# FCC RADIO TEST REPORT

| | | |
|---|---|---|
| FCC ID | : | W34UMRR1230S |
| Equipment | : | TRUGRD Stream |
| Brand Name | : | smartmicro |
| Model Name | : | UMRR-12 Type 48 |
| Applicant | : | s.m.s, smart microwave sensors GmbH<br>In den Waashainen 1, 38108 Braunschweig, Germany |
| Manufacturer | : | s.m.s, smart microwave sensors GmbH<br>In den Waashainen 1, 38108 Braunschweig, Germany |
| Standard | : | 47 CFR FCC Part 15.245 |

The product was received on Nov. 30, 2020, and testing was started from Dec. 07, 2020 and completed on Jan. 23, 2020. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 and shown compliance with the applicable technical standards.

The test results in this variant report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Approved by: Sam Chen

*SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory*
*No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)*

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# History of this test report

| Report No. | Version | Description | Issued Date |
|---|---|---|---|
| FR0N2466-01 | 01 | Initial issue of report | Feb. 01, 2021 |
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# Summary of Test Result

| Report Clause | Ref Std. Clause | Test Items | Result (PASS/FAIL) | Remark |
|---|---|---|---|---|
| 3.1 | 15.215(c) | Occupied Bandwidth | PASS | - |
| 3.2 | 15.245(b) | Field Strength of Fundamental | PASS | - |
| 3.3 | 15.245(b) | Transmitter Spurious Emissions | PASS | - |
| 3.4 | 15.203 | Antenna Requirements | PASS | - |

| **Declaration of Conformity:** |
|---|
| The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. |
| **Comments and Explanations:** |
| The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification. |

**Reviewed by: Sam Chen**

**Report Producer: Wendy Pan**

# 1 General Description

## 1.1 Information

### 1.1.1 RF General Information

| RF General Information | | | | | |
|---|---|---|---|---|---|
| **Frequency Range** | 24075 - 24175 MHz | | | | |
| **Operation Frequency** | Waveform Index | Test Mode | Frequency Band (MHz) | Test Frequency (MHz) | Bandwidth (MHz) |
| | 7 | 1 | 24075-24175 | 24125 MHz | 100 |
| **Channel Number** | 1 | | | | |
| **Modulation** | FMCW | | | | |
| **Antenna** | Type: PCB Antenna.<br>Gain: 12.7 dBi. | | | | |
| **Accessories** | Sensor cable*1: Shielded, 11m. | | | | |

Note: The above information was declared by manufacturer.

### 1.1.2 Field Strength of Fundamental

| Field Strength of Fundamental | | | | | | | |
|---|---|---|---|---|---|---|---|
| Applicable power levels: | ☐ Conducted ☐ EIRP ☒ Field Strength at 3m | | | | | | |
| Frequency | Highest setting ($P_{high}$): (dBuV/m) | | | | | | |
| | Power Setting | Modulation | Data Rate (Mb/s) | Average Level | Peak Level | Average Level Limit | Peak Level Limit |
| 24125 MHz | 1 | FMCW | N/A | 102.2 | 114.98 | 128 | 148 |

Note: Field Strength of Fundamental = measurement level at 1m - distance extrapolation factor [9.54 dB].

### 1.1.3 Duty Cycle

| On Time (ms) | On+Off Time (ms) | Duty Cycle (%) | Duty Factor (dB) | 1/T Minimum VBW (kHz) |
|---|---|---|---|---|
| 54.000 | 100.000 | 54.00% | 2.68 | 0.02 |

### 1.1.4 EUT Operational Condition

| | |
|---|---|
| **EUT Power Type** | From DC power supply |
| **Test Software Version** | DriveRecorder3 Version:v 2.5.11589.0 |

Note: The above information was declared by manufacturer.

### 1.1.5 Table for Class III Change

This product is an extension of original one reported under Sporton project number: FR0N2466

Below is the table for the change of the product with respect to the original one.

| Modifications | Description |
|---|---|
| Adding the operating frequency: 24.075~24.175GHz. | Occupied Bandwidth<br>Field Strength of Fundamental<br>Transmitter Spurious Emissions |

## 1.2 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ANSI C63.10-2013
- 47 CFR FCC Part 15.245

The following reference test guidance is not within the scope of accreditation of TAF.

- FCC KDB 414788 D01 v01r01

## 1.3 Testing Location Information

| Testing Location | | | |
|---|---|---|---|
| ☐ | HWA YA | ADD : | No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) |
| | | TEL : | 886-3-327-3456 FAX : 886-3-327-0973 |
| ☒ | JHUBEI | ADD : | No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302, Taiwan (R.O.C.) |
| | | TEL : | 886-3-656-9065 FAX : 886-3-656-9085 |

| Test Condition | Test Site No. | Test Engineer | Test Environment | Test Date |
|---|---|---|---|---|
| Radiated (For others test item ) | 03CH06-CB | Brian Sun | 22.4-23.5°C / 55-58% | Dec. 07, 2020 ~ Jan. 23, 2021 |
| Radiated (Harmonic 18-40GHz) | 03CH04-CB | Brian Sun | 22.5-23.4°C / 56-69% | Dec. 07, 2020 ~ Jan. 23, 2021 |

Test site Designation No. TW0006 with FCC.

Test site registered number IC 4086D with Industry Canada.

## 1.4 Measurement Uncertainty

| Test Items | Uncertainty | Remark |
|---|---|---|
| Radiated Emission (9kHz ~ 30MHz) | 3.8 dB | Confidence levels of 95% |
| Radiated Emission (30MHz ~ 1,000MHz) | 5.6 dB | Confidence levels of 95% |
| Radiated Emission (1GHz ~ 18GHz) | 5.0 dB | Confidence levels of 95% |
| Radiated Emission (18GHz ~ 40GHz) | 4.9 dB | Confidence levels of 95% |
| Radiated Emission (40GHz ~ 60GHz) | 3.9 dB | Confidence levels of 95% |
| Radiated Emission (60GHz ~ 90GHz) | 4.5 dB | Confidence levels of 95% |
| Radiated Emission (90GHz ~ 200GHz) | 5.3 dB | Confidence levels of 95% |

# 2 Test Configuration of Equipment under Test

## 2.1 Parameters of Test Software Setting

| Software Setting | |
|---|---|
| **Test Frequencies** | 24125 MHz |
| **Software Setting** | 1 |

## 2.2 Conformance Tests and Related Test Frequencies

| Test | Condition | Test Mode | Test Frequencies |
|---|---|---|---|
| Emission Bandwidth | CTX | Mode 1 | 24125 MHz |
| Field Strength of Fundamental | CTX | Mode 1 | 24125 MHz |
| Transmitter Spurious Emissions | CTX | Mode 1 | 24125 MHz |

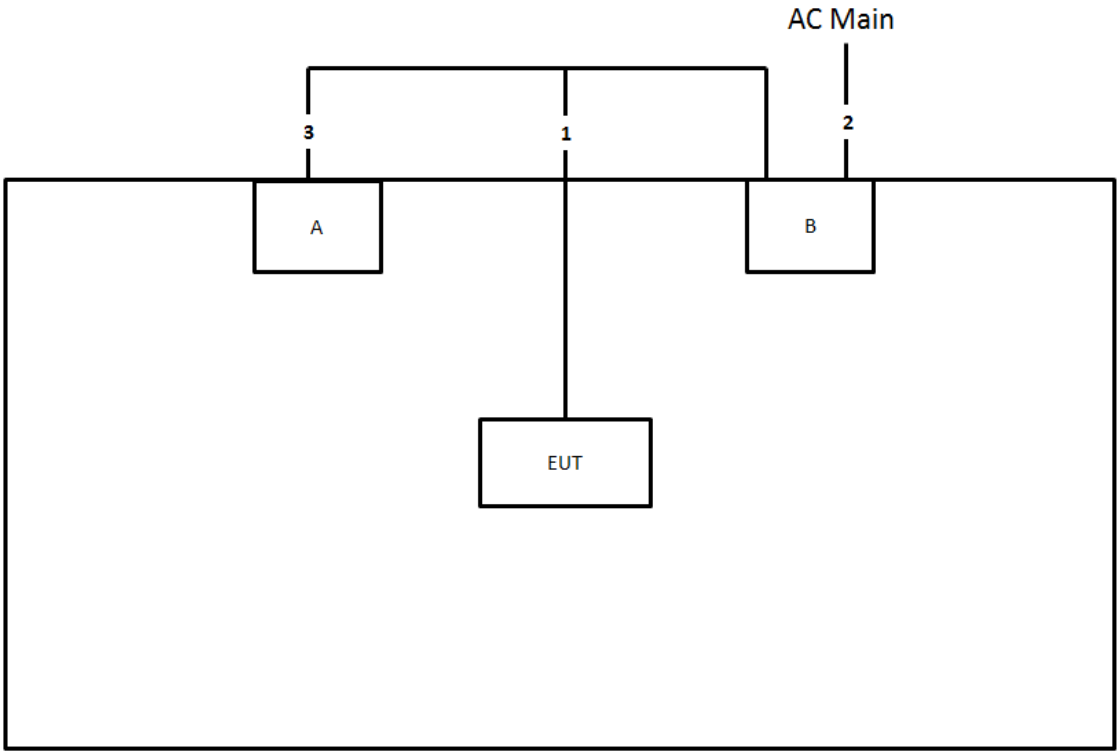
Note: The EUT can only be used at Y axis position.

## 2.3 Support Equipment

| No. | Equipment | Brand Name | Model Name | FCC ID |
|---|---|---|---|---|
| A | Power Supply | Advanced | LPS-305 | N/A |
| B | NB | DELL | E6430 | N/A |

## 2.4 EUT Setups

**Transmitter Spurious Emissions**




| Item | Connection | Shielded | Length |
|---|---|---|---|
| 1 | Sensor Cable | Yes | 11m |
| 2 | Power cable | No | 1.5m |
| 3 | Console cable | Yes | 0.8m |

# 3 Transmitter Test Result

## 3.1 Occupied Bandwidth

### 3.1.1 Limit of Occupied Bandwidth

| | |
|---|---|
| **20dB Bandwidth** (see Note 1) | None |
| **99% Occupied Bandwidth** (see Note 2) | None |

Note 1: Refer as 15.215(c). Ensure that the 20 dB occupied bandwidth shall be fall in the specified operating frequency range.

Note 2: The 99% occupied bandwidth is the frequency bandwidth of the signal power at the 99% channel power of occupied bandwidth when resolution bandwidth should be approximately 1 % to 5 % of the occupied bandwidth (OBW). These measurements shall also be performed at normal test conditions.

### 3.1.2 Measuring Instruments

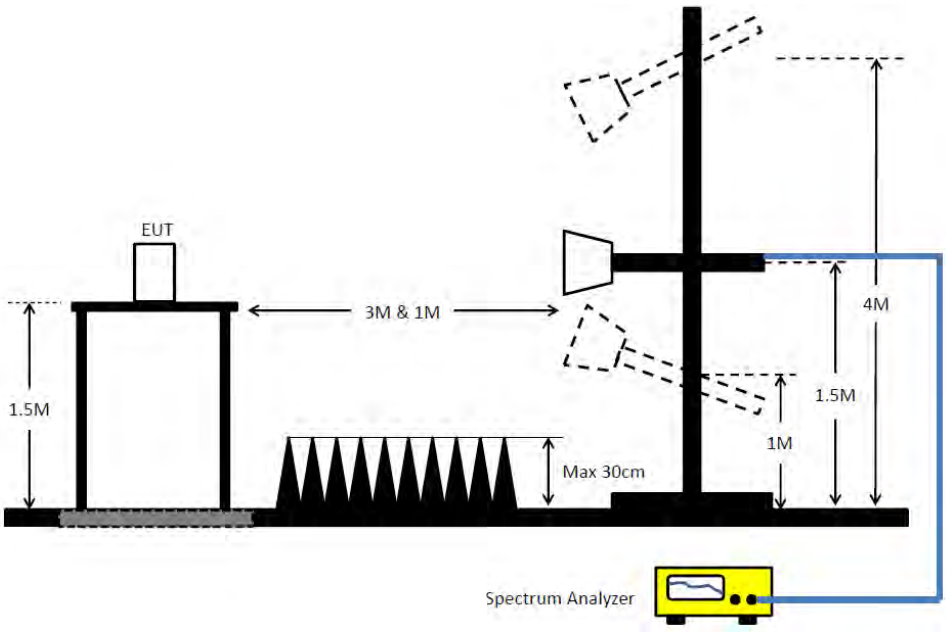
Refer a measuring instruments list in this test report.

### 3.1.3 Test Procedures

Method of measurement: Refer as ANSI C63.10-2013, clauses 6.6 and 6.9.1.

### 3.1.4 Test Setup

**Occupied Bandwidth**



### 3.1.5 Test Result of Occupied Bandwidth

| | |
|---|---|
| **Test Conditions:** | see ANSI C63.10, clause 5.11<br>see ANSI C63.10, clause 5.12 |
| **Test Setup:** | see ANSI C63.10, clause 6.6 |
| Note: If equipment having different transmit operating modes, the measurements are uninfluenced by different transmit operating modes, may not need to be repeated for all the operating modes. Similar, if the equipment supports different modulations and/or data rates, the measurements described in ANSI C63.10, clause 5.12 may not need to be repeated for all these modulations and data rates. Simple comparison of engineering test across all operating modes, modulations and data rates may need to be performed to define the worse case combination to be used for the conformance testing. Refer as ANSI C63.10, clause 6.9.1, observe and record with plotted graphs or photographs the worst-case (i.e., widest) occupied bandwidth produced by these different modulation sources. | |

Refer as Appendix A

## 3.2 Field Strength of Fundamental

### 3.2.1 Limit of Field Strength of Fundamental

| Frequencies (MHz) | Field Strength (mV/meter) | Field Strength (dBuV/m) at 3m |
|---|---|---|
| 902~928 MHz | 500 at 3m | 114 (Average) |
| 902~928 MHz | 5000 at 3m | 134 (Peak) |
| 2435~2465MHz | 500 at 3m | 114 (Average) |
| 2435~2465MHz | 5000 at 3m | 134 (Peak) |
| 5785~5815 MHz | 500 at 3m | 114 (Average) |
| 5785~5815 MHz | 5000 at 3m | 134 (Peak) |
| 10.5~10.55 GHz | 2500 at 3m | 128 (Average) |
| 10.5~10.55 GHz | 25000 at 3m | 148 (Peak) |
| 24.075~24.175 GHz | 2500 at 3m | 128 (Average) |
| 24.075~24.175 GHz | 25000 at 3m | 148 (Peak) |
| Note1: For the applicable limit, see 15.245(b)<br>Note2: The limit shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade from 3m to 1m.<br>Distance extrapolation factor = 20 log (specific distance [3m] / test distance [1m]) (dB);<br>Limit line = specific limits (dBuV) + distance extrapolation factor [9.54 dB]. | | |

### 3.2.2 Measuring Instruments

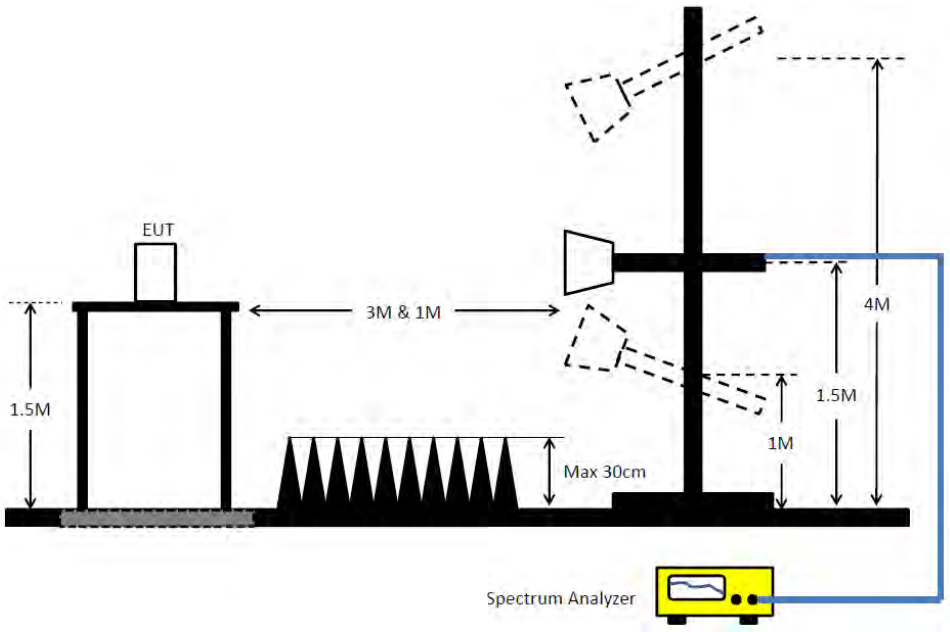
Refer a measuring instruments list in this test report.

### 3.2.3 Test Procedures

Method of measurement: Refer as ANSI C63.10-2013, clause 6.6.

### 3.2.4 Test Setup

**Field Strength of Fundamental**




### 3.2.5 Measurement Results Calculation

The measured Level is calculated using:

Corrected Reading: Antenna factor (AF) + Cable loss (CL) + Read level (Raw) - Preamp factor (PA)(if applicable) = Level.

### 3.2.6 Test Result of Field Strength of Fundamental

| | |
|---|---|
| **Test Conditions:** | see ANSI C63.10, clause 5.11 |
| **Test Setup:** | see ANSI C63.10, clause 6.6 |

Note1: If the equipment supports different modulations and/or data rates, the measurements described in ANSI C63.10, clause 5.12 may not need to be repeated for all these modulations and data rates. Simple comparison of engineering test across all operating modes, modulations and data rates may need to be performed to define the worse case combination to be used for the conformance testing.

Note2: Conformance tests have to be performed over the frequency range(s) that has been declared with this Field Strength of Fundamental and using the antenna gain of the antenna with the highest gain among those that have been declared with this Field Strength of Fundamental. For smart antenna systems, the antenna beam forming gain may have to be taken into account as well.

Refer as Appendix B

## 3.3 Transmitter Spurious Emissions

### 3.3.1 Limit of Transmitter Spurious Emissions

| Transmitter Spurious Emissions |
|---|
| 1. 902 - 928MHz, Field disturbance sensors |
| ♦ Harmonic emissions in the restricted bands: 15.209 limit<br>♦ Harmonic emissions in the non-restricted bands: 1.6mV/m<br>♦ Except harmonic emissions, spurious emissions: FCC 15.209 limit or 50 dB below the fundamental, whichever is the lesser attenuation. |
| 2. 2435 - 2465MHz, 5785 - 5815MHz, Field disturbance sensors |
| ♦ Harmonic emissions in the restricted bands at and below 17.7 GHz: 15.209 limit<br>♦ Harmonic emissions in the restricted bands at and above 17.7 GHz: 7.5mV/m<br>♦ Harmonic emissions in the non-restricted bands: 1.6mV/m<br>♦ Except harmonic emissions, spurious emissions: FCC 15.209 limit or 50 dB below the fundamental, whichever is the lesser attenuation. |
| 3. 10500 – 10550MHz, Field disturbance sensors |
| ♦ Harmonic emissions in the restricted bands at and above 17.7 GHz: 7.5mV/m<br>♦ Harmonic emissions in the non-restricted bands: 25mV/m<br>♦ Except harmonic emissions, spurious emissions: FCC 15.209 limit or 50 dB below the fundamental, whichever is the lesser attenuation. |
| 4. 24075-24175 MHz, Field disturbance sensors |
| ♦ Second and third harmonics: 25 mV/m<br>♦ Except harmonic emissions, spurious emissions: FCC 15.209 limit or 50 dB below the fundamental, whichever is the lesser attenuation. |

Note: The limit shall be extrapolated to the specified distance using 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].

### 3.3.2 Measuring Instruments

Refer a measuring instruments list in this test report.

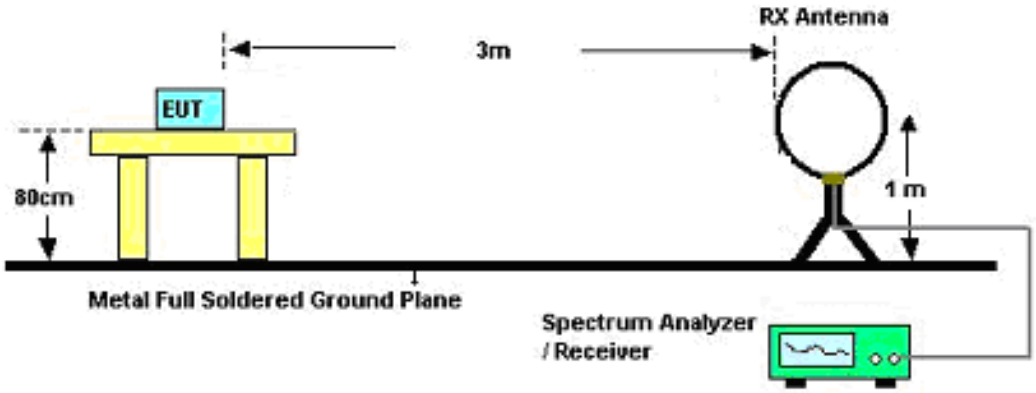
### 3.3.3 Test Procedures

Method of measurement: Refer as ANSI C63.10-2013, clauses 6.3, 6.4, 6.5, 6.6 and 9.12.

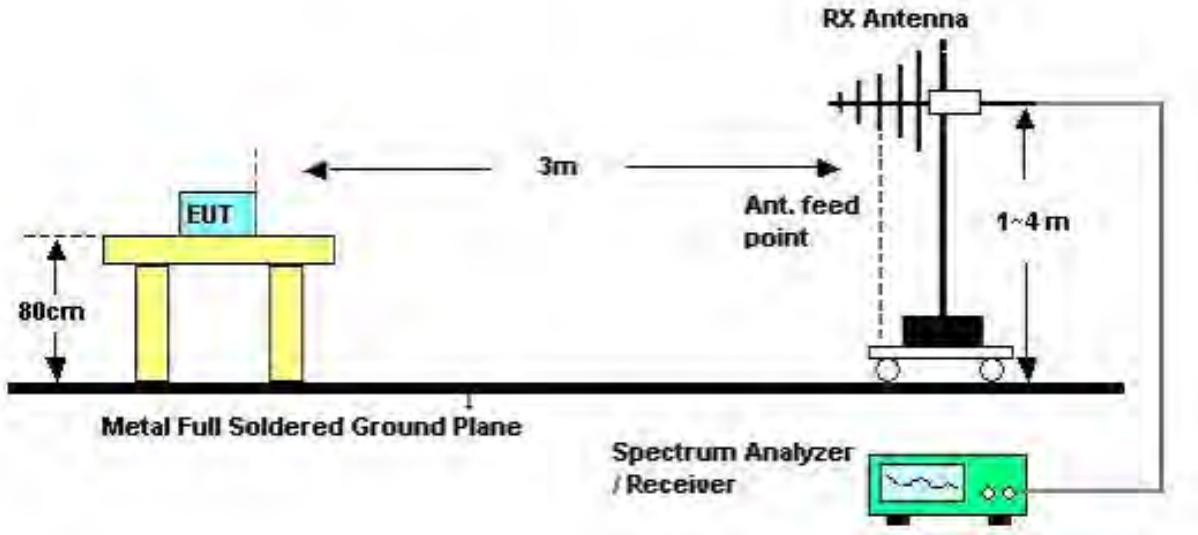
### 3.3.4 Test Setup

**Transmitter Spurious Emissions**

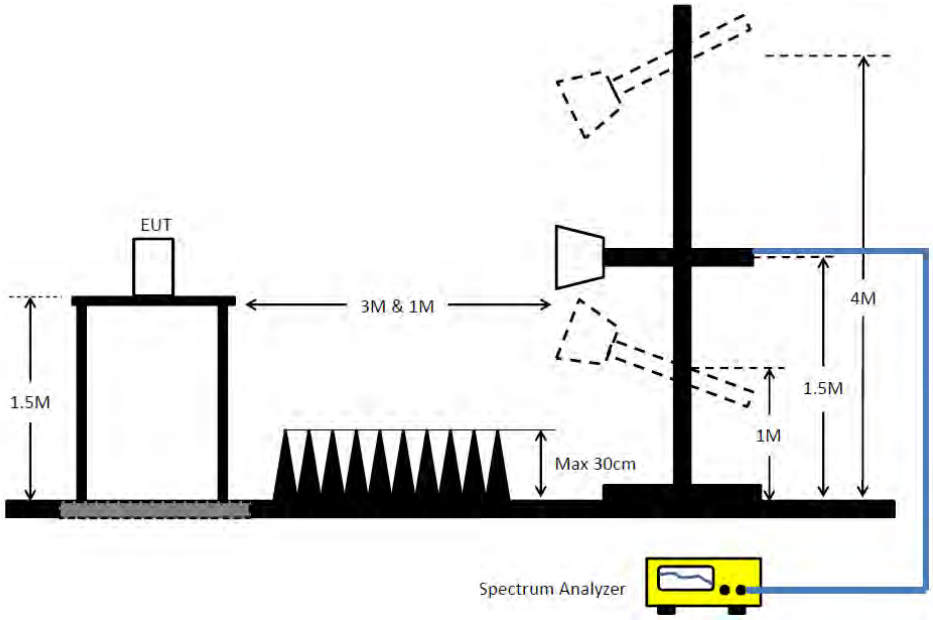
**9kHz ~30MHz**



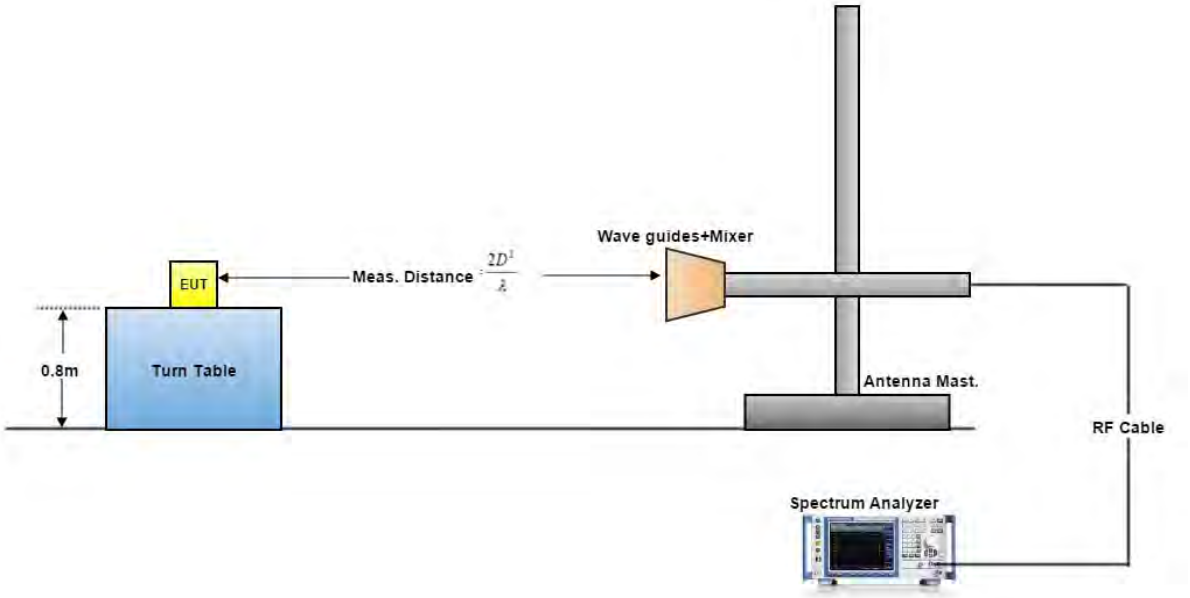

**30MHz~1GHz**



**1GHz ~40GHz**




**Above 40GHz**




A measuring distance of at 3 m shall be used for measurements at frequencies up to 15 GHz. For frequencies above 15 GHz, any suitable measuring distance may be used. The measurement distance is chosen up to far field distance, depending on the test system noise floor for detecting spurious emission signals. Then above 15 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade from spec. distance (3 m) to measurement distance. Distance extrapolation factor = 20 log (spec. distance [3 m] / measurement distance [N m]) (dB) .The measurements described in ANSI C63.10, clause 7.8.6. If the emission cannot be detected at 1 m, reduce the RBW to increase system sensitivity. Note the value. If the emission still cannot be detected, move the horn closer to the EUT, noting the distance at which a measurement is made.

### 3.3.5 Measurement Results Calculation

The measured Level is calculated using:

For below 40GHz

Corrected Reading: Antenna factor (AF) + Cable loss (CL) + Read level (Raw) - Preamp factor (PA)(if applicable) = Level.

For above 40GHz

EIRP = Meas. Level - RX Antenna Gain + 20*log(4*Pi(3.14159)*D/(300/(Frequency*1000)))

### 3.3.6 Emissions in Restricted Frequency Bands (Below 30MHz)

There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to KDB414788 Radiated Test Site, and the result came out very similar.

All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

The radiated emissions were investigated from 9 kHz or the lowest frequency generated within the device, up to the 10th harmonic or 40 GHz, whichever is appropriate.

### 3.3.7 Test Result of Transmitter Spurious Emissions

| | |
|---|---|
| **Test Conditions:** | see ANSI C63.10, clause 5.11 |
| **Test Setup:** | see ANSI C63.10, clauses 6.3, 6.4, 6.5, 6.6 and 9.12 |
| Note1: If equipment having different channel plan and nominal channel bandwidth modes, the measurements are uninfluenced by different channel plan and nominal channel bandwidth modes, may not need to be repeated for all modes. | |
| Note2: Note: Conformance tests have to be performed over the frequency range(s) that has been declared with this Field Strength of Fundamental and using the antenna gain of the antenna with the highest gain among those that have been declared with this Field Strength of Fundamental. For smart antenna systems, the antenna beam forming gain may have to be taken into account as well. | |

Refer as Appendix C for Harmonic

Refer as Appendix B for Bandedge

# 3.4 Antenna Requirements

## 3.4.1 Limit of Antenna Requirements

| Limits for Antenna Requirements |
| --- |
| The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited |

## 3.4.2 EUT Antenna

See test report clause 1.1.1, EUT antenna complied with antenna requirements.

# 4 Test Equipment and Calibration Data

| Instrument | Brand | Model No. | Serial No. | Characteristics | Calibration Date | Calibration Due Date | Remark |
|---|---|---|---|---|---|---|---|
| Loop Antenna | Teseq | HLA 6120 | 24155 | 9kHz - 30 MHz | Apr. 13, 2020 | Apr. 12, 2021 | Radiation (03CH06-CB) |
| 3m Semi Anechoic Chamber NSA | TDK | SAC-3M | 03CH06-CB | 30 MHz ~ 1 GHz | Aug. 10, 2020 | Aug, 09. 2021 | Radiation (03CH06-CB) |
| 3m Semi Anechoic Chamber VSWR | TDK | SAC-3M | 03CH06-CB | 1GHz ~18GHz 3m | Oct. 02, 2020 | Oct. 01, 2021 | Radiation (03CH06-CB) |
| Bilog Antenna with 6 dB attenuator | TESEQ & EMCI | CBL6112D & N-6-06 | 37878 & AT-N0606 | 20MHz ~ 2GHz | Aug. 02, 2020 | Aug. 01, 2021 | Radiation (03CH06-CB) |
| Horn Antenna | SCHWARZBECK | BBHA9120D | BBHA 9120D-1292 | 1GHz~18GHz | Jul. 22, 2020 | Jul. 21, 2021 | Radiation (03CH06-CB) |
| Horn Antenna | Schwarzbeck | BBHA 9170 | BBHA9170252 | 15GHz ~ 40GHz | Jul. 21, 2020 | Jul. 20, 2021 | Radiation (03CH06-CB) |
| Pre-Amplifier | Agilent | 310N | 187290 | 0.1MHz ~ 1GHz | Nov. 05, 2020 | Nov. 04, 2021 | Radiation (03CH06-CB) |
| Pre-Amplifier | Agilent | 83017A | MY53270064 | 0.5GHz ~ 26.5GHz | May 07, 2020 | May 06, 2021 | Radiation (03CH06-CB) |
| Pre-Amplifier | MITEQ | TTA1840-35-HG | 1864479 | 18GHz ~ 40GHz | Jul. 08, 2020 | Jul. 07, 2021 | Radiation (03CH06-CB) |
| Signal Analyzer | R&S | FSV40 | 101904 | 9kHz ~ 40GHz | May 12, 2020 | May 11, 2021 | Radiation (03CH06-CB) |
| EMI Test Receiver | R&S | ESCS | 826547/017 | 9kHz ~ 2.75GHz | May 13, 2020 | May 12, 2021 | Radiation (03CH06-CB) |
| RF Cable-low | Woken | RG402 | Low Cable-05+24 | 30MHz~1GHz | Oct. 05, 2020 | Oct. 04, 2021 | Radiation (03CH06-CB) |
| RF Cable-high | Woken | RG402 | High Cable-05 | 1GHz~18GHz | Oct. 05, 2020 | Oct. 04, 2021 | Radiation (03CH06-CB) |
| RF Cable-high | Woken | RG402 | High Cable-05+24 | 1GHz~18GHz | Oct. 05, 2020 | Oct. 04, 2021 | Radiation (03CH06-CB) |
| RF Cable-high | Woken | RG402 | High Cable-40G#1 | 18GHz ~ 40 GHz | Jul. 16, 2020 | Jul. 15, 2021 | Radiation (03CH06-CB) |
| RF Cable-high | Woken | RG402 | High Cable-40G#2 | 18GHz ~ 40 GHz | Jul. 16, 2020 | Jul. 15, 2021 | Radiation (03CH06-CB) |
| Test Software | Audix | E3 | 6.120210m | - | N.C.R. | N.C.R. | Radiation (03CH06-CB) |
| Test Software | SPORTON | SENSE | V5.10 | - | N.C.R. | N.C.R. | Radiation (03CH06-CB) |
| Harmonic Mixer | RPG | RPG FS-Z60 | 101033 | 40 ~ 60 GHz | Mar. 07, 2020 | Mar. 06, 2021 | Radiation (03CH06-CB) |
| Mixer | OML | M19HWA | U91113-1 | 40 ~ 60 GHz | Nov. 02, 2020 | Nov. 01, 2021 | Radiation (03CH06-CB) |
| Mixer | OML | M12HWA | E91113-1 | 60 ~ 90 GHz | Nov. 14, 2020 | Nov. 13, 2021 | Radiation (03CH06-CB) |

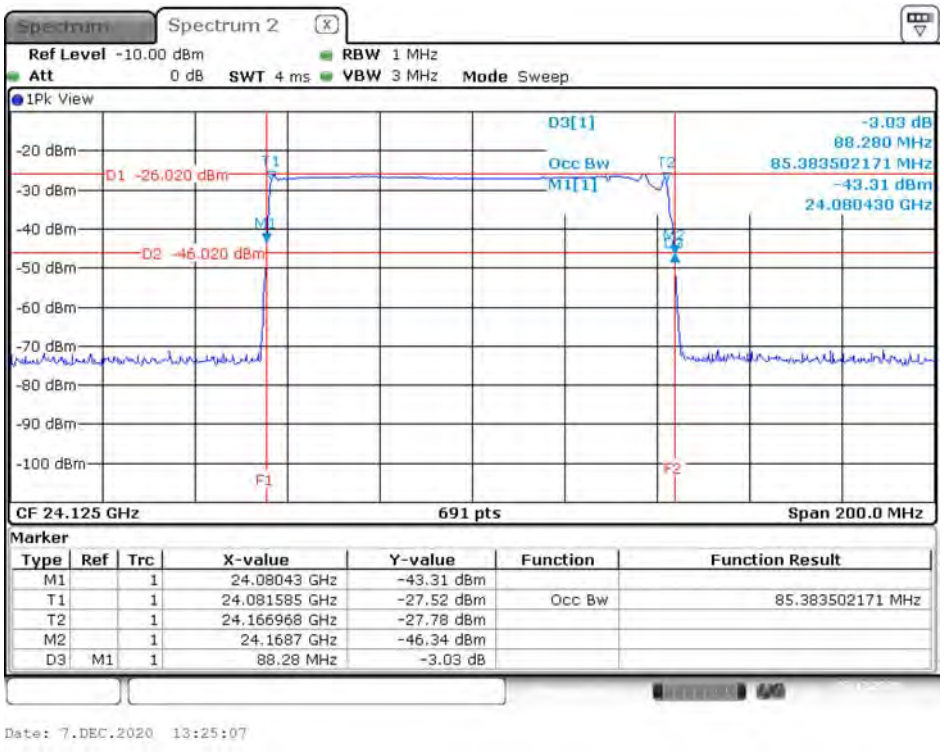
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Mixer | OML | M08HWA | F91113-1 | 90 ~ 140 GHz | Nov. 02, 2020 | Nov. 01, 2021 | Radiation (03CH06-CB) |
| Standard Horn Antenna | Custom Microwave | M19RH | U91113-A | 40 ~ 60 GHz | N.C.R | N.C.R | Radiation (03CH06-CB) |
| Standard Horn Antenna | Custom Microwave | M12RH | E91113-A | 60 ~ 90 GHz | N.C.R | N.C.R | Radiation (03CH06-CB) |
| Standard Horn Antenna | Custom Microwave | M08RH | F91113-A | 90 ~ 140 GHz | N.C.R | N.C.R | Radiation (03CH06-CB) |
| Detector | Millitech | DET-15-RPFW 0 | #A18185(074) | 50 ~ 75 GHz | Apr. 02, 2020 | Apr. 01, 2021 | Radiation (03CH06-CB) |
| PC Oscilloscope | PICO TECH | 6402C | CX372/002 | N/A | Jul. 10, 2020 | Jul. 09, 2021 | Radiation (03CH06-CB) |
| 3m Semi Anechoic Chamber VSWR | TDK | SAC-3M | 03CH04-CB | 1GHz ~18GHz 3m | Feb. 26, 2020 | Feb. 25, 2021 | Radiation (03CH04-CB) |
| Horn Antenna | ETS・Lindgren | 3115 | 00143147 | 750MHz~18GHz | Oct. 23, 2020 | Oct. 22, 2021 | Radiation (03CH04-CB) |
| Horn Antenna | Schwarzbeck | BBHA 9170 | BBHA9170252 | 15GHz ~ 40GHz | Jul. 21, 2020 | Jul. 20, 2021 | Radiation (03CH04-CB) |
| Pre-Amplifier | EMCI | EMC330N | 980391 | 20MHz ~ 3GHz | May 21, 2020 | May 20, 2021 | Radiation (03CH04-CB) |
| Pre-Amplifier | Agilent | 83017A | MY53270063 | 0.5GHz ~ 26.5GHz | Jul. 14, 2020 | Jul. 13, 2021 | Radiation (03CH04-CB) |
| Pre-Amplifier | MITEQ | TTA1840-35-HG | 1864479 | 18GHz ~ 40GHz | Jul. 08, 2020 | Jul. 07, 2021 | Radiation (03CH04-CB) |
| Spectrum Analyzer | R&S | FSP40 | 100142 | 9kHz~40GHz | Dec. 18, 2019 | Dec. 17, 2020 | Radiation (03CH04-CB |
| Signal Analyzer | R&S | FSV40 | 101904 | 9kHz ~ 40GHz | May 12, 2020 | May 11, 2021 | Radiation (03CH04-CB) |
| RF Cable-high | Woken | RG402 | High Cable-21 | 1GHz - 18GHz | Oct. 05, 2020 | Oct. 04, 2021 | Radiation (03CH04-CB) |
| RF Cable-high | Woken | RG402 | High Cable-21+67 | 1GHz - 18GHz | Nov. 05, 2020 | Nov. 04, 2021 | Radiation (03CH04-CB) |
| RF Cable-high | Woken | RG402 | High Cable-40G#1 | 18GHz ~ 40 GHz | Jul. 16, 2020 | Jul. 15, 2021 | Radiation (03CH04-CB) |
| RF Cable-high | Woken | RG402 | High Cable-40G#2 | 18GHz ~ 40 GHz | Jul. 16, 2020 | Jul. 15, 2021 | Radiation (03CH04-CB) |
| Test Software | SPORTON | SENSE | V5.10 | - | N.C.R. | N.C.R. | Radiation (03CH04-CB) |

Note: Calibration Interval of instruments listed above is one year.

N.C.R. means Non-Calibration required.

| Test Frequency | Test Results | | | |
|---|---|---|---|---|
| | 20dB Bandwidth (MHz) | 99% Bandwidth (MHz) | Frequency range $f_L > 24075$ MHz | Frequency range $f_H < 24175$ MHz |
| 24125 MHz | 88.280 | 85.383 | 24080.43 | 24168.70 |

**Occupied Bandwidth Plot on 24125 MHz**

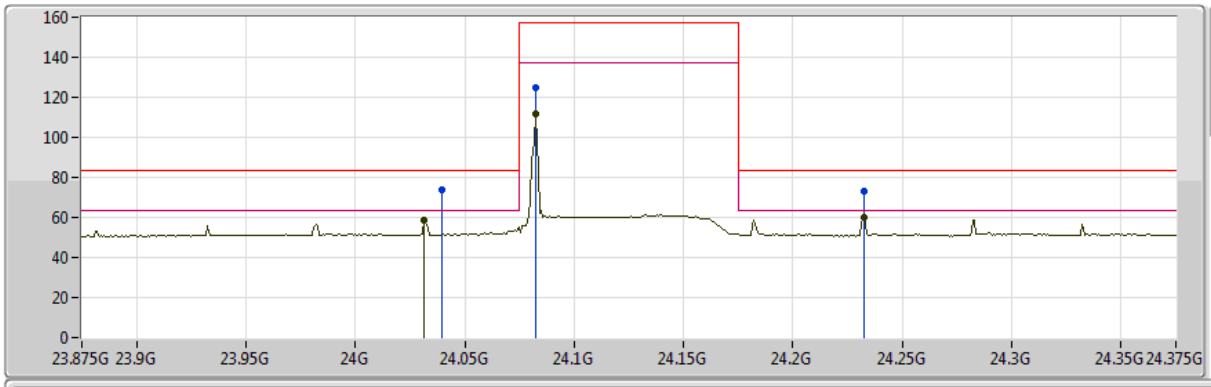


Summary

| Mode | Result | Type | Freq (Hz) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Condition |
|---|---|---|---|---|---|---|---|
| Mode 1 | Pass | AV | 24.23225G | 60.01 | 63.54 | -3.53 | Vertical |

## Mode 1

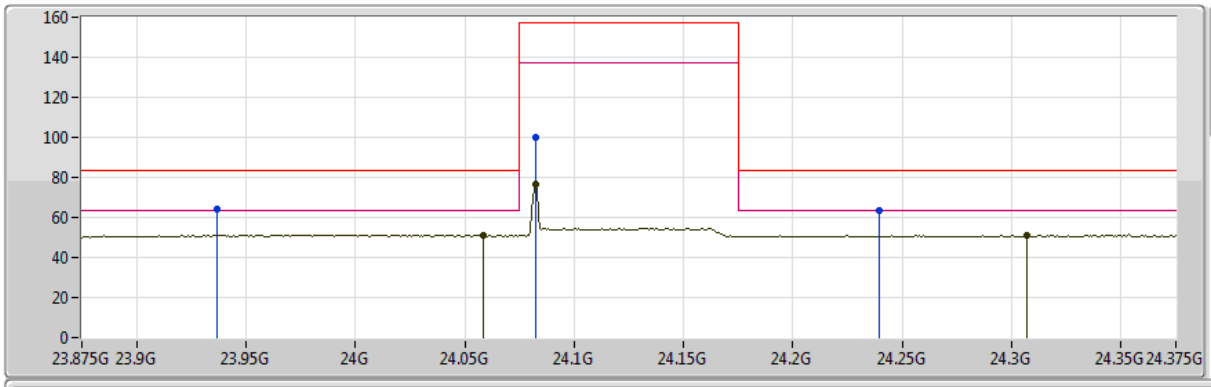
23/01/2021




| Type | Freq | Level | Limit | Margin | Factor | Dist | Condition | Azimuth | Height | Comment | Raw | AF | CL | PA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (Hz) | (dBuV/m) | (dBuV/m) | (dB) | (dB) | (m) | | (°) | (m) | | (dBuV) | (dB) | (dB) | (dB) |
| PK | 24.03949G | 73.65 | 83.54 | -9.89 | 6.59 | 1 | Vertical | 4 | 1.51 | - | 67.06 | 38.98 | 16.30 | 48.69 |
| AV | 24.03152G | 58.78 | 63.54 | -4.76 | 6.59 | 1 | Vertical | 4 | 1.51 | - | 52.19 | 38.98 | 16.30 | 48.69 |
| PK | 24.08225G | 124.52 | 157.54 | -33.02 | 6.57 | 1 | Vertical | 4 | 1.51 | - | 117.95 | 38.95 | 16.30 | 48.68 |
| AV | 24.08225G | 111.74 | 137.54 | -25.80 | 6.57 | 1 | Vertical | 4 | 1.51 | - | 105.17 | 38.95 | 16.30 | 48.68 |
| PK | 24.23225G | 73.31 | 83.54 | -10.23 | 6.52 | 1 | Vertical | 4 | 1.51 | - | 66.79 | 38.86 | 16.31 | 48.65 |
| AV | 24.23225G | 60.01 | 63.54 | -3.53 | 6.52 | 1 | Vertical | 4 | 1.51 | - | 53.49 | 38.86 | 16.31 | 48.65 |

**Mode 1**

23/01/2021



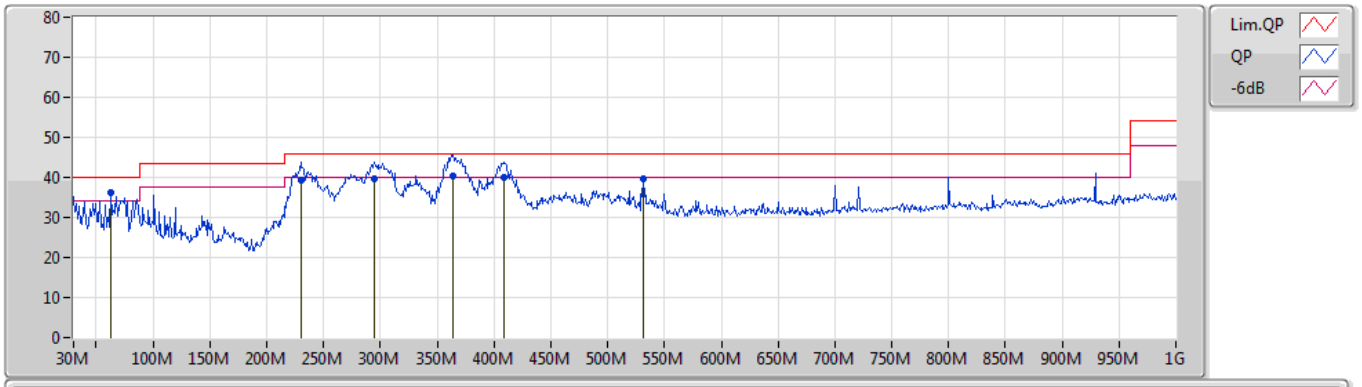

| Type | Freq | Level | Limit | Margin | Factor | Dist | Condition | Azimuth | Height | Comment | Raw | AF | CL | PA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (Hz) | (dBuV/m) | (dBuV/m) | (dB) | (dB) | (m) | | (°) | (m) | | (dBuV) | (dB) | (dB) | (dB) |
| PK | 23.93659G | 63.84 | 83.54 | -19.70 | 6.50 | 1 | Horizontal | 25 | 1.51 | - | 57.34 | 38.96 | 16.27 | 48.73 |
| AV | 24.05833G | 51.22 | 63.54 | -12.32 | 6.58 | 1 | Horizontal | 25 | 1.51 | - | 44.64 | 38.97 | 16.30 | 48.69 |
| PK | 24.08225G | 99.79 | 157.54 | -57.75 | 6.57 | 1 | Horizontal | 25 | 1.51 | - | 93.22 | 38.95 | 16.30 | 48.68 |
| AV | 24.08225G | 76.64 | 137.54 | -60.90 | 6.57 | 1 | Horizontal | 25 | 1.51 | - | 70.07 | 38.95 | 16.30 | 48.68 |
| PK | 24.23949G | 63.53 | 83.54 | -20.01 | 6.52 | 1 | Horizontal | 25 | 1.51 | - | 57.01 | 38.86 | 16.31 | 48.65 |
| AV | 24.30688G | 50.99 | 63.54 | -12.55 | 6.50 | 1 | Horizontal | 25 | 1.51 | - | 44.49 | 38.82 | 16.32 | 48.64 |

Summary

| Mode | Result | Type | Freq (Hz) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Condition |
|---|---|---|---|---|---|---|---|
| Mode 1 | Pass | QP | 362.71M | 42.85 | 46.00 | -3.15 | Vertical |

**Mode 1**

10/12/2020




| Type | Freq | Level | Limit | Margin | Factor | Dist | Condition | Azimuth | Height | Comment | Raw | AF | CL | PA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (Hz) | (dBuV/m) | (dBuV/m) | (dB) | (dB) | (m) | | (°) | (m) | | (dBuV/m) | (dB/m) | (dB) | (dB) |
| PK | 62.98M | 36.29 | 40.00 | -3.71 | -18.50 | 3 | Vertical | - | - | "Worst" | 54.79 | 12.47 | 1.40 | 32.37 |
| QP | 229.82M | 39.24 | 46.00 | -6.76 | -13.38 | 3 | Vertical | - | - | - | 52.62 | 16.05 | 2.78 | 32.21 |
| QP | 294.81M | 39.51 | 46.00 | -6.49 | -10.07 | 3 | Vertical | - | - | - | 49.58 | 19.04 | 3.08 | 32.19 |
| QP | 363.68M | 40.46 | 46.00 | -5.54 | -7.93 | 3 | Vertical | - | - | - | 48.39 | 20.60 | 3.58 | 32.11 |
| QP | 409.27M | 40.11 | 46.00 | -5.89 | -5.87 | 3 | Vertical | - | - | - | 45.98 | 22.42 | 3.84 | 32.13 |
| PK | 531.49M | 39.57 | 46.00 | -6.43 | -3.58 | 3 | Vertical | - | - | - | 43.15 | 24.12 | 4.43 | 32.13 |

## Mode 1

10/12/2020

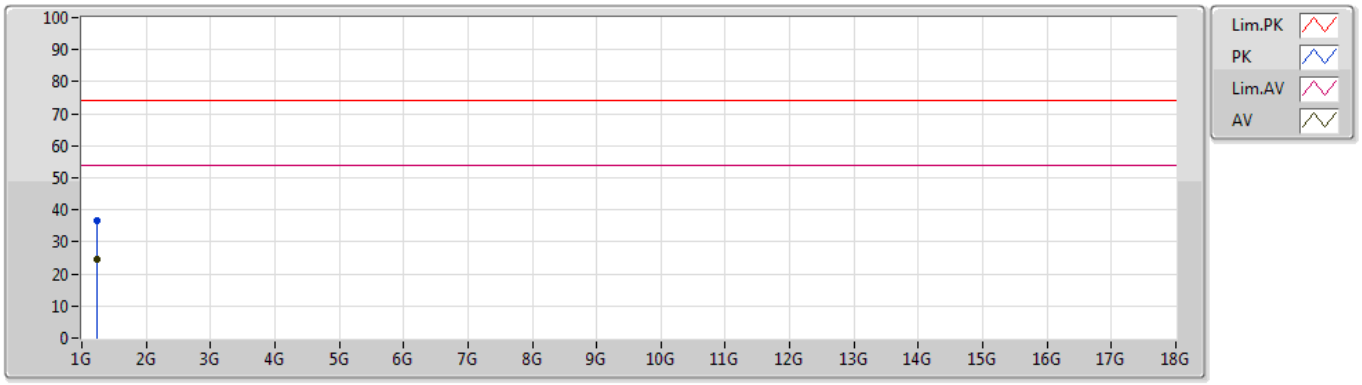

| Type | Freq | Level | Limit | Margin | Factor | Dist | Condition | Azimuth | Height | Comment | Raw | AF | CL | PA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (Hz) | (dBuV/m) | (dBuV/m) | (dB) | (dB) | (m) | | (°) | (m) | | (dBuV/m) | (dB/m) | (dB) | (dB) |
| PK | 95.96M | 39.73 | 43.50 | -3.77 | -14.47 | 3 | Horizontal | - | - | - | 54.20 | 16.12 | 1.72 | 32.31 |
| PK | 142.52M | 38.60 | 43.50 | -4.90 | -13.27 | 3 | Horizontal | - | - | - | 51.87 | 16.90 | 2.13 | 32.30 |
| QP | 242.43M | 38.41 | 46.00 | -7.59 | -11.91 | 3 | Horizontal | - | - | - | 50.32 | 17.44 | 2.85 | 32.20 |
| QP | 288.99M | 42.09 | 46.00 | -3.91 | -10.23 | 3 | Horizontal | - | - | - | 52.32 | 18.90 | 3.06 | 32.19 |
| PK | 327.79M | 42.15 | 46.00 | -3.85 | -9.17 | 3 | Horizontal | - | - | - | 51.32 | 19.64 | 3.32 | 32.13 |
| PK | 362.71M | 42.85 | 46.00 | -3.15 | -7.95 | 3 | Horizontal | - | - | "Worst" | 50.80 | 20.58 | 3.58 | 32.11 |

Summary

| Mode | Result | Type | Freq (Hz) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Condition |
|---|---|---|---|---|---|---|---|
| Mode 1 | Pass | AV | 1.23588G | 24.70 | 54.00 | -29.30 | Vertical |

## Mode 1

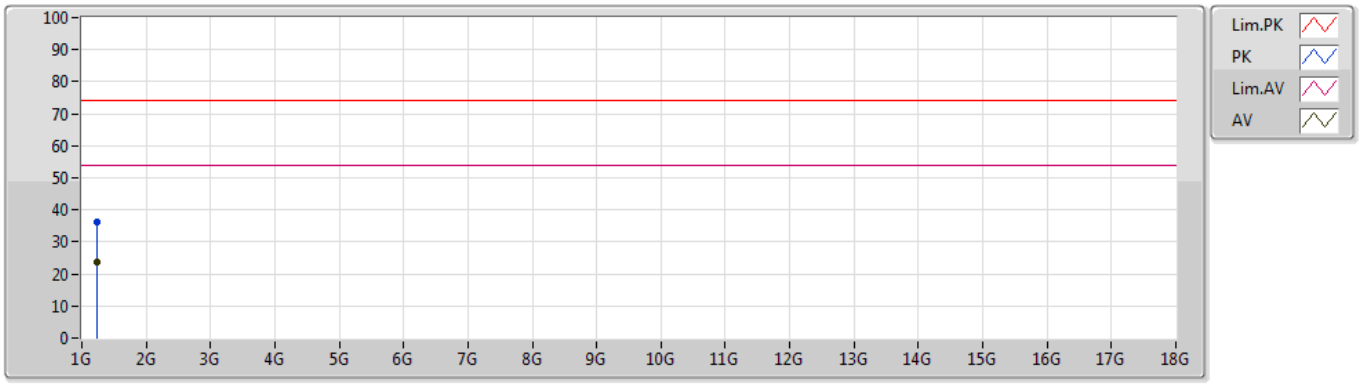
10/12/2020




| Type | Freq | Level | Limit | Margin | Factor | Dist | Condition | Azimuth | Height | Comment | Raw | AF | CL | PA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (Hz) | (dBuV/m) | (dBuV/m) | (dB) | (dB) | (m) | | (°) | (m) | | (dBuV) | (dB) | (dB) | (dB) |
| PK | 1.23594G | 36.67 | 74.00 | -37.33 | -8.14 | 3 | Vertical | 290 | 1.58 | - | 44.81 | 25.14 | 2.32 | 35.60 |
| AV | 1.23588G | 24.70 | 54.00 | -29.30 | -8.14 | 3 | Vertical | 290 | 1.58 | "Worst" | 32.84 | 25.14 | 2.32 | 35.60 |

## Mode 1

10/12/2020



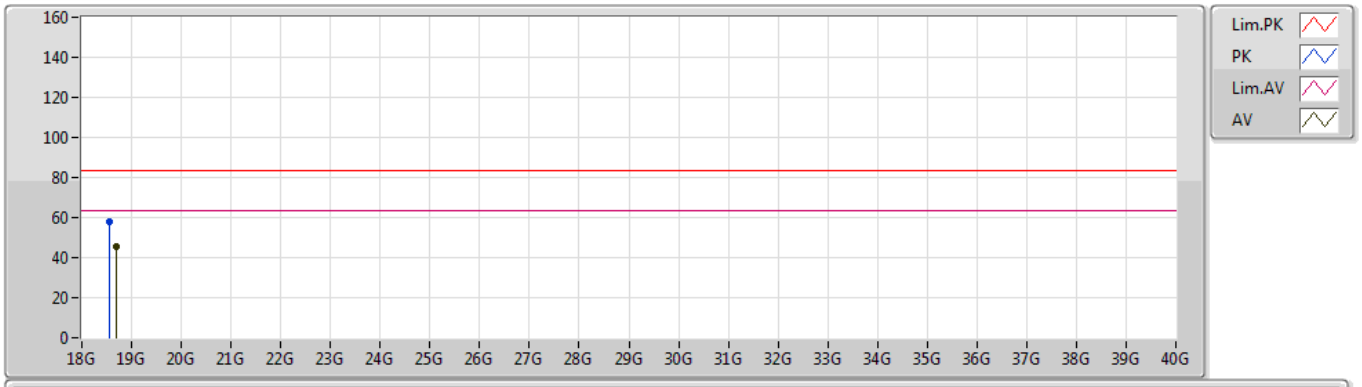

| Type | Freq | Level | Limit | Margin | Factor | Dist | Condition | Azimuth | Height | Comment | Raw | AF | CL | PA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (Hz) | (dBuV/m) | (dBuV/m) | (dB) | (dB) | (m) | | (°) | (m) | | (dBuV) | (dB) | (dB) | (dB) |
| PK | 1.236G | 36.34 | 74.00 | -37.66 | -8.14 | 3 | Horizontal | 113 | 1.65 | - | 44.48 | 25.14 | 2.32 | 35.60 |
| AV | 1.2361G | 23.75 | 54.00 | -30.25 | -8.14 | 3 | Horizontal | 113 | 1.65 | "Worst" | 31.89 | 25.14 | 2.32 | 35.60 |

Summary

| Mode | Result | Type | Freq (Hz) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Condition |
|---|---|---|---|---|---|---|---|
| Mode 1 | Pass | AV | 18.166G | 47.28 | 63.54 | -16.26 | Horizontal |

## Mode 1

20/01/2021

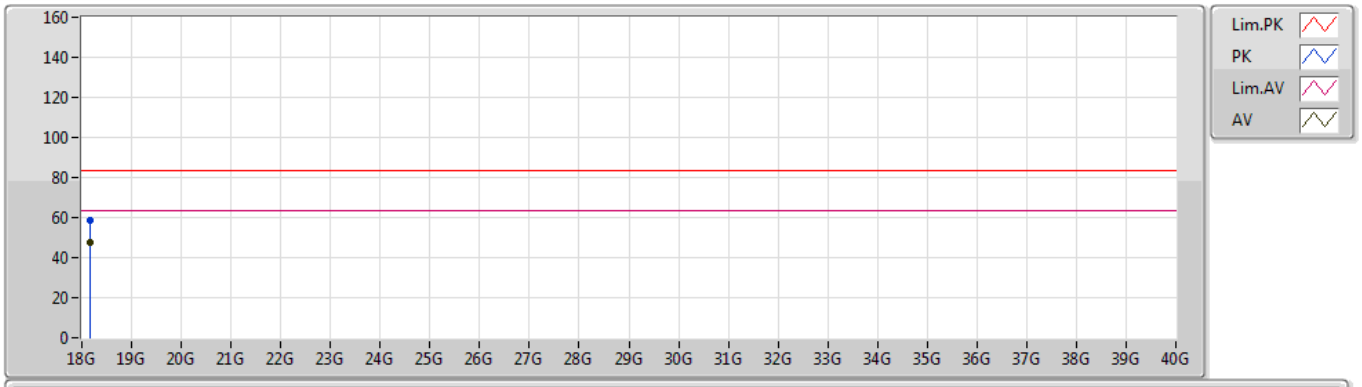



EUT Y
CTX Index7 24.125GHz
Power 1 High Power
04-E-C-5

| Type | Freq | Level | Limit | Margin | Factor | Dist | Condition | Azimuth | Height | Comment | Raw | AF | CL | PA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (Hz) | (dBuV/m) | (dBuV/m) | (dB) | (dB) | (m) | | (°) | (m) | | (dBuV) | (dB) | (dB) | (dB) |
| PK | 18.551G | 58.23 | 83.54 | -25.31 | 1.74 | 1 | Vertical | 150 | 356 | - | 56.49 | 37.77 | 14.26 | 50.29 |
| AV | 18.697G | 45.67 | 63.54 | -17.87 | 1.99 | 1 | Vertical | 150 | 356 | - | 43.68 | 37.98 | 14.27 | 50.26 |

**Mode 1**

20/01/2021




EUT Y
CTX Index7 24.125GHz
Power 1 High Power
04-E-C-5

| Type | Freq | Level | Limit | Margin | Factor | Dist | Condition | Azimuth | Height | Comment | Raw | AF | CL | PA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (Hz) | (dBuV/m) | (dBuV/m) | (dB) | (dB) | (m) | | (°) | (m) | | (dBuV) | (dB) | (dB) | (dB) |
| PK | 18.165G | 58.29 | 83.54 | -25.25 | 1.42 | 1 | Horizontal | 153 | 261 | - | 56.87 | 37.43 | 14.22 | 50.23 |
| AV | 18.166G | 47.28 | 63.54 | -16.26 | 1.42 | 1 | Horizontal | 153 | 261 | - | 45.86 | 37.43 | 14.22 | 50.23 |

| **Test Frequency:** 24125 MHz | | | | **Test Range:** 40 GHz – 100 GHz | | | |
|---|---|---|---|---|---|---|---|
| | | | | **Test Distance:** 1m | | | |
| **Test Results** | | | | | | | |
| **Freq. (GHz)** | **Measurement Distance (m)** | **Measurement Peak (dBm)** | **Rx Antenna Gain (dBi)** | **Measurement EIRP (dBm)** | **Measurement Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** |
| 48.229 | 1 | -82.09 | 23.9 | -39.88 | 67.118 | 117.50 | -50.382 |
| **Freq. (GHz)** | **Measurement Distance (m)** | **Measurement Average (dBm)** | **Rx Antenna Gain (dBi)** | **Measurement EIRP (dBm)** | **Measurement Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** |
| 48.254 | 1 | -87.65 | 23.9 | -45.44 | 61.562 | 97.50 | -35.938 |

EIRP = Prx – Grx + Free Space Path Loss = Prx – Grx + 20Log(4πd/ λ)2