.39 |
| 2000 | 20.64 |
| 2400* | 20.48 |
| 2500* | 20.52 |
| 3000 | 20.68 |
| 4000 | 20.89 |
| 5000 | 21.07 |
| 6000 | 21.06 |
| 7000 | 21.35 |
| 8000 | 21.32 |
| 9000 | 21.48 |
| 10000 | 21.56 |
| 11000 | 21.56 |
| 12000 | 21.68 |
| 13000 | 21.83 |
| 14000 | 21.90 |
| 15000 | 21.98 |
| 16000 | 22.04 |

| | |
|---|---|
| 17000 | 22.02 |
| 18000 | 22.08 |
| 19000 | 22.07 |
| 20000 | 22.14 |
| 21000 | 22.17 |
| 22000 | 22.31 |
| 23000 | 22.60 |
| 24000 | 22.34 |
| 25000 | 22.53 |

Note : 1. '*' is fundamental frequency range.

2. Factor = Cable loss + Attenuator loss

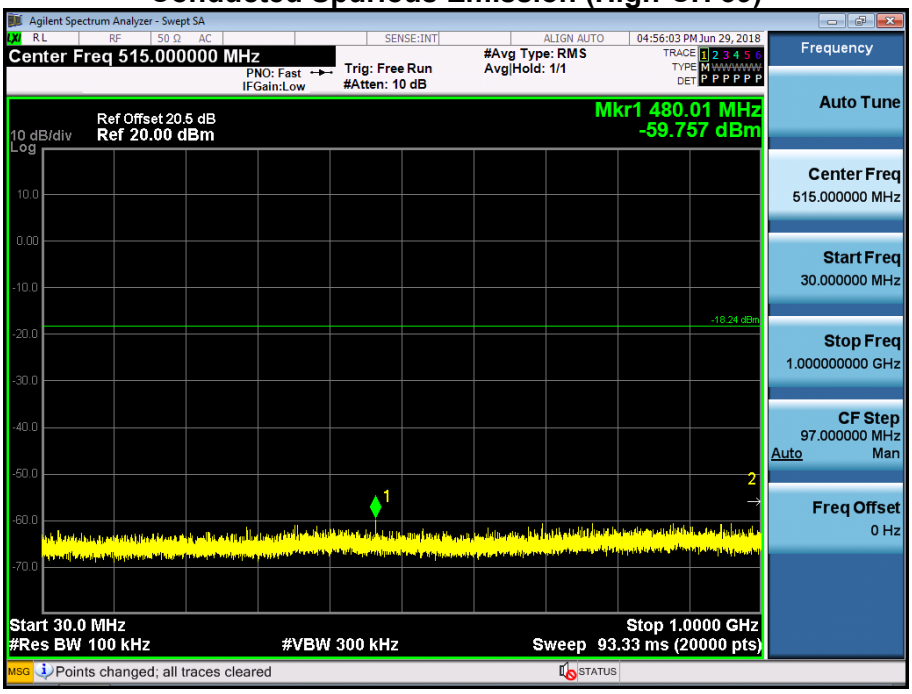
## ▣ RESULT PLOTS

### BandEdge (Low-CH 0)

### BandEdge (High-CH 39)

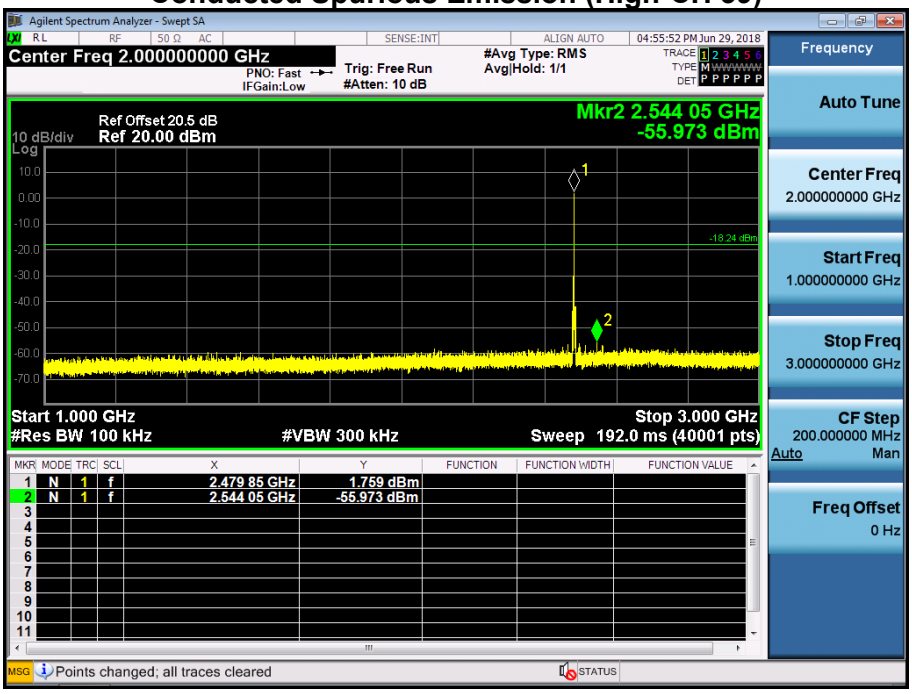
## 30 MHz ~ 1 GHz

### Conducted Spurious Emission (High-CH 39)



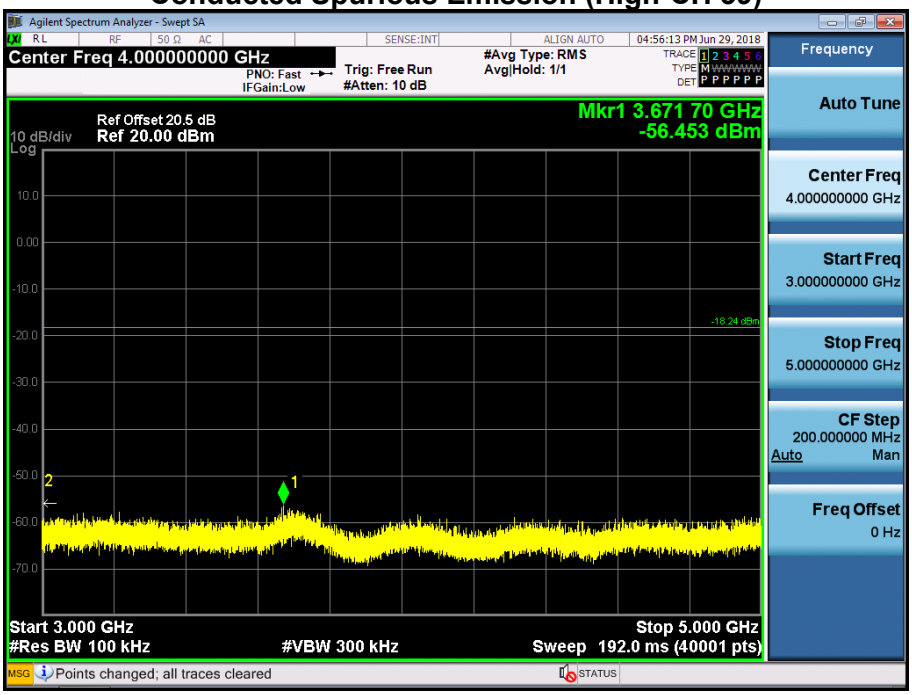

## 1 GHz ~ 3 GHz

### Conducted Spurious Emission (High-CH 39)



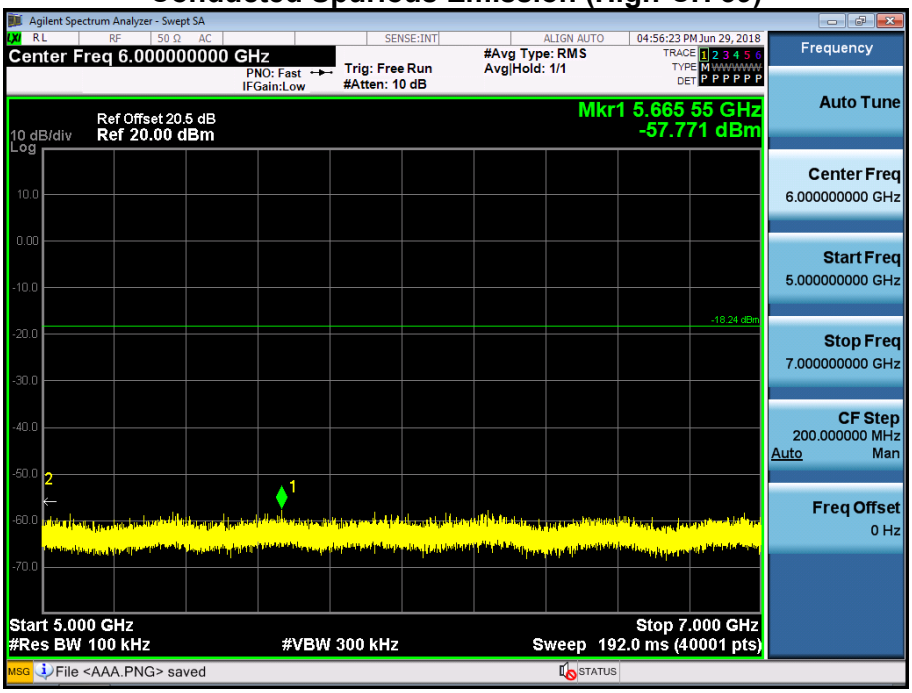
### 3 GHz ~ 5 GHz

**Conducted Spurious Emission (High-CH 39)**



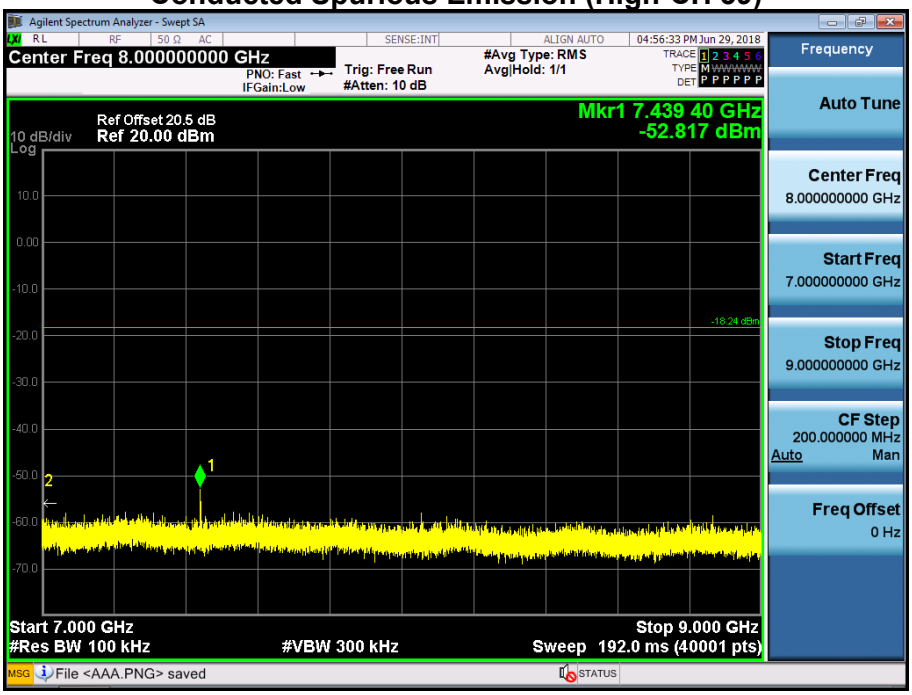

### 5 GHz ~ 7 GHz

**Conducted Spurious Emission (High-CH 39)**



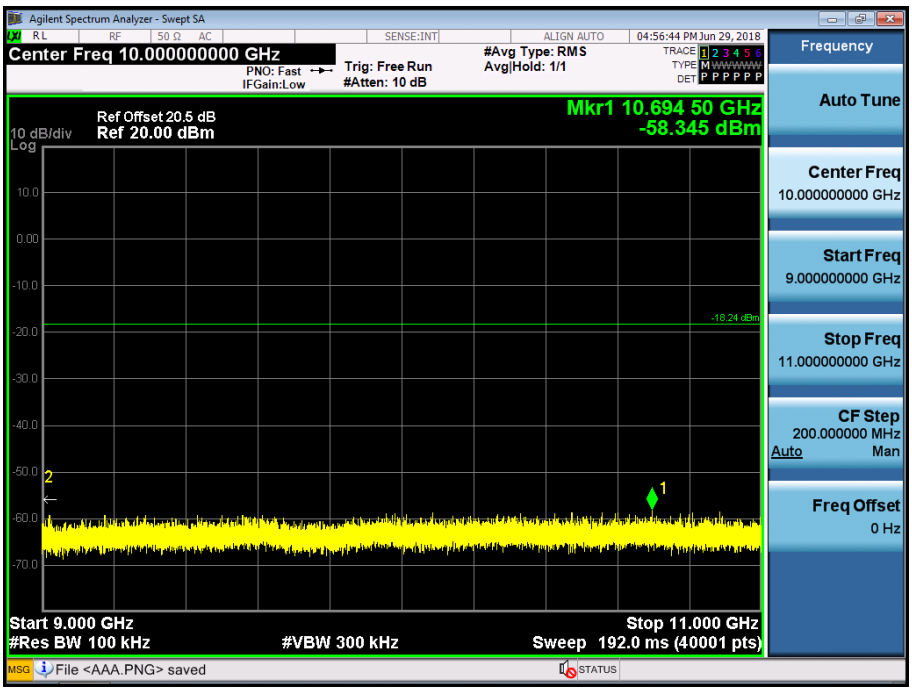
## 7 GHz ~ 9 GHz

### Conducted Spurious Emission (High-CH 39)



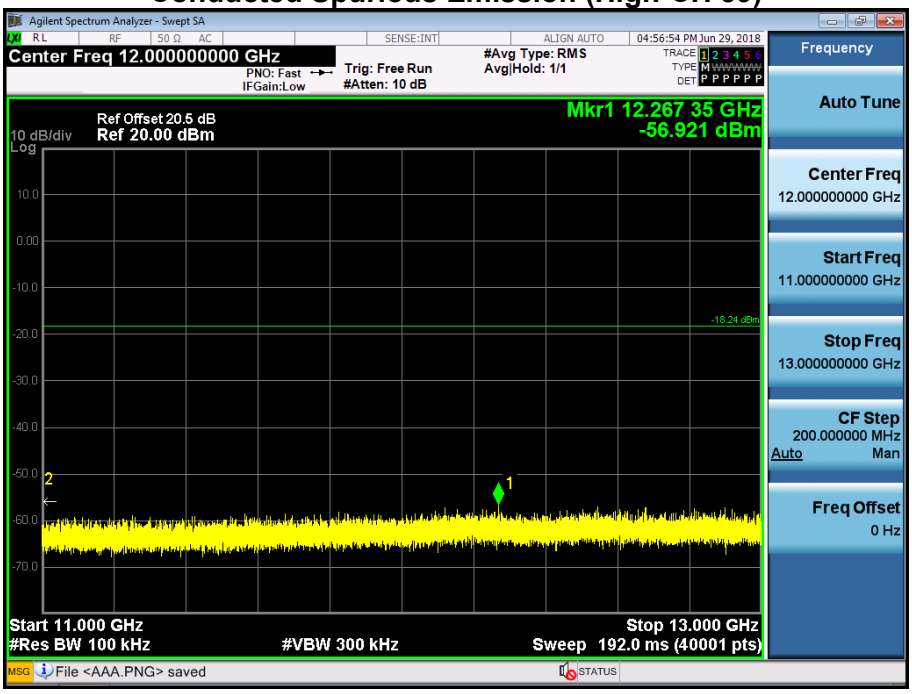

## 9 GHz ~ 11 GHz

### Conducted Spurious Emission (High-CH 39)



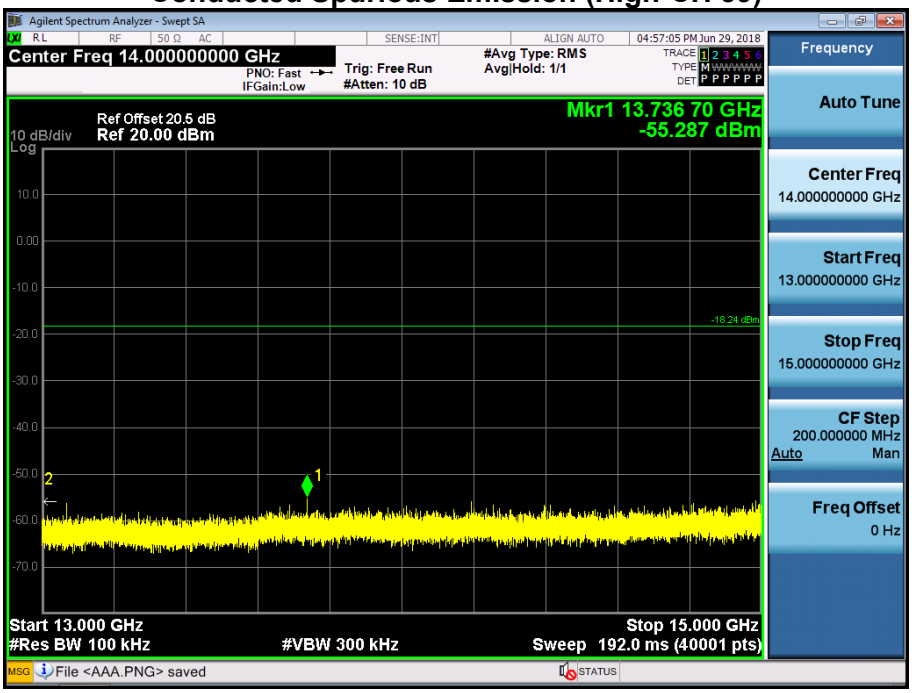
## 11 GHz ~ 13 GHz

### Conducted Spurious Emission (High-CH 39)



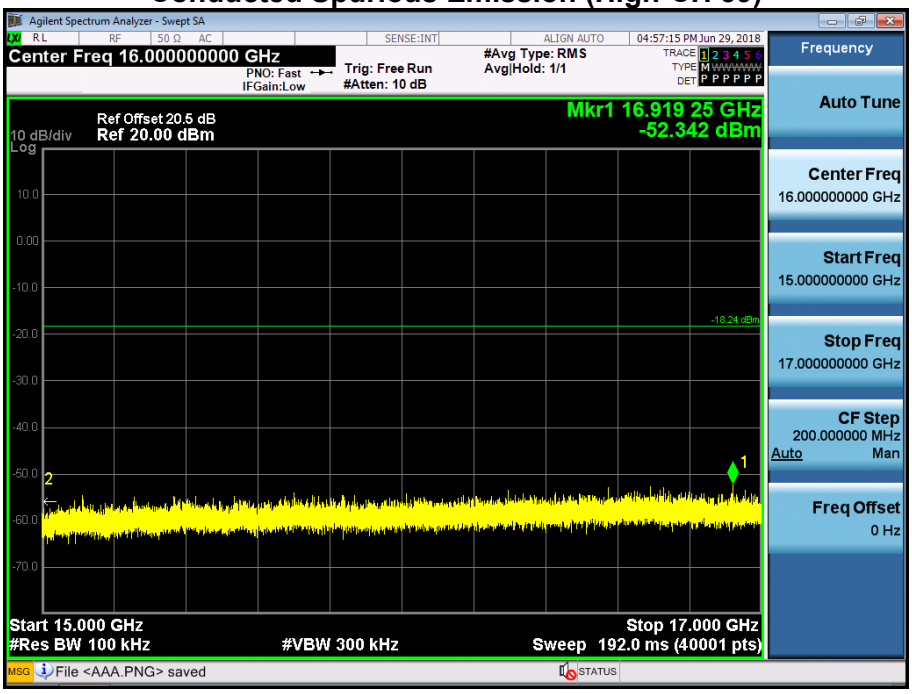

## 13 GHz ~ 15 GHz

### Conducted Spurious Emission (High-CH 39)



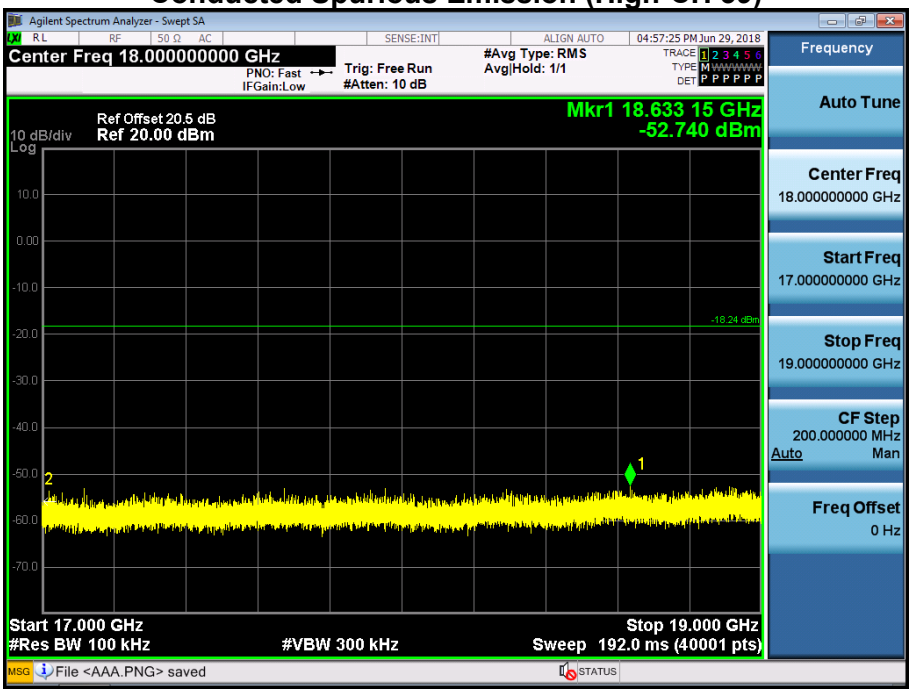
## 15 GHz ~ 17 GHz

### Conducted Spurious Emission (High-CH 39)



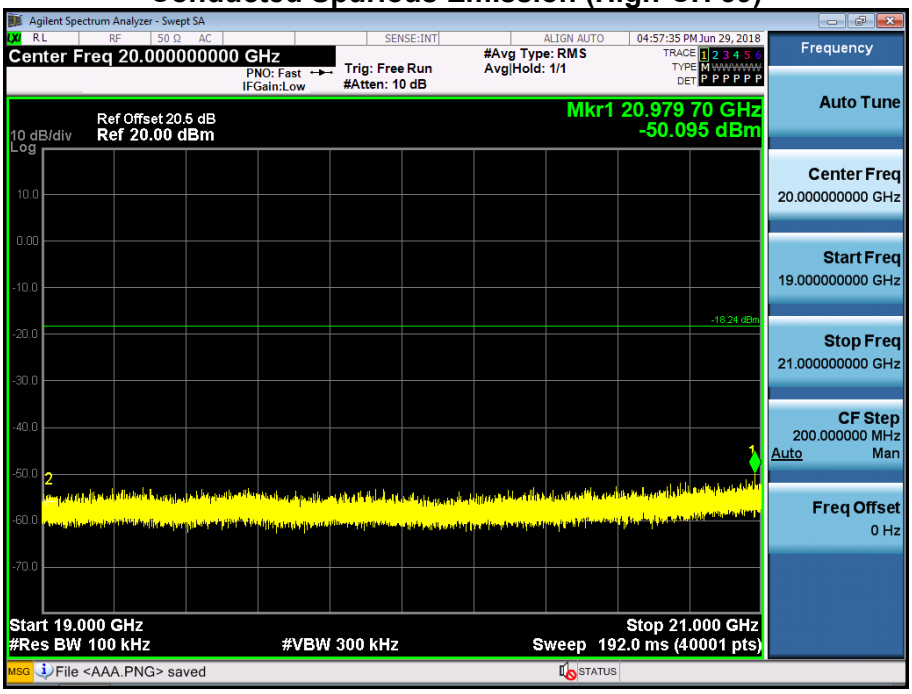

## 17 GHz ~ 19 GHz

### Conducted Spurious Emission (High-CH 39)



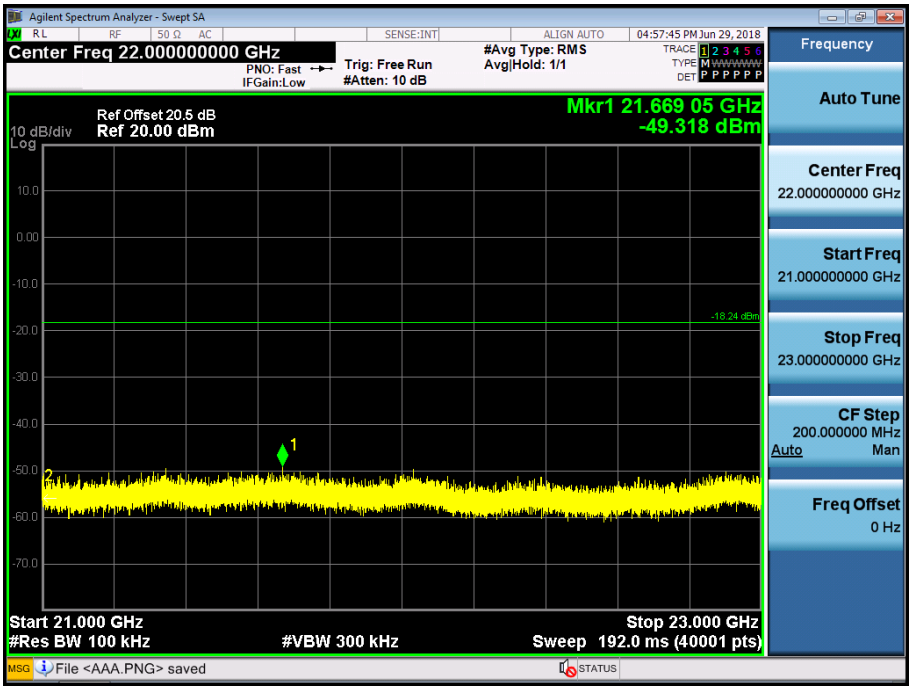
## 19 GHz ~ 21 GHz

### Conducted Spurious Emission (High-CH 39)



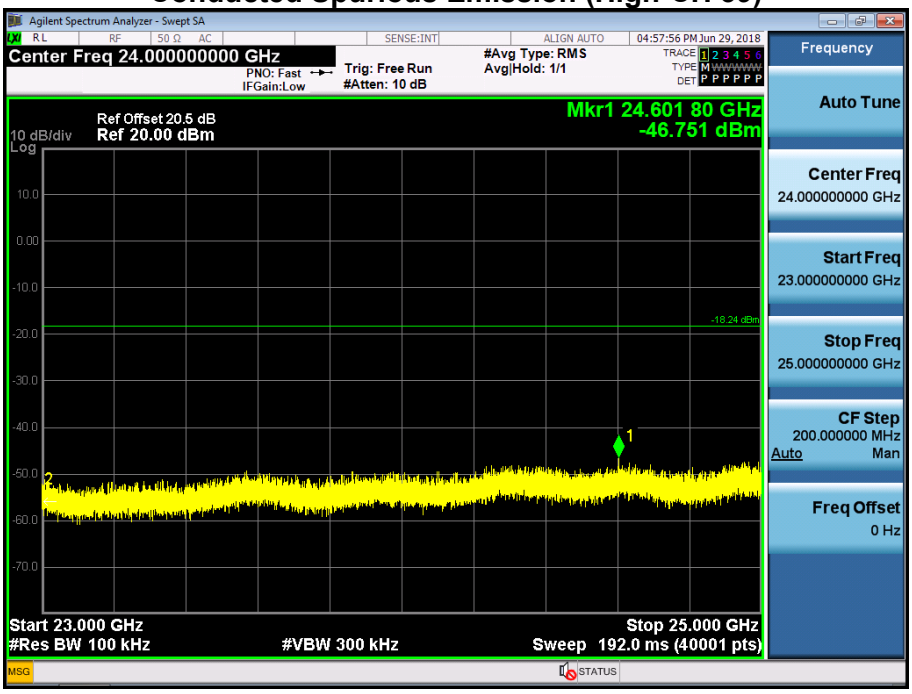

## 21 GHz ~ 23 GHz

### Conducted Spurious Emission (High-CH 39)



**23 GHz ~ 25 GHz**

**Conducted Spurious Emission (High-CH 39)**



## 9.7 RADIATED MEASUREMENT.

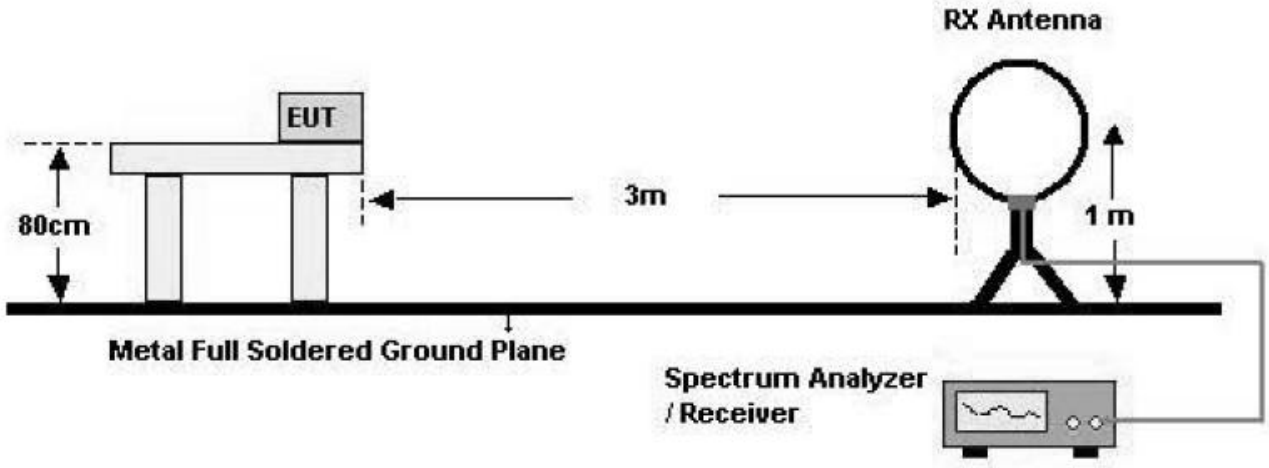
### 9.7.1 RADIATED SPURIOUS EMISSIONS.

**Test Requirements and limit, §15.205, §15.209, RSS-Gen(Issue 5) Section 8.9.**

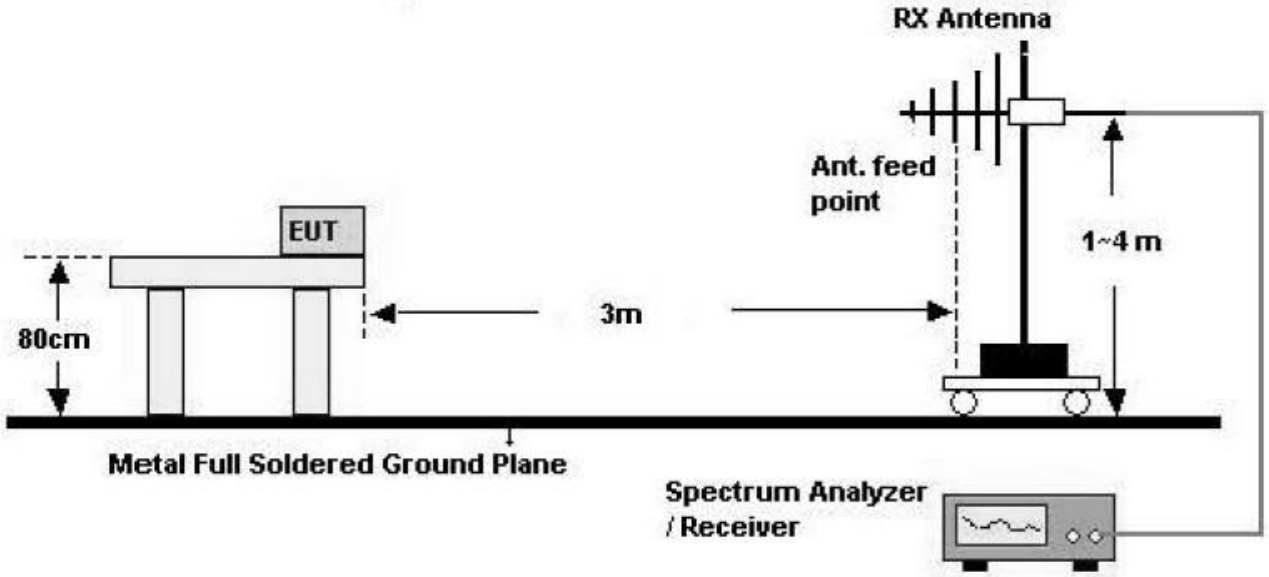
| Frequency (MHz) | Field Strength (uV/m) | Measurement Distance (m) |
|---|---|---|
| 0.009 – 0.490 | 2400/F(kHz) | 300 |
| 0.490 – 1.705 | 24000/F(kHz) | 30 |
| 1.705 – 30 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

**Test Configuration**

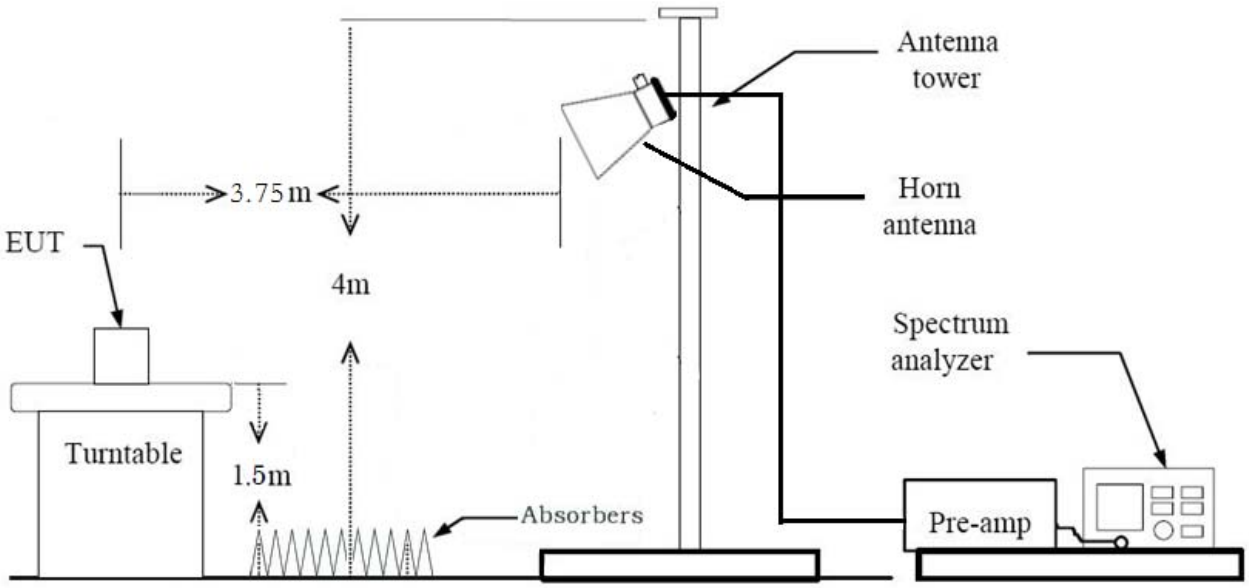
**Below 30 MHz**




**30 MHz - 1 GHz**



**Above 1 GHz**




**TEST PROCEDURE USED**

Method 12.1 in KDB 558074 v04

Spectrum Setting

- Peak

Peak emission levels are measured by setting the instrument as follows:

RBW = cf. Table 1.

VBW ≥ 3 x RBW.

Detector = Peak.

Sweep time = auto.

Trace mode = max hold.

Allow sweeps to continue until the trace stabilizes.

(Note that the required measurement time may be longer for low duty cycle applications).

**Table 1 —RBW as a function of frequency**

| Frequency | RBW |
|---|---|
| 9-150 kHz | 200-300 Hz |
| 0.15-30 MHz | 9-10 kHz |
| 30-1000 MHz | 100-120 kHz |
| > 1000 MHz | 1 MHz |

- Average (duty cycle < 98%, duty cycle variations are less than ±2%)

Set RBW = 1 MHz

Set VBW ≥ 3 x RBW

Detector = RMS.

Averaging type = power (*i.e.*, RMS).

Sweep time = auto.

Trace mode = average (at least 100 traces).

A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle.

**Note :**

1. We are performed the RSE and radiated band edge using standard radiated method(RMS).
2. According to SVSWR requirement in ANSI 63.4-2014, We performed the radiated test at 3.75 m distance from center of turn table. So, we applied the distance factor( reference distance : 3 m).
3. Distance extrapolation factor = 20 log (test distance / specific distance) (dB)

| LE Mode | $T_{on}$ (ms) | $T_{total}$ (ms) | Duty Cycle | Duty Cycle Factor (dB) |
|---|---|---|---|---|
| | 0.3965 | 0.6245 | 0.6349 | 1.97 |

**TEST RESULTS**

**9 kHz – 30MHz**

**Operation Mode:** Normal Mode

| Frequency | Reading | Ant. factor | Cable loss | Ant. POL | Total | Limit | Margin |
|---|---|---|---|---|---|---|---|
| MHz | dBuV/m | dBm/m | dBm | (H/V) | dBuV/m | dBuV/m | dB |
| No Critical peaks found | | | | | | | |

**Notes:**

1. Measuring frequencies from 9 kHz to the 30MHz.
2. The reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.
3. Distance extrapolation factor = 40 log (specific distance / test distance) (dB)
4. Limit line = specific Limits (dBuV) + Distance extrapolation factor
5. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
6. The test results for below 30 MHz is correlated to an open site.
   The result on OATS is about 2 dB higher than semi-anechoic chamber (10 m chamber)

**TEST RESULTS**

**Below 1 GHz**

**Operation Mode:** Normal Mode

| Frequency | Reading | Ant. factor | Cable loss | Ant. POL | Total | Limit | Margin |
|---|---|---|---|---|---|---|---|
| MHz | dBuV/m | dBm/m | dBm | (H/V) | dBuV/m | dBuV/m | dB |
| No Critical peaks found | | | | | | | |

**Notes:**

1. Measuring frequencies from 30 MHz to the 1 GHz.
2. Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Quasi peak detector mode.
3. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

**Above 1 GHz**

Operation Mode: CH.0

| Frequency [MHz] | Reading [dBuV/m] | Duty Cycle Factor [dB] | A.F.+C.L.-A.G.+D.F. [dBm] | ANT. POL [H/V] | Total [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Measurement Type |
|---|---|---|---|---|---|---|---|---|
| 4804 | 52.59 | 0 | 2.07 | V | 54.66 | 73.98 | 19.32 | PK |
| 4804 | 41.93 | 1.97 | 2.07 | V | 45.97 | 53.98 | 8.01 | AV |
| 7206 | 51.05 | 0 | 9.57 | V | 60.62 | 73.98 | 13.36 | PK |
| 7206 | 38.44 | 1.97 | 9.57 | V | 49.98 | 53.98 | 4.00 | AV |
| 4804 | 52.49 | 0 | 2.07 | H | 54.56 | 73.98 | 19.42 | PK |
| 4804 | 40.65 | 1.97 | 2.07 | H | 44.69 | 53.98 | 9.29 | AV |
| 7206 | 50.98 | 0 | 9.57 | H | 60.55 | 73.98 | 13.43 | PK |
| 7206 | 38.39 | 1.97 | 9.57 | H | 49.93 | 53.98 | 4.05 | AV |

*A.F. : Antenna Factor / C.L. : Cable Loss / A.G. : Amplifier Gain / D.F. : Distance Factor

**Notes:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Distance Factor + Duty Cycle Factor
5. Distance extrapolation factor = 20 log (test distance / specific distance) (dB)
6. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Operation Mode: CH.19

| Frequency [MHz] | Reading [dBuV/m] | Duty Cycle Factor [dB] | A.F.+C.L.-A.G.+D.F. [dBm] | ANT. POL [H/V] | Total [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Measurement Type |
|---|---|---|---|---|---|---|---|---|
| 4880 | 52.69 | 0 | 2.56 | V | 55.25 | 73.98 | 18.73 | PK |
| 4880 | 41.96 | 1.97 | 2.56 | V | 46.49 | 53.98 | 7.49 | AV |
| 7320 | 51.03 | 0 | 9.72 | V | 60.75 | 73.98 | 13.23 | PK |
| 7320 | 38.37 | 1.97 | 9.72 | V | 50.06 | 53.98 | 3.92 | AV |
| 4880 | 52.52 | 0 | 2.56 | H | 55.08 | 73.98 | 18.90 | PK |
| 4880 | 40.54 | 1.97 | 2.56 | H | 45.07 | 53.98 | 8.91 | AV |
| 7320 | 50.93 | 0 | 9.72 | H | 60.65 | 73.98 | 13.33 | PK |
| 7320 | 38.35 | 1.97 | 9.72 | H | 50.04 | 53.98 | 3.94 | AV |

**Notes:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Distance Factor + Duty Cycle Factor
5. Distance extrapolation factor = 20 log (test distance / specific distance) (dB)
6. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Operation Mode: CH.39

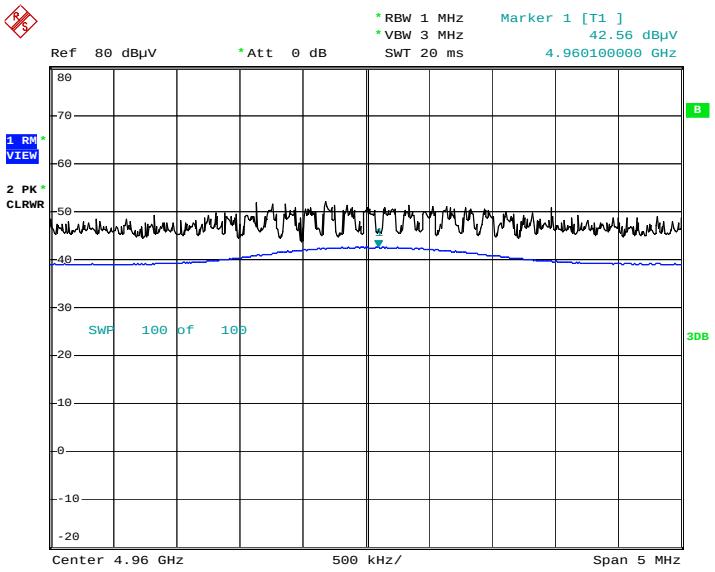
| Frequency [MHz] | Reading [dBuV/m] | Duty Cycle Factor [dB] | A.F.+C.L.-A.G.+D.F. [dBm] | ANT. POL [H/V] | Total [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Measurement Type |
|---|---|---|---|---|---|---|---|---|
| 4960 | 53.71 | 0 | 2.66 | V | 56.37 | 73.98 | 17.61 | PK |
| 4960 | 42.56 | 1.97 | 2.66 | V | 47.19 | 53.98 | 6.79 | AV |
| 7440 | 50.60 | 0 | 10.20 | V | 60.8 | 73.98 | 13.18 | PK |
| 7440 | 38.21 | 1.97 | 10.20 | V | 50.38 | 53.98 | 3.60 | AV |
| 4960 | 52.79 | 0 | 2.66 | H | 55.45 | 73.98 | 18.53 | PK |
| 4960 | 40.94 | 1.97 | 2.66 | H | 45.57 | 53.98 | 8.41 | AV |
| 7440 | 50.22 | 0 | 10.20 | H | 60.42 | 73.98 | 13.56 | PK |
| 7440 | 38.16 | 1.97 | 10.20 | H | 50.33 | 53.98 | 3.65 | AV |

**Notes:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Distance Factor + Duty Cycle Factor
5. Distance extrapolation factor = 20 log (test distance / specific distance) (dB)
6. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

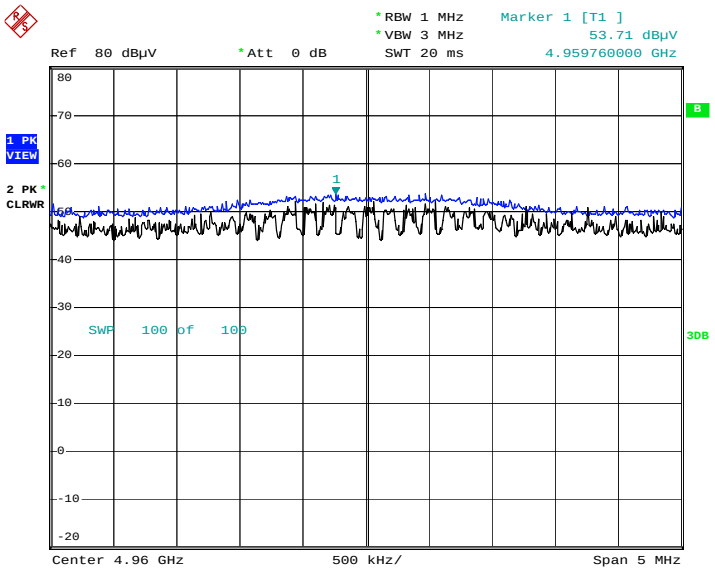
## ▣ RESULT PLOTS (Worst case : X-V)

### Radiated Spurious Emissions plot – Average Reading (Ch.39 2nd Harmonic)



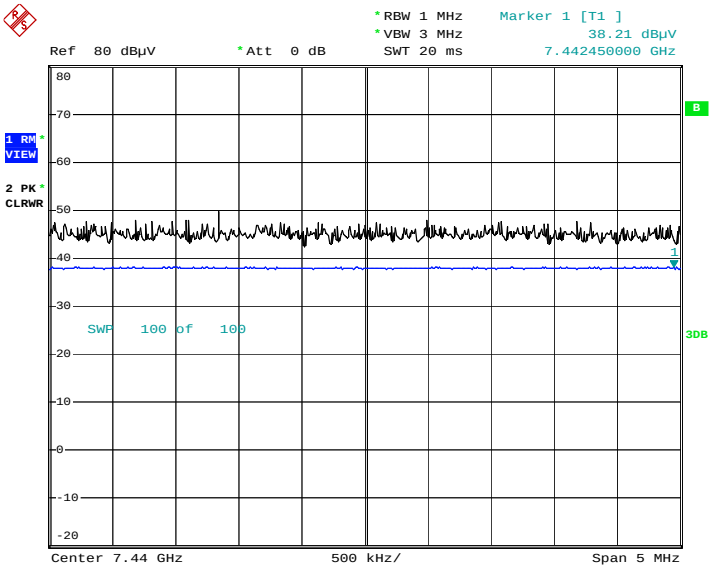

Date: 11.MAY.2003 05:10:02

### Radiated Spurious Emissions plot – Peak Reading (Ch.39 2nd Harmonic)



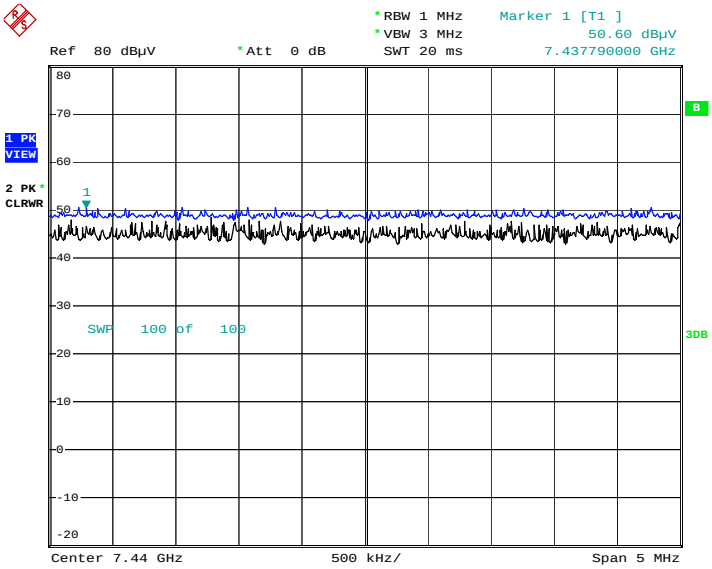

Date: 11.MAY.2003 05:10:40

## Radiated Spurious Emissions plot – Average Reading (Ch.39 3rd Harmonic) (Worst case : X-V)




Date: 10.MAY.2003 11:52:44

## Radiated Spurious Emissions plot – Peak Reading (Ch.39 3rd Harmonic) (Worst case : X-V)




Date: 10.MAY.2003 11:52:15

**Note : Only the worst case plots for Radiated Spurious Emissions.**

## 9.7.2 RADIATED RESTRICTED BAND EDGES

**Test Requirements and limit, §15.247(d) §15.205, §15.209, RSS-Gen(Issue 5) 8.10**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a) (See section 15.205(c)).

| | |
|---|---|
| Operation Mode | BT_LE |
| Operating Frequency | 2402 MHz |
| Channel No. | 0 |

| Frequency [MHz] | Reading [dBuV/m] | Duty Cycle Factor [dB] | A.F.+C.L.+D.F. [dB] | Ant. Pol. [H/V] | Total [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Measurement Type |
|---|---|---|---|---|---|---|---|---|
| 2390.0 | 20.44 | 0.00 | 35.36 | H | 55.80 | 73.98 | 18.18 | PK |
| 2390.0 | 9.25 | 1.97 | 35.36 | H | 46.58 | 53.98 | 7.40 | AV |
| 2390.0 | 20.45 | 0.00 | 35.36 | V | 55.81 | 73.98 | 18.17 | PK |
| 2390.0 | 9.30 | 1.97 | 35.36 | V | 46.63 | 53.98 | 7.35 | AV |

**Notes:**

1. Frequency range of measurement = 2310 MHz ~ 2390 MHz
2. Total = Reading Value + Antenna Factor + Cable Loss + Duty Cycle Factor + Distance Factor
3. Distance extrapolation factor = 20 log (test distance / specific distance) (dB)
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

| | |
|---|---|
| Operation Mode | BT_LE |
| Operating Frequency | 2480 MHz |
| Channel No. | 39 |

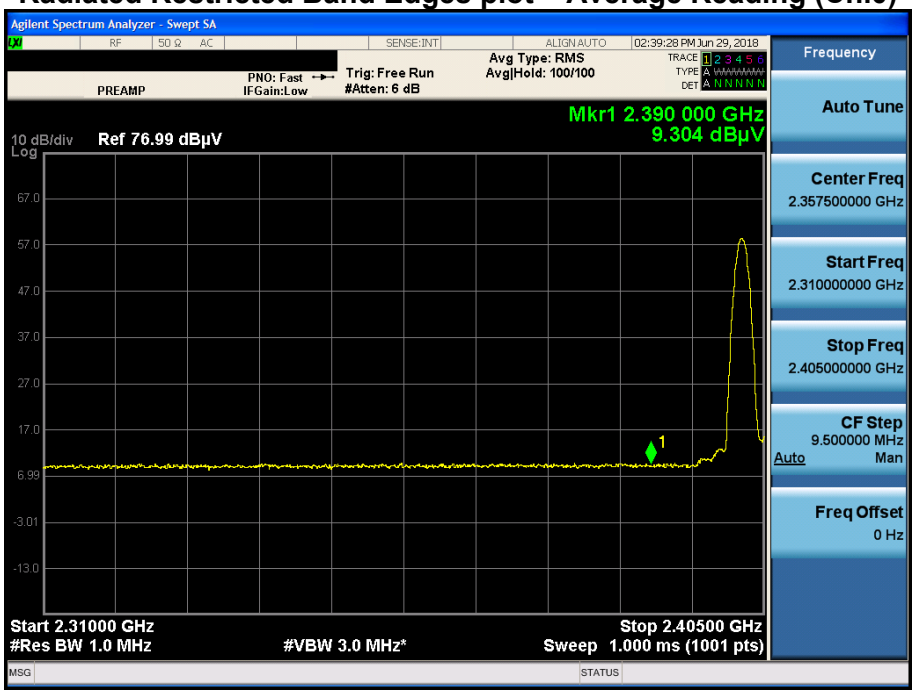
| Frequency [MHz] | Reading [dBuV/m] | Duty Cycle Factor [dB] | A.F.+C.L.+D.F. [dB] | Ant. Pol. [H/V] | Total [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Measurement Type |
|---|---|---|---|---|---|---|---|---|
| 2483.5 | 19.97 | 0.00 | 35.73 | H | 55.70 | 73.98 | 18.29 | PK |
| 2483.5 | 9.21 | 1.97 | 35.73 | H | 46.91 | 53.98 | 7.08 | AV |
| 2483.5 | 20.07 | 0.00 | 35.73 | V | 55.80 | 73.98 | 18.18 | PK |
| 2483.5 | 9.32 | 1.97 | 35.73 | V | 47.02 | 53.98 | 6.96 | AV |

**Notes:**

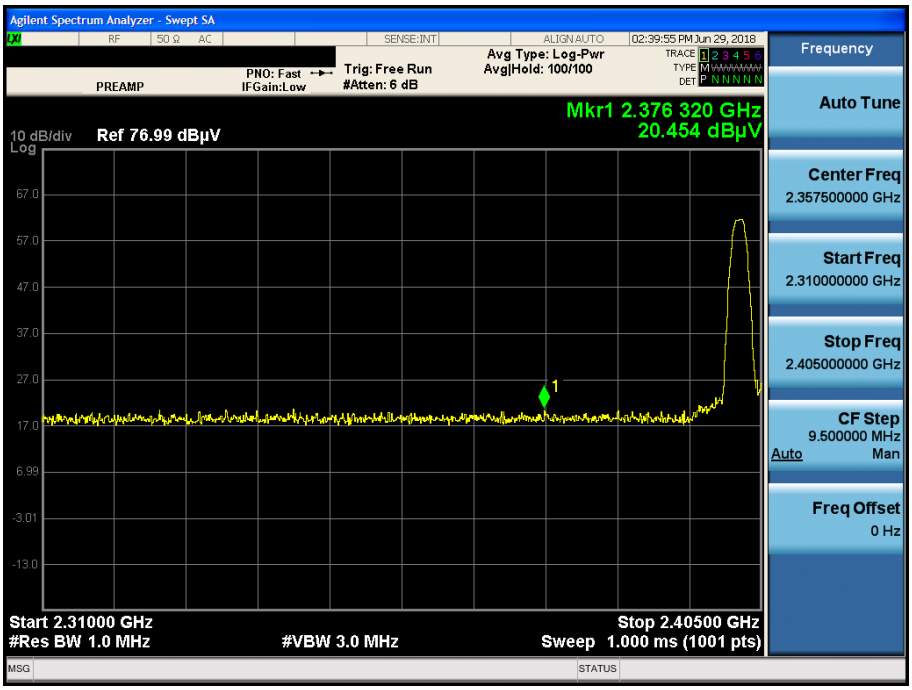
1. Frequency range of measurement = 2483.5 MHz ~ 2500 MHz
2. Total = Reading Value + Antenna Factor + Cable Loss + Duty Cycle Factor + Distance Factor
3. Distance extrapolation factor = 20 log (test distance / specific distance) (dB)
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

## ▣ RESULT PLOTS (Worst case : X-V)

### Radiated Restricted Band Edges plot – Average Reading (Ch.0)




### Radiated Restricted Band Edges plot – Peak Reading (Ch.0)




**Note : Only the worst case plots for Radiated Restricted Band Edges.**

### 9.7.3 RECEIVER SPURIOUS EMISSIONS

- IC Rule(s) : RSS-GEN
- Test Requirements : Blow the table
- Method of testing : Radiated
- S/A. Settings:

  Frequency < 1 GHz : RBW 120 kHz, VBW 300 kHz (Quasi Peak)

  Frequency > 1 GHz : RBW 1 MHz, VBW 1 MHz (Peak)
- Mode of operation : Receive
- Limit :

| Frequency (MHz) | Field Strength (microvolts/m at 3 meters) |
|---|---|
| 30 – 88 | 100 |
| 88 - 216 | 150 |
| 216 – 960 | 200 |
| Above 960 | 500 |

### ▣ TEST RESULTS

Frequency Range : 30 MHz ~ 1 GHz

| Frequency | Reading | Ant. factor | Cable loss | Ant. POL | Total | Limit | Margin |
|---|---|---|---|---|---|---|---|
| ㎒ | dBμV | dB /m | dB | (H/V) | dBμV/m | dBμV/m | dB |
| No Critical peaks found | | | | | | | |

Above 1 GHz

| Frequency | Reading | Ant. factor | Cable loss | Ant. POL | Total | Limit | Margin |
|---|---|---|---|---|---|---|---|
| ㎒ | dBμV | dB /m | dB | (H/V) | dBμV/m | dBμV/m | dB |
| No Critical peaks found | | | | | | | |

## 9.8 POWERLINE CONDUCTED EMISSIONS

**Test Requirements and limit, §15.207, RSS-Gen(Issue 5) Section 8.8**

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

| Frequency Range (MHz) | Limits (dBµV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 to 0.50 | 66 to 56 | 56 to 46 |
| 0.50 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

**Test Configuration**

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

**TEST PROCEDURE**

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors – Quasi Peak and Average Detector.

**Sample Calculation**

Quasi-peak(Final Result) = Reading Value + Correction Factor

Note: We don’t perform powerline conducted emission test. Because this EUT uses DC power.

# 10. LIST OF TEST EQUIPMENT

## 10.1 LIST OF TEST EQUIPMENT(Conducted Test)

| Manufacturer | Model / Equipment | Calibration Date | Calibration Interval | Serial No. |
|---|---|---|---|---|
| Rohde & Schwarz | ENV216 / LISN | 12/20/2017 | Annual | 102245 |
| Rohde & Schwarz | ESCI / Test Receiver | 06/25/2018 | Annual | 100584 |
| ESPAC | SU-642 /Temperature Chamber | 03/30/2018 | Annual | 0093008124 |
| Agilent | N9020A / Signal Analyzer | 06/08/2018 | Annual | MY51110085 |
| Agilent | N9030A / Signal Analyzer | 11/22/2017 | Annual | MY49431210 |
| Agilent | N1911A / Power Meter | 04/16/2018 | Annual | MY45100523 |
| Agilent | N1921A / Power Sensor | 04/16/2018 | Annual | MY52260025 |
| Hewlett Packard | E3632A / DC Power Supply | 06/26/2018 | Annual | KR75303960 |
| Agilent | 8493C / Attenuator(10 dB) | 07/10/2018 | Annual | 07560 |
| Hewlett Packard | 8493C/ATTENUATOR(20dB) | 06/21/2018 | Annual | 17280 |
| HCT CO., LTD. | FCC WLAN&BT&BLE Conducted Test Software v3.0 | N/A | N/A | N/A |

## 10.2 LIST OF TEST EQUIPMENT(Radiated Test)

| Manufacturer | Model / Equipment | Calibration Date | Calibration Interval | Serial No. |
|---|---|---|---|---|
| Innco system | CO3000 / Controller(Antenna mast) | N/A | N/A | CO3000-4p |
| Innco system | MA4640/800-XP-EP / Antenna Position Tower | N/A | N/A | N/A |
| Audix | EM1000 / Controller | N/A | N/A | 060520 |
| Audix | Turn Table | N/A | N/A | N/A |
| Rohde & Schwarz | Loop Antenna | 04/19/2017 | Biennial | 1513-175 |
| Schwarzbeck | VULB 9168 / Hybrid Antenna | 04/06/2017 | Biennial | 760 |
| Schwarzbeck | BBHA 9120D / Horn Antenna | 05/02/2017 | Biennial | 9120D-937 |
| Schwarzbeck | BBHA9170 / Horn Antenna(15 GHz ~ 40 GHz) | 12/04/2017 | Biennial | BBHA9170541 |
| Rohde & Schwarz | FSP(9 kHz ~ 30 GHz) / Spectrum Analyzer | 09/06/2017 | Annual | 100688 |
| Rohde & Schwarz | FSV40-N / Spectrum Analyzer | 09/27/2017 | Annual | 101068-SZ |
| Wainwright Instruments | WHK3.0/18G-10EF / High Pass Filter | 06/07/2018 | Annual | 8 |
| Wainwright Instruments | WHFX7.0/18G-8SS / High Pass Filter | 05/09/2018 | Annual | 29 |
| Wainwright Instruments | WRCJV2400/2483.5-2370/2520-60/12SS / Band Reject Filter | 06/29/2018 | Annual | 2 |
| Wainwright Instruments | WRCJV5100/5850-40/50-8EEK / Band Reject Filter | 01/03/2018 | Annual | 2 |
| Api tech. | 18B-03 / Attenuator (3 dB) | 06/07/2018 | Annual | 1 |
| Agilent | 8493C-10 / Attenuator(10 dB) | 07/19/2017 | Annual | 08285 |
| CERNEX | CBLU1183540 / Power Amplifier | 07/10/2018 | Annual | 22964 |
| CERNEX | CBL06185030 / Power Amplifier | 07/10/2018 | Annual | 22965 |
| CERNEX | CBL18265035 / Power Amplifier | 01/10/2018 | Annual | 22966 |
| CERNEX | CBL26405040 / Power Amplifier | 06/29/2018 | Annual | 25956 |

# 11. APPENDIX A_TEST SETUP PHOTO

Please refer to test setup photo file no. as follows;

| No. | Description |
|---|---|
| 1 | HCT-RF-1807-FI009-R1-P |