# TEST REPORT

| KOSTEC Co., Ltd.<br>28(175-20, Annyeong-dong) 406-gil sejaro, Hwaseong-si, Gyeonggi-do, Korea<br>Tel:031-222-4251, Fax:031-222-4252 | Report No.: KST-FCR-190009(1) | KOSTEC Co., Ltd.<br>http://www.kostec.org |
|---|---|---|

1. Applicant

- Name : Geoplan Co., Ltd.
- Address : #501, Anyang Finance Center, Simin-daero 260 Dongan-gu, Anyang-si, Gyeonggi-do, 14067, Korea

2. Test Item

- Product Name: RTLS AP
- Model Name: GEO-DA300
- Brand: None
- FCC ID: 2ASPN-GEO-DA300

3. Manufacturer

- Name : Geoplan Co., Ltd.
- Address : #501, Anyang Finance Center, Simin-daero 260 Dongan-gu, Anyang-si, Gyeonggi-do, 14067, Korea

4. Date of Test : 2019. 04. 19. ~ 2019. 04. 23.,
2019. 05. 02

5. Test Method Used : FCC CFR 47, Part 15. Subpart F-15.517
ANSI C 63.10-2013

6. Test Result : Compliance

7. Note: None

**Supplementary Information**

The device bearing the brand name and FCC ID specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with measurement procedures specified in ANSI C 63.10-2013.

We attest to the accuracy of data and all measurements reported herein were performed by KOSTEC Co., Ltd. and were made under Chief Engineer's supervision. We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
This test report is not related to KOLAS accreditation.

| Affirmation | Tested by<br>Name : Choo, Kwang-Yeol (Signature) | Technical Manager<br>Name : Park, Gyeong-Hyeon (Signature) |
|---|---|---|

**2019. 05. 03.**

**KOSTEC Co., Ltd.**

# Table of Contents

# 1. GENERAL INFORMATION

## 1.1 Test Facility

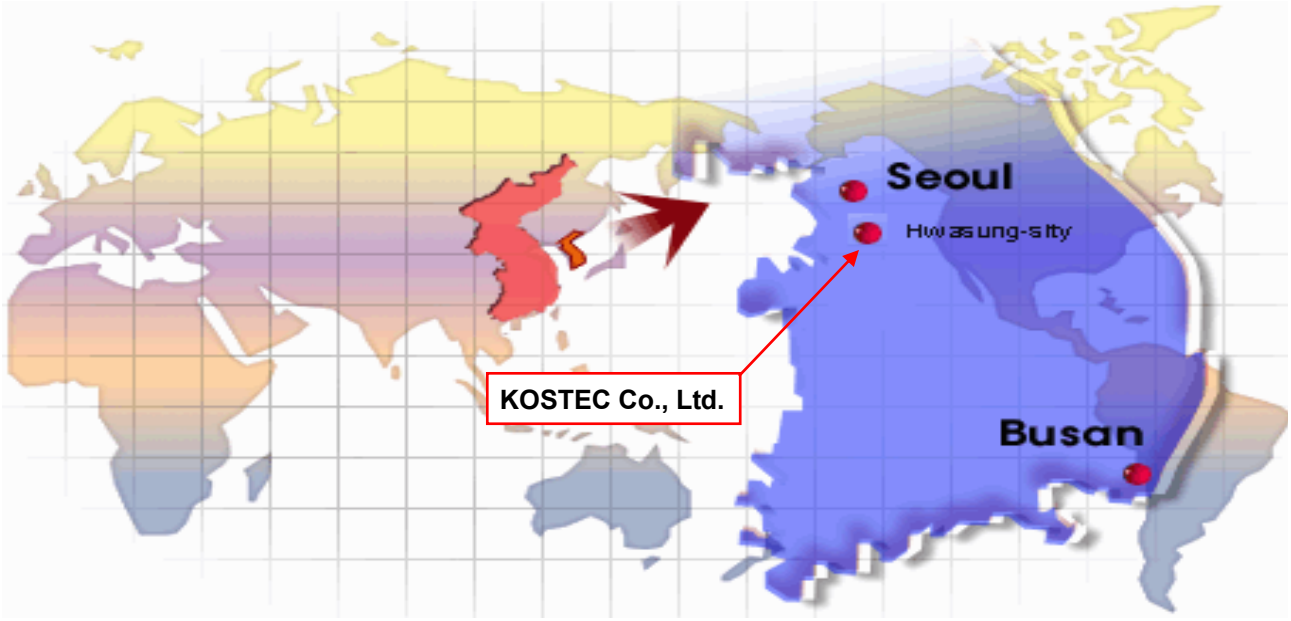
### Test laboratory and address

KOSTEC Co., Ltd.
128(175-20,Annyeong-dong)406-gil sejaro, Hwaseong-si Gyeonggi-do, Korea

### Registration information

KOLAS No. : 232
FCC/IC Designation No. : KR0041

## 1.2 Location



## 1.3 Revision History of test report

| Rev. | Revisions | Effect page | Reviewed | Date |
|---|---|---|---|---|
| - | Initial issue | All | Gyeong Hyeon, Park | 2019. 04. 25. |
| 1 | Added radiated test for simultaneous emissions | 19, 22 | Gyeong Hyeon, Park | 2019. 05. 03. |

# 2. EQUIPMENT DESCRIPTION

The product specification described herein was declared by manufacturer. And refer to user's manual for the details.

| | |
|---|---|
| Equipment Name | RTLS AP |
| Model No | GEO-DA300 |
| Usage | RTLS AP |
| Use Environment | Indoor use only |
| Serial Number | Proto type |
| Modulation type | BPSK/BPM |
| Emission Type | IEEE 802.15.4-2011 UWB |
| Maximum Output Power | 73.87 dBμV/m |
| Operated Frequency | 6 489.6 MHz |
| Channel Number | 1 |
| Operation temperature | -10 ℃ ~ 55 ℃ |
| Power Source | DC 12 V(Adapter), DC 48 V(PoE) |
| Antenna Description | Internal Chip antenna, max gain : 3.5 dBi |
| Remark | 1. The device was operating at its maximum output power for all measurements.<br>2. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case (Y) is shown in the report.<br>3. The above DUT's information was declared by manufacturer. Please refer to the specifications or user manual for more detailed description.<br>4. After having scan all input voltage mode, found the input voltage mode(PoE) which it was worst case, so only the worst case's on the test report. |
| FCC ID | 2ASPN-GEO-DA300 |

# 3. SYSTEM CONFIGURATION FOR TEST

## 3.1 Characteristics of equipment

RTLS AP

## 3.2 Used peripherals list

| Description | Model No. | Serial No. | Manufacture | Remark |
|---|---|---|---|---|
| Notebook | NT300E4S | 0T4391JJ800909K | Samsung Electronics | - |
| Adapter | PA-1400-96 | CN60BA4400313AD2 VHJFP086 | LITE-ON TECHNOLOGY CHANGZHOU CO.,LTD | For notebook |
| PoE Switch Hub | PoE-504ST | WR141200516 | WooriTech | - |
| Light | S50L-DC12V-G | None | Q-Light | - |
| Switch | None | None | None | - |
| Barcode Scanner | GD4500 | Z18P02466 | None | - |
| Adapter | PSC15R-050 | None | Phihong(Dongguan) Electronics Co., Ltd. | For barcode scanner |
| RTLS Smart Tag | None | None | Geoplan Co., Ltd. | - |

## 3.3 Product Modification

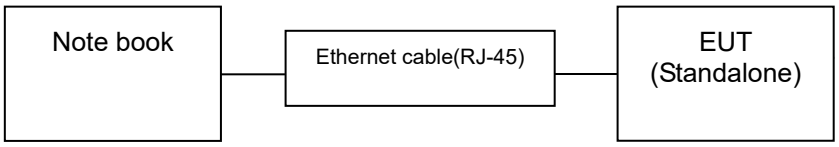
N/A

## 3.4 Operating Mode

The EUT was used for making continuous transmitting and receiving mode during the test.

## 3.5 Test Setup of EUT

The measurements were taken in continuous transmit mode using the test mode which controlled by Telnet command. The test command and the test Jig and cables were provided by the applicant.



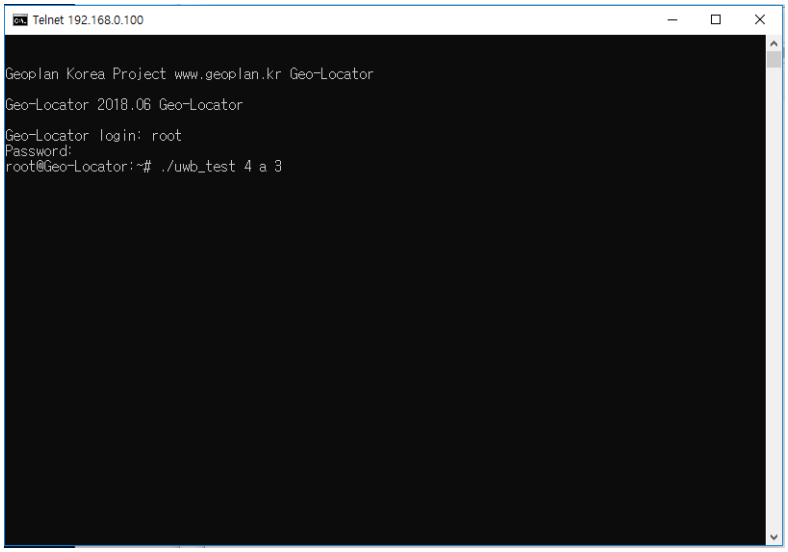
## 3.6 Parameters of Test Software Setting

During testing, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

▣ TX Power setting value during test

| Band | TX Power setting value (Telnet command) |
|---|---|
| 6 489.6 MHz | ./uwb_test 4 6 9 |

▣ Test Program : Telnet



## 3.7 Used Test Equipment List

| No. | Instrument | Model | S/N | Manufacturer | Next Cal Date | Cal interval | used |
|---|---|---|---|---|---|---|---|
| 1 | T & H Chamber | PL-3J | 15003623 | ESPEC | 2019.11.12 | 1 year | ☐ |
| 2 | T & H Chamber | SH-662 | 93000067 | ESPEC CORP | 2019.09.28 | 1 year | ☐ |
| 3 | Spectrum Analyzer | 8563EC | 3046A00527 | Agilent Technology | 2020.01.25 | 1 year | ☐ |
| 4 | Signal Analyzer | FSV13 | 101247 | Rohde & Schwarz | 2020.01.24 | 1 year | ☐ |
| 5 | Spectrum Analyzer | FSV30 | 20-353063 | Rohde& Schwarz | 2020.01.25 | 1 year | ☐ |
| 6 | Signal Analyzer | N9010A | MY56070441 | Agilent Technologies | 2019.05.25 | 1 year | ☒ |
| 7 | EMI Test Receiver | ESCI7 | 100823 | Rohde& Schwarz | 2020.01.22 | 1 year | ☒ |
| 8 | EMI Test Receiver | ESI | 837514/004 | Rohde& Schwarz | 2019.09.03 | 1 year | ☐ |
| 9 | Vector Signal Analyzer | 89441A | 3416A02620 | Agilent Technology | 2020.01.25 | 1 year | ☐ |
| 10 | Network Analyzer | 8753ES | US39172348 | AGILENT | 2019.09.03 | 1 year | ☐ |
| 11 | EPM Series Power meter | E4418B | GB39512547 | Agilent Technology | 2020.01.23 | 1 year | ☐ |
| 12 | RF Power Sensor | E9300A | MY41496631 | Agilent Technology | 2020.01.23 | 1 year | ☐ |
| 13 | Microwave Frequency Counter | 5352B | 2908A00480 | Agilent Technology | 2020.01.24 | 1 year | ☐ |
| 14 | Audio Analyzer | 8903B | 3514A16919 | Agilent Technology | 2020.01.23 | 1 year | ☐ |
| 15 | Audio Telephone Analyzer | DD-5601CID | 520010281 | CREDIX | 2020.01.23 | 1 year | ☐ |
| 16 | Modulation Analyzer | 8901A | 3041A0576 | H.P | 2020.01.24 | 1 year | ☐ |
| 17 | Digital storage Oscilloscope | TDS3052 | B015962 | Tektronix | 2019.09.04 | 1 year | ☐ |
| 18 | ESG-D Series Signal Generator | E4436B | US39260458 | Agilent Technology | 2020.01.25 | 1 year | ☐ |
| 19 | Vector Signal Generator | SMBV100A | 257557 | Rohde & Schwarz | 2020.01.25 | 1 year | ☐ |
| 20 | GNSS Signal Generator | TC-2800A | 2800A000494 | TESCOM CO., LTD. | 2020.01.24 | 1 year | ☐ |
| 21 | Signal Generator | SMB100A | 179628 | Rohde & Schwarz | 2019.05.09 | 1 year | ☒ |
| 22 | SLIDAC | None | 0207-4 | Myoung sung Ele. | 2020.01.23 | 1 year | ☐ |
| 23 | DC Power supply | DRP-5030 | 9028029 | Digital Electronic Co.,Ltd | 2020.01.23 | 1 year | ☐ |
| 24 | DC Power supply | E3610A | KR24104505 | Agilent Technology | 2020.01.23 | 1 year | ☐ |
| 25 | DC Power supply | UP-3005T | 68 | Unicon Co.,Ltd | 2020.01.23 | 1 year | ☐ |
| 26 | DC Power Supply | SM 3400-D | 114701000117 | DELTA ELEKTRONIKA | 2020.01.22 | 1 year | ☐ |
| 27 | DC Power supply | 6632B | MY43004005 | Agilent Technology | 2020.01.23 | 1 year | ☐ |
| 28 | DC Power Supply | 6632B | MY43004137 | Agilent Technology | 2020.01.23 | 1 year | ☐ |
| 29 | Termination | 1433-3 | LM718 | WEINSCHEL | 2019.07.09 | 1 year | ☐ |
| 30 | Termination | 1432-3 | QR946 | AEROFLEX/WEINSCHEL | 2019.07.09 | 1 year | ☐ |
| 31 | Attenuator | 24-30-34 | BX5630 | Aeroflex / Weinschel | 2019.12.19 | 1 year | ☐ |
| 32 | Attenuator | 8498A | 3318A09485 | HP | 2020.01.24 | 1 year | ☐ |
| 33 | Step Attenuator | 8494B | 3308A32809 | HP | 2020.01.24 | 1 year | ☐ |
| 34 | RF Step Attenuator | RSP | 100091 | Rohde & Schwarz | 2020.01.24 | 1 year | ☐ |
| 35 | Attenuator | 18B50W-20F | 64671 | INMET | 2020.01.24 | 1 year | ☐ |
| 36 | Attenuator | 10 dB | 1 | Rohde & Schwarz | 2019.05.04 | 1 year | ☐ |
| 37 | Attenuator | 10 dB | 2 | Rohde & Schwarz | 2019.05.04 | 1 year | ☐ |
| 38 | Attenuator | 10 dB | 3 | Rohde & Schwarz | 2019.05.04 | 1 year | ☐ |
| 39 | Attenuator | 10 dB | 4 | Rohde & Schwarz | 2019.05.04 | 1 year | ☐ |
| 40 | Attenuator | 54A-10 | 74564 | WEINSCHEL | 2019.09.04 | 1 year | ☒ |
| 41 | Attenuator | 56-10 | 66920 | WEINSCHEL | 2019.05.09 | 1 year | ☐ |
| 42 | Attenuator | 48-20-11 | BV2658 | Aeroflex/Weinschel | 2019.08.06 | 1 year | ☐ |
| 43 | Attenuator | 48-30-33-LIM | BL5350 | Weinschel Corp. | 2019.07.09 | 1 year | ☐ |
| 44 | Power divider | 11636B | 51212 | HP | 2020.01.28 | 1 year | ☐ |
| 45 | 3Way Power divider | KPDSU3W | 00070365 | KMW | 2019.09.03 | 1 year | ☐ |
| 46 | 4Way Power divider | 70052651 | 173834 | KRYTAR | 2020.01.28 | 1 year | ☐ |
| 47 | 3Way Power divider | 1580 | SQ361 | WEINSCHEL | 2019.05.09 | 1 year | ☐ |
| 48 | OSP | OSP120 | 101577 | Rohde & Schwarz | 2019.05.04 | 1 year | ☐ |
| 49 | White noise audio filter | ST31EQ | 101902 | SoundTech | 2019.09.04 | 1 year | ☐ |

| No. | Instrument | Model | S/N | Manufacturer | Next Cal Date | Cal interval | used |
|---|---|---|---|---|---|---|---|
| 50 | Dual directional coupler | 778D | 17693 | HEWLETT PACKARD | 2020.01.24 | 1 year | ☐ |
| 51 | Dual directional coupler | 772D | 2839A00924 | HEWLETT PACKARD | 2020.01.24 | 1 year | ☐ |
| 52 | Band rejection filter | 3TNF-0006 | 26 | DOVER Tech | 2020.01.24 | 1 year | ☐ |
| 53 | Band rejection filter | 3TNF-0007 | 311 | DOVER Tech | 2020.01.24 | 1 year | ☐ |
| 54 | Band rejection filter | WTR-BRF2442-84NN | 09020001 | WAVE TECH Co.,LTD | 2020.01.24 | 1 year | ☐ |
| 55 | Band rejection filter | WRCJV12-5695-5725-5825-5855-50SS | 1 | Wainwright Instruments GmbH | 2019.05.04 | 1 year | ☐ |
| 56 | Band rejection filter | WRCJV12-5120-5150-5350-5380-40SS | 4 | Wainwright Instruments GmbH | 2019.05.04 | 1 year | ☐ |
| 57 | Band rejection filter | WRCGV10-2360-2400-2500-2540-50SS | 2 | Wainwright Instruments GmbH | 2019.05.04 | 1 year | ☐ |
| 58 | Band rejection filter | CTF-155M-S1 | 001 | RF One Electronics | 2019.09.06 | 1 year | ☐ |
| 59 | Band rejection filter | CTF-435M-S1 | 001 | RF One Electronics | 2019.09.06 | 1 year | ☐ |
| 60 | Highpass Filter | WHJS1100-10EF | 1 | WAINWRIGHT | 2020.01.24 | 1 year | ☐ |
| 61 | Highpass Filter | WHJS3000-10EF | 1 | WAINWRIGHT | 2020.01.24 | 1 year | ☐ |
| 62 | Highpass Filter | WHNX6-5530-7000-26500-40CC | 2 | Wainwright Instruments GmbH | 2019.05.09 | 1 year | ☐ |
| 63 | Highpass Filter | WHNX6-2370-3000-26500-40CC | 4 | Wainwright Instruments GmbH | 2019.05.09 | 1 year | ☐ |
| 64 | WideBand Radio Communication Tester | CMW500 | 102276 | Rohde & Schwarz | 2020.01.24 | 1 year | ☐ |
| 65 | Bluetooth Tester | TC-3000B | 3000B6A0166 | TESCOM CO., LTD. | 2020.01.24 | 1 year | ☐ |
| 66 | Loop Antenna | 6502 | 9203-0493 | EMCO | 2019.05.29 | 2 year | ☒ |
| 67 | BiconiLog Antenna | 3142B | 1745 | EMCO | 2020.05.10 | 2 year | ☒ |
| 68 | Biconical Antenna | VUBA9117 | 9117-342 | Schwarz beck | 2020.03.12 | 2 year | ☐ |
| 69 | Trilog-Broadband Antenna | VULB 9168 | 9168-606 | SCHWARZBECK | 2020.09.14 | 2 year | ☒ |
| 70 | Horn Antenna | 3115 | 2996 | EMCO | 2020.02.14 | 2 year | ☒ |
| 71 | Horn Antenna | 3115 | 9605-4834 | EMCO | 2020.03.12 | 2 year | ☐ |
| 72 | Horn Antenna | BBHA9170 | 743 | SCHWARZBECK | 2021.01.22 | 2 year | ☒ |
| 73 | PREAMPLIFIER(3) | 8449B | 3008A00149 | Agilent | 2019.09.05 | 1 year | ☐ |
| 74 | AMPLIFIER(10) | TK-PA6S | 120009 | TESTEK | 2020.01.22 | 1 year | ☒ |
| 75 | AMPLIFIER | TK-PA18 | 150003 | TESTEK | 2020.01.24 | 1 year | ☒ |
| 76 | AMPLIFIER | TK-PA1840H | 160010-L | TESTEK | 2020.01.22 | 1 year | ☒ |
| 77 | AMPLIFIER | 8447D | 2944A07881 | H.P | 2020.01.24 | 1 year | ☐ |

# 4. SUMMARY TEST RESULTS

| Description of Test | FCC Rule | Reference Clause | Used | Test Result |
|---|---|---|---|---|
| Transmission time | § 15.517(a)(5) | Clause 5.1 | ☒ | Compliance |
| UWB Bandwidth | § 15.517(b) | Clause 5.2 | ☒ | Compliance |
| Radiated Emissions | § 15.517(c)/15.209 | Clause 5.3 | ☒ | Compliance |
| Radiated Emissions in GPS Bands | § 15.517(d) | Clause 5.4 | ☒ | Compliance |
| Peak Emissions within a 50MHz Bandwidth | § 15.517(e)/15.521(g) | Clause 5.5 | ☒ | Compliance |
| Antenna Requirement | § 15.203 | Clause 5.6 | ☒ | Compliance |
| AC Power Conducted emissions | § 15.207 | Clause 5.7 | ☒ | Compliance |
| Compliance: The EUT complies with the essential requirements in the standard.<br>Not Compliance : The EUT does not comply with the essential requirements in the standard.<br>N/A : The test was not applicable in the standard. | | | | |

**Procedure Reference**

FCC CFR 47, Part 15. Subpart F-15.517

ANSI C 63.10-2013

# 5. MEASUREMENT RESULTS

## 5.1 Transmission time

### 5.1.1 Standard Applicable [FCC §15.517(a)(5)]

A communications system shall transmit only when the intentional radiator is sending information to an associated receiver.

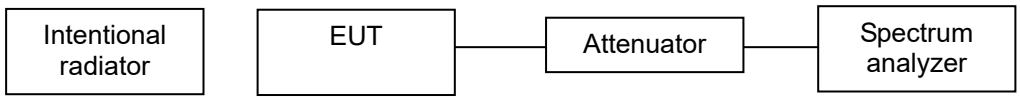
### 5.1.2 Test Environment conditions

• Ambient temperature : (21 ~ 22) ℃ • Relative Humidity : (49 ~ 51) % R.H.

### 5.1.3 Measurement Procedure

For test purpose the UWB port of the EUT is connected with the spectrum analyzer through a RF cable. The intentional radiator is located close by EUT. In this measurement intentional radiator is RTLS Smart Tag.
The measurement is made in time domain by the central frequency of the channel. Measurement duration 30 s. RBW = 50 MHz.
The first measurement is made without turning on intentional radiator. It will be checked, that the EUT doesn't transmit.
Shortly before the second measurement an intentional radiator is switched on. Then the measurement is started by the spectrum analyzer. It is checked, whether the EUT transmits, when the intentional radiator is switched on. After 15 s the intentional radiator is switched off. And it will be checked, whether the EUT continues to transmit and if so then how long.

### 5.1.4 Test setup

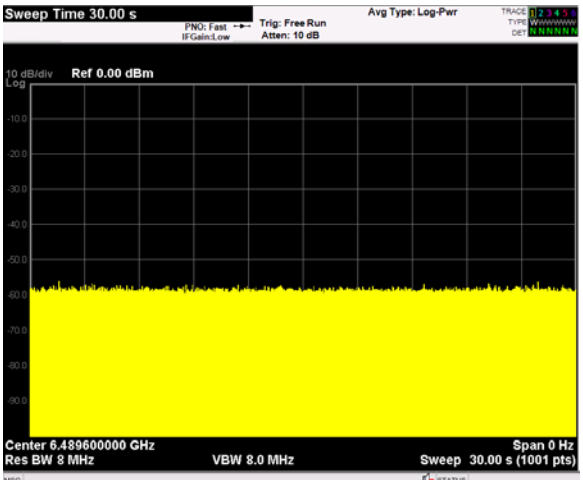



### 5.1.5 Measurement Result

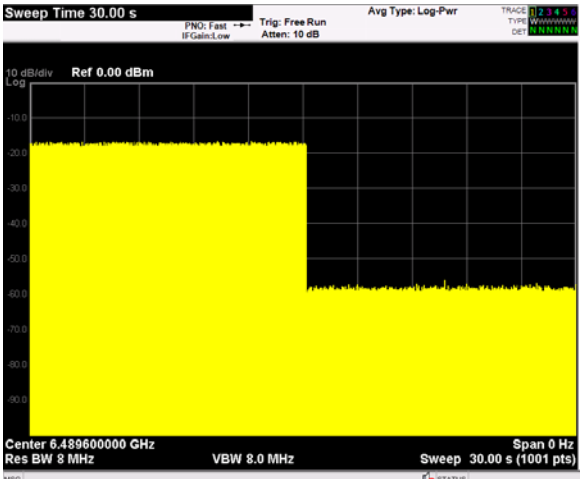
The EUT stops to transmit immediately after the intentional radiator is switched off.

### 5.1.6 Test Plot

Intentional radiator is switched off




Intentional radiator is switched on and after 15 s is switched off



## 5.2 UWB Bandwidth Measurement

### 5.2.1 Standard Applicable [FCC §15.517(b)]

The UWB bandwidth of a UWB system operating under the provisions of this section must be contained between 3100 MHz and 10,600 MHz.

### 5.2.2 Test Environment conditions

• Ambient temperature : (21 ~ 22) ℃ • Relative Humidity : (49 ~ 51) % R.H.

### 5.2.3 Measurement Procedure

The frequency at which the maximum power level is measured with the peak detector is designated fM (RBW=1 MHz, VBW= 3 MHz, peak detection, maxhold). The outermost 1 MHz segments above and below fM, where the peak power falls by 10 dB relative to the level at fM, are designated as fH and fL. The UWB transmission, and the -10 dB bandwidth (B - 10), is defined as (fH - fL). -10 dB bandwidth should be ≥500 MHz and must be contained between 3100 MHz and 10.600 MHz.

### 5.2.4 Measurement Result

| The frequency at which the maximum power $f_M$ [MHz] | Power of the frequency $f_M$ [dBuV] | $f_L$ [MHz] | $f_H$ [MHz] | -10 dB bandwidth [MHz] |
|---|---|---|---|---|
| 6 488 | 79.36 | 6 226 | 6 778 | 552 |

• Operation mode: PoE 48 vdc(Worst case)

## 5.2.6 Test Plot

UWB Bandwidth

## 5.3 Spurious RF Radiated emissions

### 5.3.1 Standard Applicable [ FCC §15.517(c)/15.209]

The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in § 15.209.

§15.209 limits for radiated emissions measurements (distance at 3 m)

| Frequency Band [MHz] | DISTANCE [Meters] | Limit [㎶/m] | Limit [dB㎶/m] |
|---|---|---|---|
| 0.009 ~ 0.490 | 300 | 2400/F(kHz) | 67.6-20log(F) |
| 0.490 ~ 1.705 | 30 | 24000/F(kHz) | 87.6-20log(F) |
| 1.705 ~ 30.0 | 30 | 30 | 29.54 |
| 30 - 88 | 3 | 100 ** | 40.00 |
| 88 - 216 | 3 | 150 ** | 43.52 |
| 216 - 960 | 3 | 200 ** | 46.02 |
| Above 960 | 3 | 500 | 54.00 |
| ** fundamental emissions from intentional radiators operation under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz, or 470-806 MHz. However, operation within these Frequency bands is permitted under other sections of this Part Section 15.231 and 15.241 | | | |

The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

§15.517(c)

| Frequency Band [MHz] | EIRP[dBm] | E-Field[dBuV/m] at 3 m | E-Field[dBuV/m] at 1 m |
|---|---|---|---|
| 960-1 610 | −75.3 | 19.9 | 29.5 |
| 1 610-1 990 | −53.3 | 41.9 | 51.5 |
| 1 990-3 100 | −51.3 | 43.9 | 53.5 |
| 3 100-10 600 | −41.3 | 53.9 | 63.5 |
| Above 10 600 | −51.3 | 43.9 | 53.5 |

Note 1: This may be converted to a peak field strength level at 3 meters using E(dBuV/m) = P(dBm EIRP) + 95.2
Note 2: Above 960 MHz shall be extrapolated to the specified distance suing an extrapolation factor of 20 dB/decade from 3m to 1m. Distance extrapolation factor = 20 log (specific distance [3m] / test distance [1m]) (dB); Limit line = specific limits (dBuV) + distance extrapolation factor [9.54 dB]
From 47 CFR Section 15.517(c): Emissions from digital circuitry used to enable the operation fo the UWB transmitter shall comply with the limits in Section 15.209 of this chapter, rather than the limits specified in this subpart, provided it can be clearly demonstrated that those emissions from the UWB device are due solely to emissions from digital circuitry contained within the transmitter and that the emissions are not intended to be radiated from the transmitter's antenna. Emissions from associated digital devices, as defined in Section 15.3(k) of this chapter, e.g., emissions from digital circuitry used to control additional functions or capabilities other than the UWB transmission, are subject to the limits contained in Subpart B of Part 15 of this chapter.

### 5.3.2 Test Environment conditions

• Ambient temperature : (21 ~ 22) ℃ • Relative Humidity : (49 ~ 51) % R.H.

### 5.3.3 Measurement Procedure

1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable for measured the frequency range below 960 MHz and antenna tower was placed below 1 meters far away from the turntable for measured the frequency range above 960 MHz.

2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.

3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.

4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.

5. The measurements made over the frequency range from 9 kHz to 960 MHz were maximized using an EMI receiver with peak detector capabilities. Measurements of the radiated field from 9 kHz to 960 MHz were made with the measurement antenna located a distance of 3 meters from the EUT. If the emissions level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.

6. Measurements above 960 MHz were maximized using a spectrum analyzer with RMS detector capabilities. A spectrum analyzer was used for the final measurements utilizing an RMS detector at the frequencies with the largest amplitudes. The prescribed RBW of 1 MHz and VBW of 3 MHz, and a1 msec averaging time were used for these measurements. Measurements of the radiated field at frequencies above 960 MHz were made with the measurement antenna located a distance of below 1 meter from the EUT.

7. The spectrum between 9 kHz and 960 MHz contained no intentional radiation and lies below the limits. The spectrum from 960MHz to18GHz contained intentional UWB signals between 3100 MHz and 10600 MHz and lie below the limits. No other emissions above 10600 MHz were detected. The maximum frequency tested was 40 GHz.

8. Per 47 CFR, Part 15, Subpart F, §15.521(c) (§15.209) all digital emissions from the transmitter not intended to be radiated from the antenna port meet the 15.209 subpart C limits.

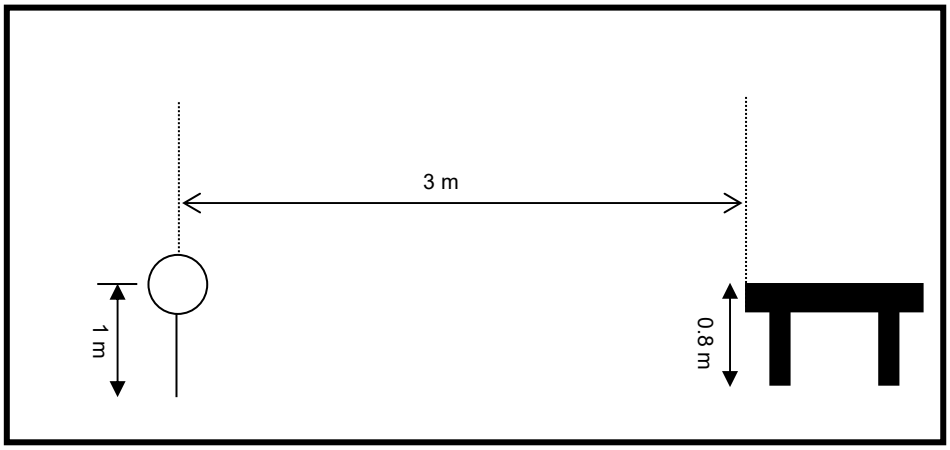
9. Additional measurements in the 960 MHz to 40 GHz range were performed to determine the nature of all unintentional emissions in this span. Conducted antenna port measurement and terminated antenna port measurement were done in the 960 MHz to 8 GHz range show that all noise peaks have the same frequency and polarization and are determined to be emission from the digital circuit and are not radiated from the antenna.

### 5.3.4 Measurement Uncertainty

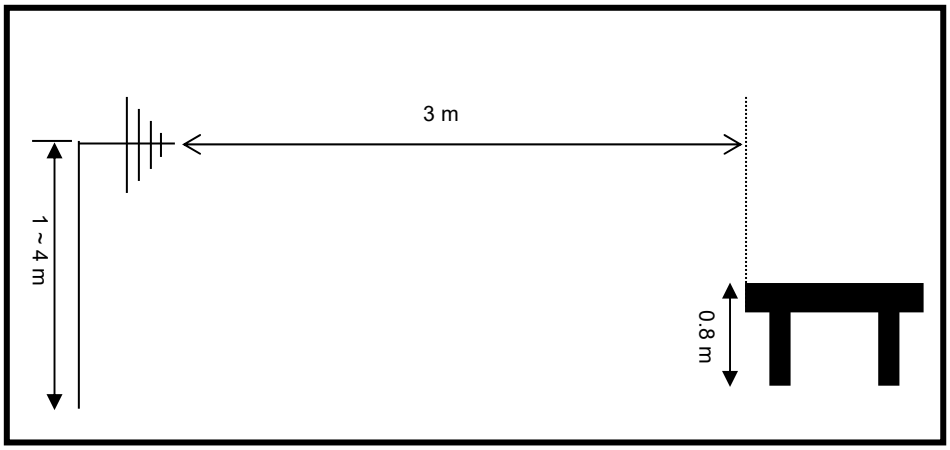
Radiated Emission measurement: Below 1 GHz: 3.56 dB (CL: Approx 95 %, k=2)
Above 1 GHz: 3.60 dB (CL: Approx 95 %, k=2)

### 5.3.5 Test Configuration

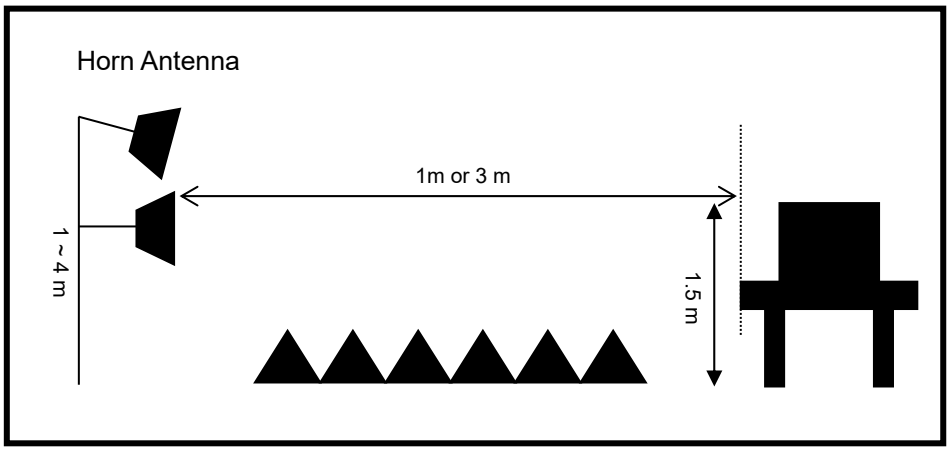
Radiated emission setup, below 30 MHz




Radiated emission setup, below 1 000 MHz




Radiated emission setup, above 1 GHz



## 5.3.6 Measurement Result

Above 1 GHz

Measurement distance: 1m

| Freq. (MHz) | Reading (dBμV/m) | Detector Mode | Antenna | | | CL (dB) | AMP (dB) | Meas Result (dBμV/m) | Limit (dBμV/m ) | Mgn. (dB) | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Pol. (H/V) | Fctr. (dB/m) | | | | | | |
| 1 200.08 | 48.47 | Average | 1.5 | H | 24.40 | 0.69 | -45.72 | 27.84 | 29.5 | 1.66 | Compliance |
| 1 920.08 | 46.44 | Average | 1.5 | H | 27.10 | 0.88 | -45.80 | 28.62 | 51.5 | 22.88 | Compliance |
| 2 131.00 | 43.95 | Average | 1.5 | H | 27.79 | 0.94 | -45.80 | 26.88 | 53.5 | 26.62 | Compliance |
| 3 370.00 | 49.10 | Average | 1.5 | H | 30.92 | 1.19 | -45.37 | 35.84 | 63.5 | 27.66 | Compliance |
| 12 072.60 | 39.08 | Average | 1.5 | H | 39.62 | 3.58 | -44.59 | 37.69 | 53.5 | 15.81 | Compliance |
| 1 200.08 | 47.56 | Average | 1.5 | V | 24.40 | 0.69 | -45.72 | 26.93 | 29.5 | 2.57 | Compliance |
| 1 920.08 | 47.11 | Average | 1.5 | V | 27.10 | 0.88 | -45.80 | 29.29 | 51.5 | 22.21 | Compliance |
| 2 242.00 | 44.63 | Average | 1.5 | V | 28.03 | 0.96 | -45.79 | 27.83 | 53.5 | 25.67 | Compliance |
| 4 247.50 | 50.90 | Average | 1.5 | V | 32.50 | 1.35 | -45.06 | 39.70 | 63.5 | 23.8 | Compliance |
| 12 072.60 | 39.18 | Average | 1.5 | V | 39.62 | 3.58 | -44.59 | 37.79 | 53.5 | 15.71 | Compliance |

**※Note**

- Limit: 54 dBμV/m(Average), 74 dBμV/m(Peak), Attenuated more than 20 dB below the permissible value.
- It is not recorded on the report that the reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to measured.
- The transmitter radiated spectrum was investigated from 9 kHz to 40 GHz.
- Operation mode: PoE 48 vdc(Worst case)

Below 1 GHz

Measurement distance: 3m

| Freq. (MHz) | Reading (dBμV/m) | Table (Deg) | Antenna | | | CL (dB) | AMP (dB) | Meas Result (dBμV/m) | Limit (dBμV/m ) | Mgn (dB) | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Pol. (H/V) | Fctr. (dB/m) | | | | | | |
| 49.86 | 69.88 | 160 | 1.5 | H | 8.74 | 0.82 | -42.43 | 37.02 | 40.00 | 2.98 | Compliance |
| 50.43 | 69.83 | 160 | 1.0 | V | 8.64 | 0.82 | -42.44 | 36.86 | 40.00 | 3.14 | Compliance |
| 55.34 | 70.30 | 160 | 1.5 | V | 7.95 | 0.87 | -42.40 | 36.72 | 40.00 | 3.28 | Compliance |
| 87.38 | 70.62 | 180 | 1.5 | V | 7.29 | 1.19 | -42.22 | 36.88 | 40.00 | 3.12 | Compliance |
| 155.64 | 72.16 | 180 | 1.0 | H | 9.18 | 1.62 | -41.72 | 41.24 | 43.52 | 2.28 | Compliance |
| 250.82 | 68.28 | 160 | 1.0 | H | 12.90 | 2.12 | -41.39 | 41.92 | 46.02 | 4.10 | Compliance |
| 350.48 | 65.95 | 160 | 1.0 | H | 15.71 | 2.63 | -41.09 | 43.21 | 46.02 | 2.81 | Compliance |
| 358.24 | 61.26 | 160 | 1.5 | V | 15.90 | 2.67 | -41.06 | 38.77 | 46.02 | 7.25 | Compliance |

Freq.(㎒) : Measurement frequency, Reading(dBμV/m) : Indicated value for test receiver, Table (Deg) : Directional degree of Turn table
Antenna (Height, Pol, Fctr) : Antenna Height, Polarization and Factor, Cbl(dB) : Cable loss, Pre AMP(dB) : Preamplifier gain(dB)
Meas Result (dBμV/m ) :Reading(dBμV/m)+ Antenna factor.(dB/m )+ CL(dB) - Pre AMP(dB)
Limit(dBμV/m): Limit value specified with FCC Rule, Mgn(dB) : FCC Limit (dBμV/m) − Meas Result(dBμV/m)

- Operation mode: PoE 48 vdc(Worst case)

Simultaneous TX Radiated Spurious Emissions Measurements (Worst case)

Measurement distance: 3m

DXX Module 1: 2 480 MHz

DXX Module 2: 2 402 MHz

UWB: 6 489.6 MHz

| Freq. (GHz) | Reading (dBμV/m) | | Table (Deg) | Antenna | | | CL (dB) | AMP (dB) | Meas Result (dBμV/m) | | Limit (dBμV/m ) | | Mgn. (dB) | | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PK | AV | | Height (m) | Pol. (H/V) | Fctr. (dB/m) | | | PK | AV | PK | AV | PK | AV | |
| 1 660.00 | 56.76 | - | 180 | 1.5 | H | 25.80 | 6.03 | -45.78 | 42.82 | - | 74 | 54 | 31.18 | - | Compliance |
| 1 828.00 | 56.19 | - | 180 | 1.5 | H | 26.64 | 6.26 | -45.79 | 43.29 | - | 74 | 54 | 30.71 | - | Compliance |
| 2 660.00 | 58.33 | - | 180 | 1.5 | H | 29.18 | 7.43 | -45.70 | 49.23 | - | 74 | 54 | 24.77 | - | Compliance |
| 4 875.00 | 54.53 | - | 180 | 1.5 | H | 33.00 | 10.51 | -45.19 | 52.84 | - | 74 | 54 | 21.16 | - | Compliance |
| 1 044.00 | 58.88 | - | 180 | 1.5 | V | 24.09 | 4.67 | -45.77 | 41.86 | - | 74 | 54 | 32.14 | - | Compliance |
| 4 875.00 | 52.56 | - | 180 | 1.5 | V | 33.00 | 10.51 | -45.19 | 50.87 | - | 74 | 54 | 23.13 | - | Compliance |

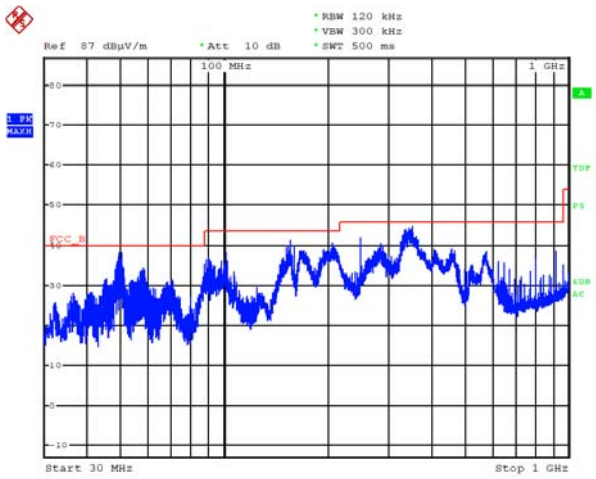
**※Note**

- Limit: 54 dBμV/m(Average), 74 dBμV/m(Peak), Attenuated more than 20 dB below the permissible value.
- It is not recorded on the report that the reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to measured.
- The transmitter radiated spectrum was investigated from 9 kHz to 40 GHz.
- Operation mode: PoE 48 vdc(Worst case)
- Average test would be performed if the peak result were greater than the average limit.

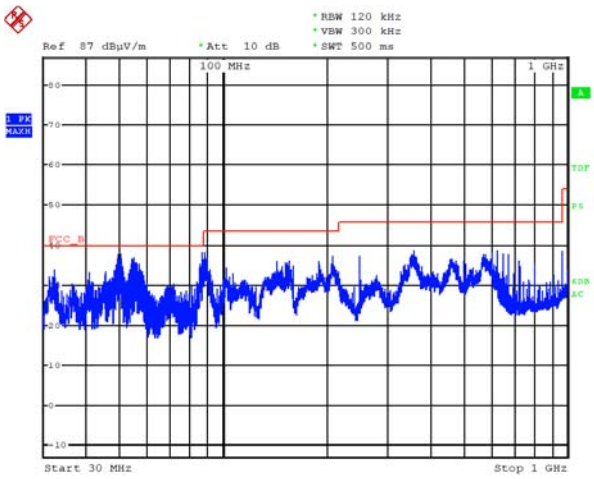
5.3.7 Plots
*The worst case only.

▪ Below 1 GHz

Horizontal

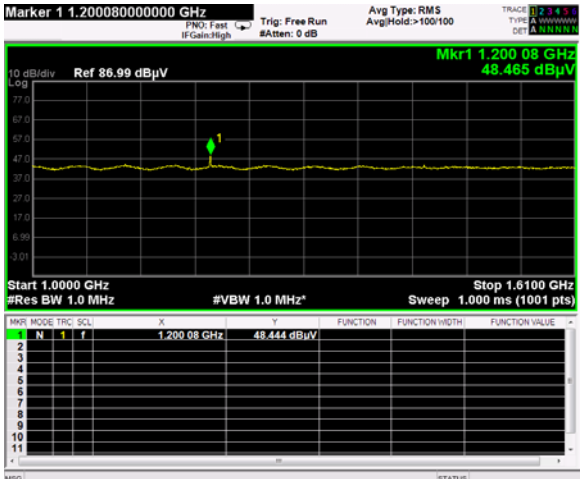



Vertical

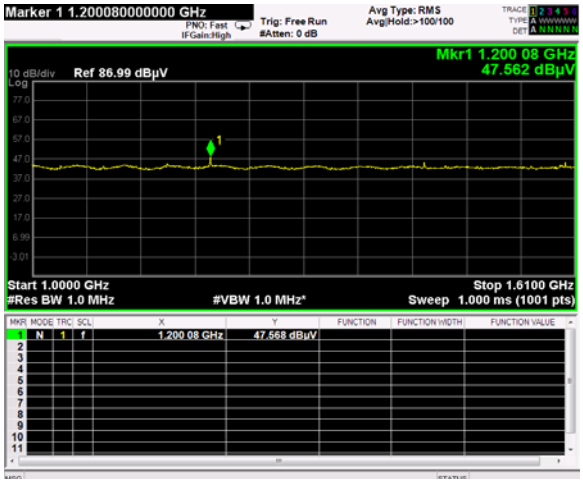



▪ Above 1 GHz

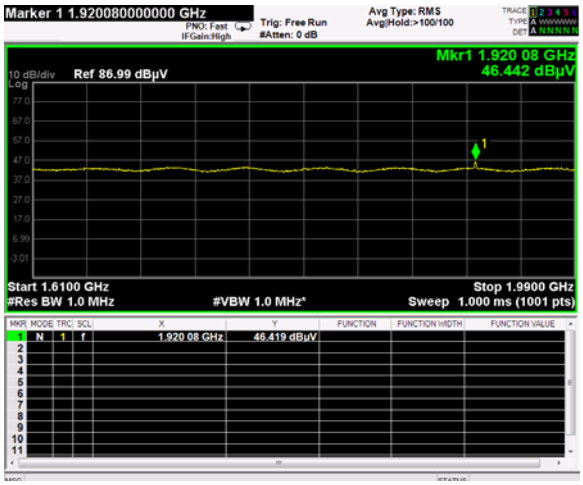
Horizontal(960-1 610 MHz)



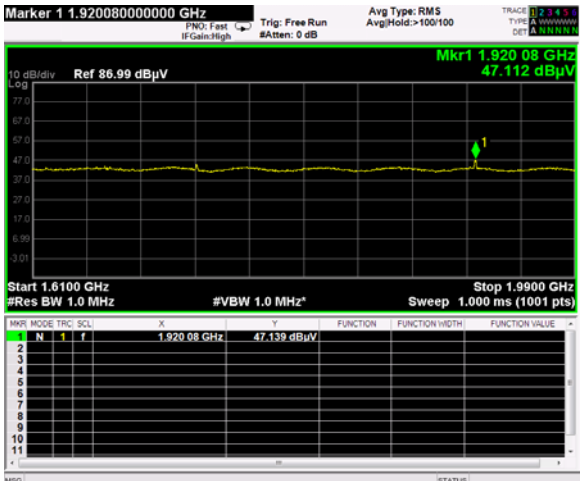

Vertical(960-1 610 MHz)



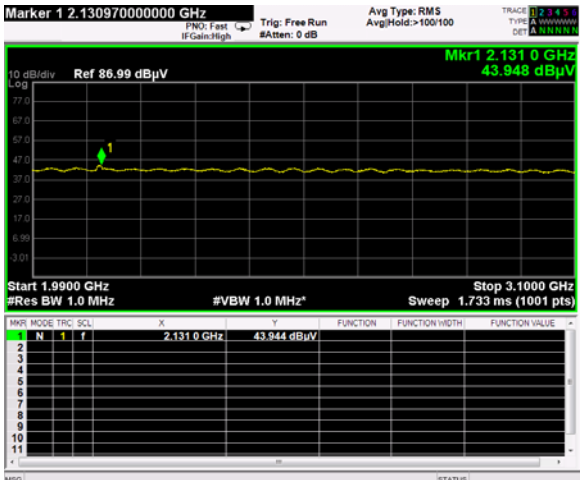

Horizontal(1 610-1 990 MHz)



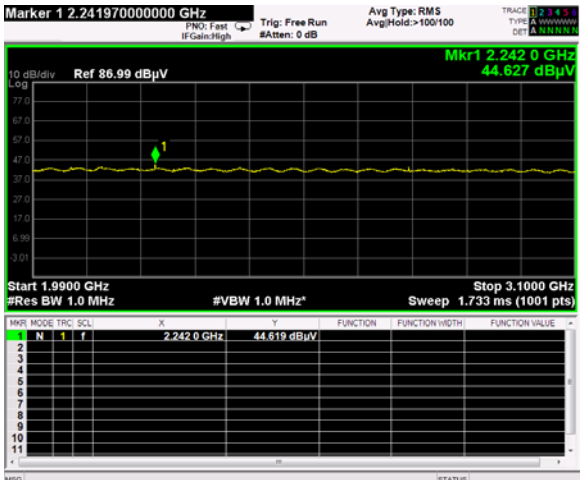

Vertical(1 610-1 990 MHz)



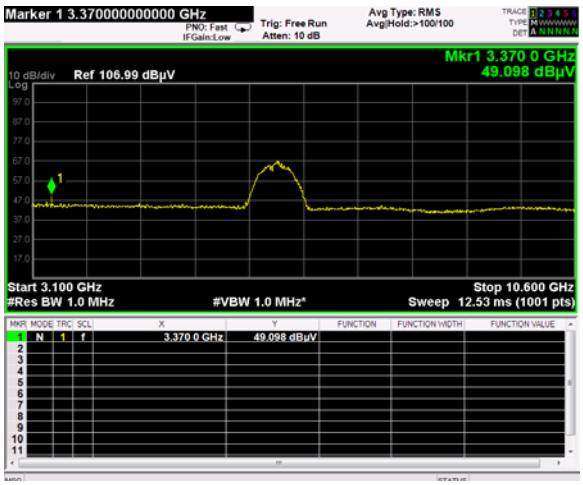
Horizontal(1 990-3 100 MHz)



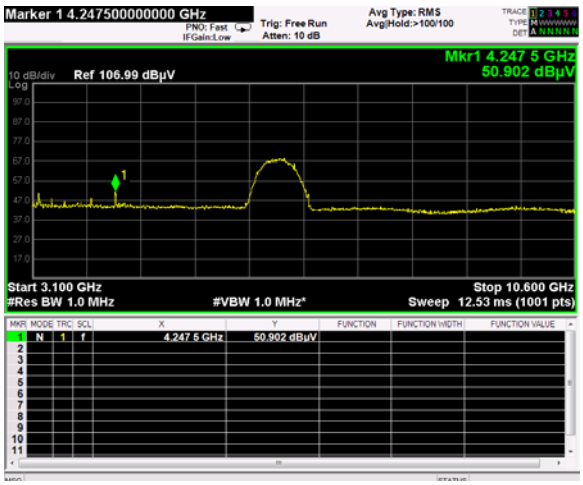

Vertical(1 990-3 100 MHz)



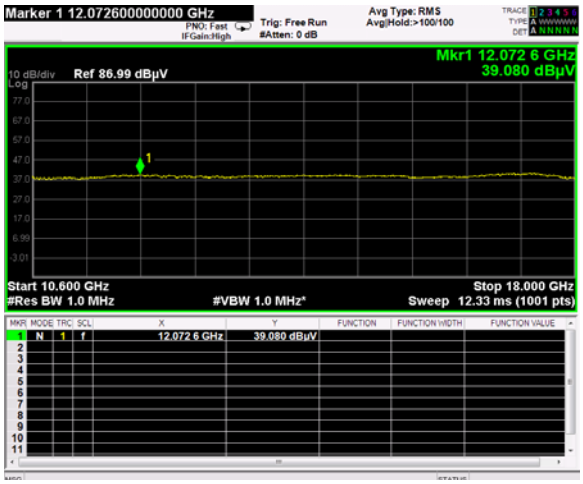

Horizontal(3 100-10 600 MHz)



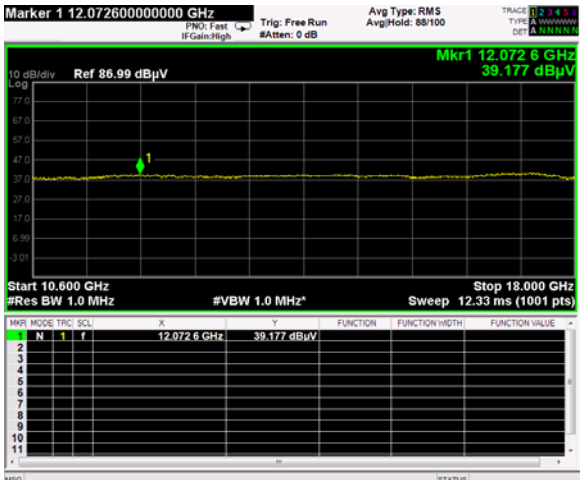

Vertical(3 100-10 600 MHz)




Horizontal(Above 10 600 MHz)

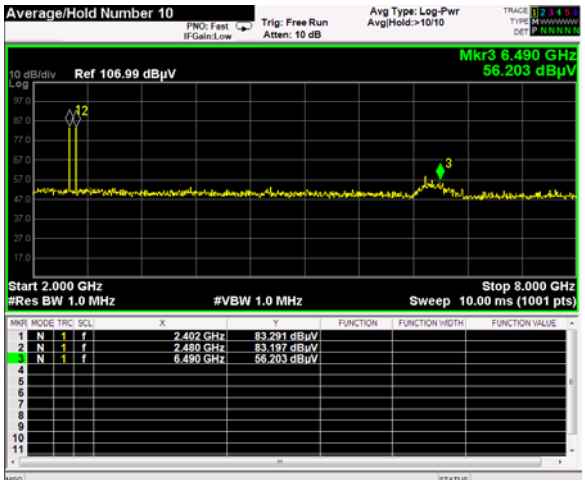



Vertical(Above 10 600 MHz)

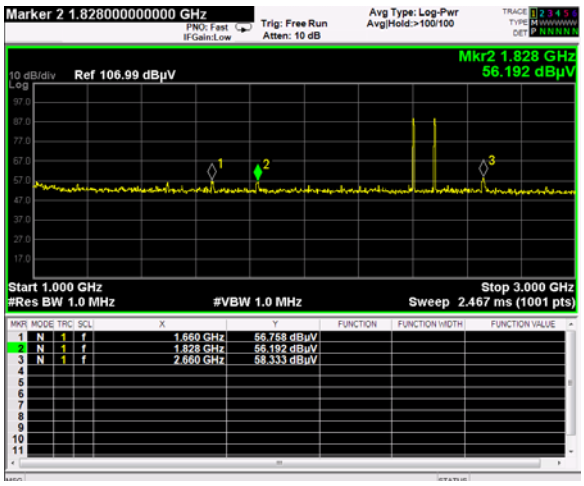


-Simultaneous TX Radiated Spurious Emissions

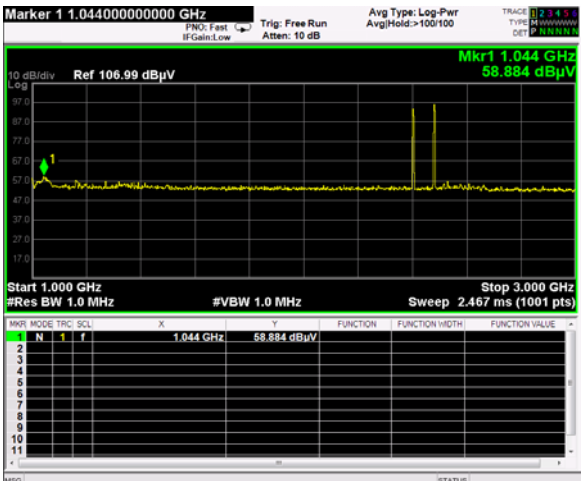
Simultaneous TX check



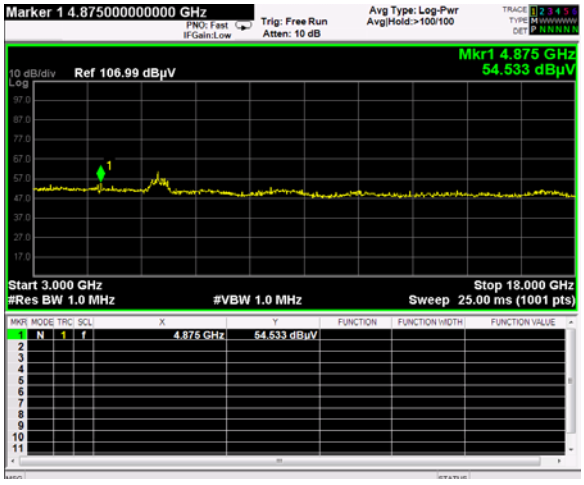

Horizontal



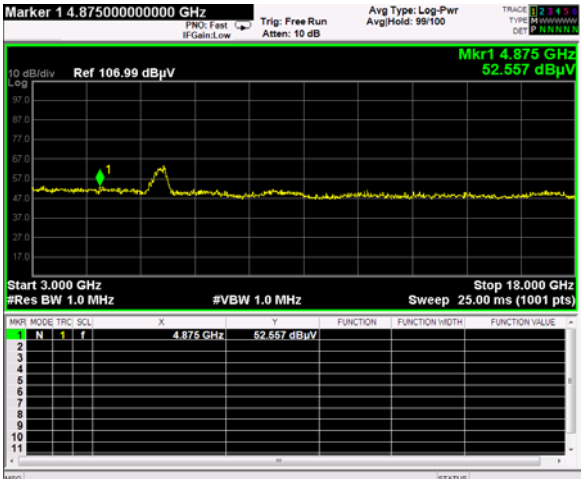

Vertical




Horizontal




Vertical



## 5.4 Radiated Emissions in GPS Bands Measurement

### 5.4.1 Standard Applicable [FCC §15.517(d)]

In addition to the radiated emission limits specified in the table in paragraph (c) of this section, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

| Frequency Band [MHz] | EIRP[dBm] | E-Field[dBuV/m] at 3 m | E-Field[dBuV/m] at 1 m |
|---|---|---|---|
| 1 164-1 240 | -85.3 | 9.9 | 19.44 |
| 1 559-1 610 | -85.3 | 9.9 | 19.44 |

Note 1: This may be converted to a peak field strength level at 3 meters using E(dBuV/m) = P(dBm EIRP) + 95.2 dB.

Note 2: Above 960MHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1m. Distance extrapolation factor = 20 log (specific distance [3m] / test distance [1m]) (dB); Limit line = specific limits (dBuV) + distance extrapolation factor [9.54 dB].

Note 3: Above 960MHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1m. Distance extrapolation factor = 20 log (specific distance [3m] / test distance [1m]) (dB); Limit line = specific limits (dBuV) + distance extrapolation factor [9.54 dB]. from 3m to 0.5m. Distance extrapolation factor = 20 log (specific distance [3m] / test distance [0.5m]) (dB); Limit line = specific limits (dBuV) + distance extrapolation factor [15.56 dB]

### 5.4.2 Test Environment conditions

• Ambient temperature : (21 ~ 22) ℃ • Relative Humidity : (49 ~ 51) % R.H.

### 5.4.3 Measurement Procedure

1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 1 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Measurements frequencies were maximized using a spectrum analyzer with RMS detector capabilities. A spectrum analyzer was used for the final measurements utilizing an RMS detector at the frequencies with the largest amplitudes. The prescribed RBW of 1 kHz and VBW of 1 kHz, and a 1 msec averaging time were used for these measurements.
6. Per 47 CFR, Part 15, Subpart F, §15.521© (§15.209) all digital emissions from the transmitter not intended to be radiated from the antenna port meet the 15.209 subpart C limits.

## 5.4.5 Measurement Result

1 164 MHz ~ 1 240 MHz

| Freq. (MHz) | Reading (dBμV/m) | Detector Mode | Antenna | | | CL (dB) | AMP (dB) | Meas Result (dBμV/m) | Limit (dBμV/m ) | Mgn. (dB) | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Pol. (H/V) | Fctr. (dB/m) | | | | | | |
| 1190.37 | 30.77 | Average | 1.5 | H | 24.38 | 0.69 | -45.72 | 10.11 | 19.44 | 9.33 | Compliance |
| 1199.95 | 32.00 | Average | 1.5 | H | 24.40 | 0.69 | -45.72 | 11.37 | 19.44 | 8.07 | Compliance |
| 1223.96 | 30.78 | Average | 1.5 | H | 24.45 | 0.70 | -45.72 | 10.21 | 19.44 | 9.23 | Compliance |
| 1175.10 | 24.46 | Average | 1.5 | V | 24.35 | 0.68 | -45.73 | 3.76 | 19.44 | 15.68 | Compliance |
| 1190.37 | 27.96 | Average | 1.5 | V | 24.38 | 0.69 | -45.72 | 7.30 | 19.44 | 12.14 | Compliance |
| 1199.95 | 27.75 | Average | 1.5 | V | 24.40 | 0.69 | -45.72 | 7.12 | 19.44 | 12.32 | Compliance |

1 559 MHz ~ 1 610 MHz

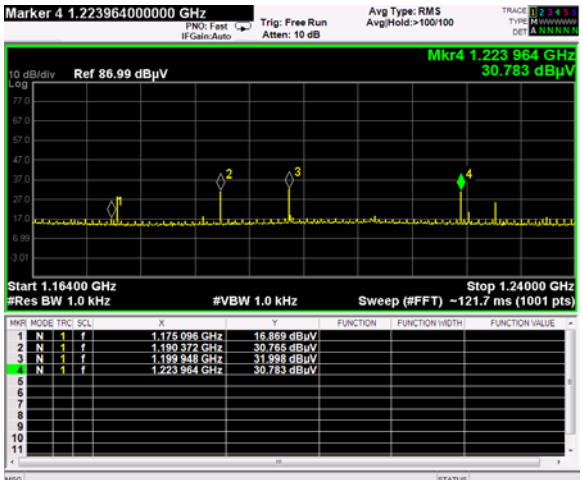
| Freq. (MHz) | Reading (dBμV/m) | Detector Mode | Antenna | | | CL (dB) | AMP (dB) | Meas Result (dBμV/m) | Limit (dBμV/m ) | Mgn. (dB) | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Pol. (H/V) | Fctr. (dB/m) | | | | | | |
| 1574.40 | 33.37 | Average | 1.5 | H | 25.37 | 0.79 | -45.76 | 13.77 | 19.44 | 5.67 | Compliance |
| 1574.40 | 34.81 | Average | 1.5 | V | 25.37 | 0.79 | -45.76 | 15.21 | 19.44 | 4.23 | Compliance |

• Operation mode: PoE 48 vdc(Worst case)

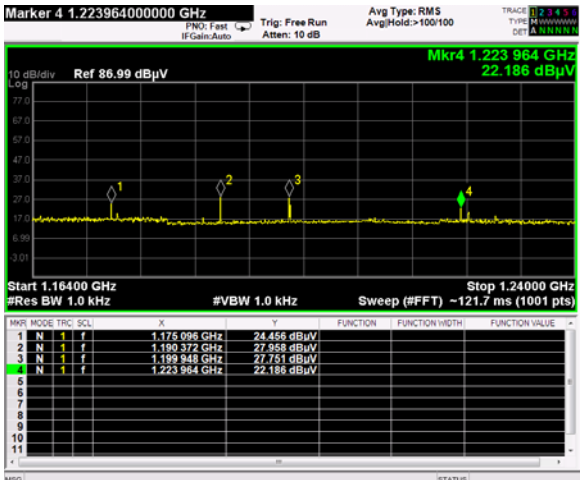
## 5.4.6 Test plot

▣ 1 164 MHz ~ 1 240 MHz

Horizontal

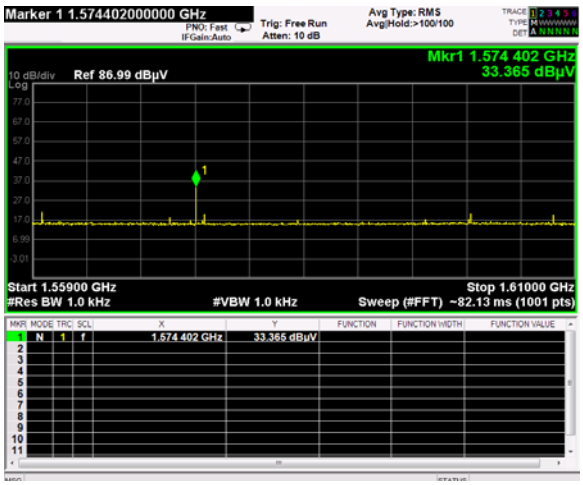



Vertical

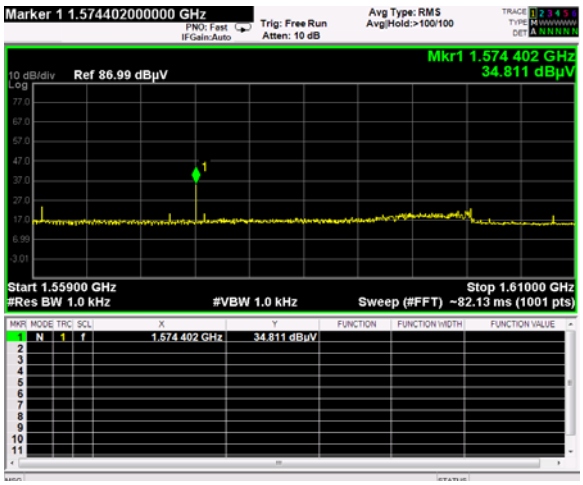



▣ 1 559 MHz ~ 1 240 MHz

Horizontal




Vertical



## 5.5 Peak Emissions within a 50 MHz Bandwidth Measurement

### 5.4.1 Standard Applicable [FCC §15.517(e)/15.521(g)]

**15.517(e)** There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, $f_M$. That limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit.

**15.521(g)** When a peak measurement is required, it is acceptable to use a resolution bandwidth other than the 50 MHz specified in this subpart. This resolution bandwidth shall not be lower than 1 MHz or greater than 50 MHz, and the measurement shall be centered on the frequency at which the highest radiated emission occurs, $f_M$. If a resolution bandwidth other than 50 MHz is employed, the peak EIRP limit shall be 20 log (RBW/50) dBm where RBW is the resolution bandwidth in megahertz that is employed. This may be converted to a peak field strength level at 3 meters using E(dBuV/m) = P(dBm EIRP) + 95.2. If RBW is greater than 3 MHz, the application for certification filed with the Commission must contain a detailed description of the test procedure, calibration of the test setup, and the instrumentation employed in the testing.

| Peak EIRP Limit [dBm] (RBW: 50 MHz) | Peak EIRP Limit [dBm] (RBW: 10 MHz) | E-Field [dBuV/m] at 3 m (RBW: 10 MHz) | E-Field [dBuV/m] at 1 m (RBW: 10 MHz) |
|---|---|---|---|
| 0 | -15.91 | 79.29 | 88.83 |

EIRP limit has to be adjusted by the resolution bandwidth ratio of 20log(RBW/50) dB, where RBW is the resolution bandwidth used for the measurement expressed in MHz. In addition, This may be converted to a peak field strength level at 3 meters using E(dBuV/m) = P(dBm EIRP) + 95.2 dB. And Peak emission shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1m. Distance extrapolation factor = 20 log (specific distance [3m] / test distance [1m]) (dB); Limit line = specific limits (dBuV) + distance extrapolation factor [9.54 dB]

### 5.4.2 Test Environment conditions

• Ambient temperature : (21 ~ 22) ℃ • Relative Humidity : (49 ~ 51) % R.H.

### 5.4.3 Measurement Procedure

1. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 1 meters far away from the turntable.
2. The horn receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
3. For maximum peak emission amplitude, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading and was used to determine the frequency at which the highest radiated emission occurs, $f_M$.
4. The individual UWB bandwidths were measured for each BAND_ID (nb) of the UWB spectrum. Both horizontal and vertical polarizations were taken into account to determine the full UWB BW on the maximized (in azimuth and elevation) signals.
5. A spectrum analyzer was used for the final measurement utilizing a peak detector at the frequency with the largest amplitude. The prescribed resolution bandwidth of 50 MHz was not supported by the spectrum analyzer. However, when a peak measurement is required, The resolution bandwidth for this measurement was set to 8 MHz, and the measurement was centered on the frequency at which the highest radiated emission occurred, $f_M$. The video bandwidth was 8 MHz.

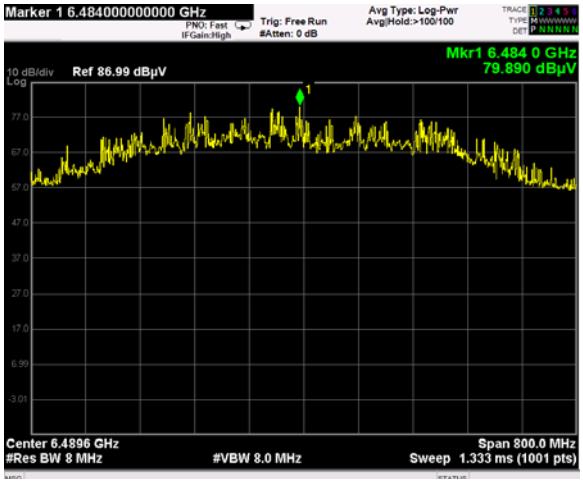
## 5.4.5 Measurement Result

| Freq. (MHz) | Reading (dBμV/m) | Detector Mode | Antenna | | | CL (dB) | AMP (dB) | Meas Result (dBμV/m) | Limit (dBμV/m ) | Mgn. (dB) | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Pol. (H/V) | Fctr. (dB/m) | | | | | | |
| 6489.60 | 79.89 | Average | 1.5 | H | 35.04 | 1.86 | -44.60 | 72.19 | 88.83 | 16.64 | Compliance |
| 6489.60 | 81.57 | Average | 1.5 | V | 35.04 | 1.86 | -44.60 | 73.87 | 88.83 | 14.96 | Compliance |

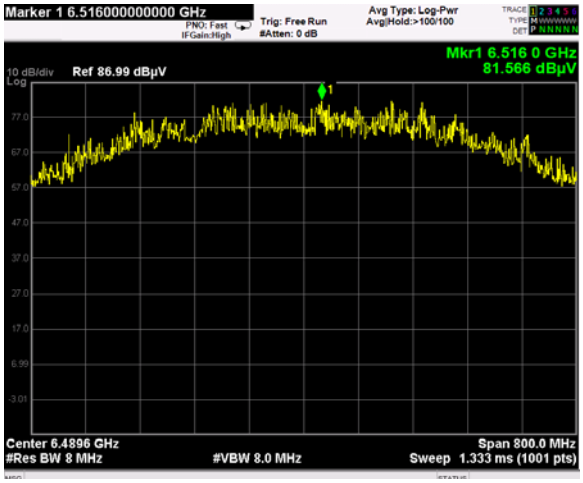
• Operation mode: PoE 48 vdc(Worst case)

## 5.4.6 Test plot

▣ Horizontal at 1 m




▣ Vertical at 1 m



## 5.6 Antenna requirement

### 5.6.1 Standard applicable [FCC §15.203]

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

The use of a permanently attached antenna or of an antenna that user a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The manufacturer may design the unit so that broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

### 5.6.2 Antenna details

| Frequency Band | Antenna Type | Gain [dBi] | Results |
|---|---|---|---|
| 6.2~8.0 GHz | SMD UWB Chip antenna | 3.5 | Compliance |

## 5.7 AC Power Conducted emissions

### 5.7.1 Standard Applicable [FCC §15.207(a)]

For intentional radiator that 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 frequencies hopping mode within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line Impedance stabilization network(LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

§15.207 limits for AC line conducted emissions;

| Frequency of Emission(㎒) | Conducted Limit (dBμV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 ~ 0.5 | 66 to 56 * | 56 to 46 * |
| 0.5 ~ 5 | 56 | 46 |
| 5 ~ 30 | 60 | 50 |

* Decreases with the logarithm of the frequency

### 5.7.2 Test Environment conditions

• Ambient temperature : (21 ~ 22) ℃ • Relative Humidity : (49 ~ 51) % R.H.

### 5.7.3 Measurement Procedure

EUT was placed on a non- metallic table height of 0.8 m above the reference ground plane. Cables connected to EUT were fixed to cause maximum emission. Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the Maximum signal strength.

### 5.7.4 Used equipment

| Equipment | Model No. | Serial No. | Manufacturer | Next cal date | Cal interval | Used |
|---|---|---|---|---|---|---|
| Test receiver | ESCS30 | 100111 | Rohde & Schwarz | 2020. 01. 22 | 1 year | ☒ |
| Pulse Limiter | ESH3-Z2 | 100097 | Rohde & Schwarz | 2020. 01. 22 | 1 year | ☒ |
| LISN | ESH2-Z5 | 100044 | R&S | 2020. 01. 22 | 1 year | ☐ |
| | ESH3-Z5 | 100147 | R&S | 2020. 01. 22 | 1 year | ☒ |

*Test Program: “ ESXS-K1 V2.2”

Measurement uncertainty

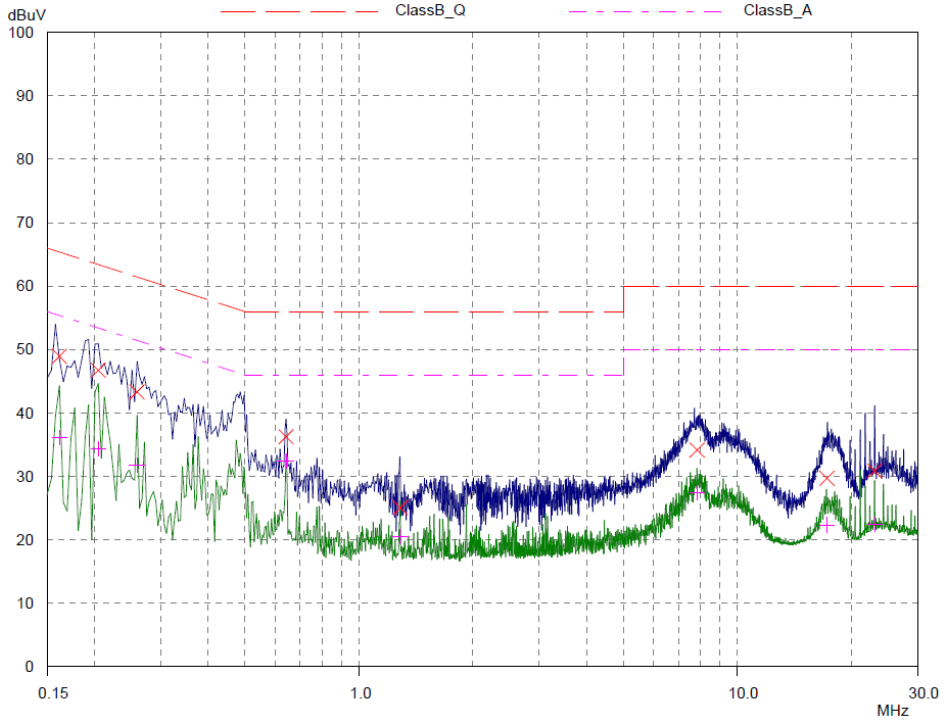
0.15 ~ 30 MHz : ±3.34 (CL: Approx 95 %, *k*=2)

## 5.7.5 Measurement Result

| Freq. | Factor [dB] | | POL | QP | | | CISPR AV | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Limit | Reading | Result | Limit | Reading | Result |
| [MHz] | LISN | CABLE +P/L | | [dBμV] | [dBμV] | [dBμV] | [dBμV] | [dBμV] | [dBμV] |
| 0.162 | 0.08 | 9.98 | L | 65.38 | 48.93 | 49.01 | 55.38 | 35.59 | 35.67 |
| 0.205 | 0.08 | 9.99 | L | 63.42 | 46.74 | 46.82 | 53.42 | 33.88 | 33.96 |
| 0.259 | 0.08 | 10.00 | L | 61.45 | 43.33 | 43.41 | 51.45 | 31.25 | 31.33 |
| 0.642 | 0.08 | 10.04 | L | 56.00 | 36.25 | 36.33 | 46.00 | 31.91 | 31.99 |
| 1.287 | 0.11 | 10.07 | L | 56.00 | 25.03 | 25.14 | 46.00 | 20.01 | 20.12 |
| 7.826 | 0.34 | 10.33 | L | 60.00 | 34.15 | 34.49 | 50.00 | 26.93 | 27.27 |
| 17.267 | 0.67 | 10.51 | L | 60.00 | 29.70 | 30.37 | 50.00 | 21.78 | 22.45 |
| 23.088 | 0.77 | 10.64 | L | 60.00 | 30.87 | 31.64 | 50.00 | 21.95 | 22.72 |
| 0.166 | 0.09 | 9.98 | N | 65.18 | 46.64 | 46.73 | 55.18 | 26.70 | 26.79 |
| 0.181 | 0.09 | 9.99 | N | 64.43 | 46.26 | 46.35 | 54.43 | 27.53 | 27.62 |
| 0.236 | 0.09 | 10.00 | N | 62.24 | 43.58 | 43.67 | 52.24 | 28.22 | 28.31 |
| 0.638 | 0.09 | 10.04 | N | 56.00 | 33.56 | 33.65 | 46.00 | 28.15 | 28.24 |
| 17.607 | 0.64 | 10.52 | N | 60.00 | 30.43 | 31.07 | 50.00 | 22.75 | 23.39 |
| 21.755 | 0.70 | 10.61 | N | 60.00 | 34.42 | 35.12 | 50.00 | 26.49 | 27.19 |
| 23.048 | 0.71 | 10.63 | N | 60.00 | 32.29 | 33.00 | 50.00 | 23.56 | 24.27 |

* LISN: LISN insertion Loss, Cable: Cable Loss, P/L:pulse limiter factor
* L: Line. Live, N: Line. Neutral
* Reading: test receiver reading value (with cable loss & pulse limiter factor)
* Result = LISN + Reading

Line. Live




Line. Neutral