# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

## INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT CLASS II PC REPORT

| | |
|---|---|
| **Applicant:** | MARS TOHKEN SOLUTION CO.LTD<br>1-10-7 Shinjuku, Shinjuku-ku, Tokyo 160-0022, Japan |
| **Product Name:** | UHF RFID READER/WRITER MODULE |
| **Brand Name:** | MARS |
| **Model No.:** | FRU-4100Q |
| **Model Difference:** | N/A |
| **Report Number:** | E2/2020/40028 |
| **FCC ID:** | WK4FRU4100Q |
| **FCC Rule Part:** | §15.247, Cat: DSS |
| **Issue Date:** | May 20, 2020 |
| **Date of Test:** | Apr. 16, 2020 ~ Apr. 28, 2020 |
| **Date of EUT Received:** | Apr. 16, 2020 |

## We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits.

The test results of this report relate only to the tested sample identified in this report.

***Approved By:*** CHUN-CHIEH, CHEN

***Chun Chieh Chen / Supervisor***

Testing Laboratory
0513

| Revision History | | | | |
|---|---|---|---|---|
| **Report Number** | **Revision** | **Description** | **Issue Date** | **Remark** |
| E2/2020/40028 | Rev.00 | Original. | May 20, 2020 | Revised By: Yuri Tsai |

**Note:**

Disclaimer:
Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.

# Table of Contents

# 1 GENERAL INFORMATION

## 1.1 Product description

| | |
|---|---|
| Product Name: | UHF RFID READER/WRITER |
| Brand Name: | MaRS |
| Model No. of Host: | MRU-F5100US |
| Model Difference: | N/A |
| Hardware Version: | N/A |
| Software Version: | N/A |
| Model No. of RFID Module: | FRU-4100Q |
| Module FCC ID: | WK4FRU4100Q |
| Scope: | The test report covers the radiated emissions requirements of the standards referenced in the report to allow system level approval of the module in this specific host. |
| Class II Permissive change: | UHF RFID READER/WRITER MODULE INSTALLED IN UHF RFID READER/WRITER |
| Power Supply: | DC 12V / 24V |

| | |
|---|---|
| Radio Technology: | RFID |
| Frequency Range: | 902.75 – 927.25MHz |
| Channel number: | 50 channels |
| Modulation type: | PR-ASK, ASK |
| Transmit Power: | 28.99dBm (Peak) |
| Dwell Time: | <= 0.4s |
| Operating Mode: | Point-to-Point |
| Antenna Designation: | 1. Patch Antenna , Gain: 4.75dBi, Model No.: UAT-002<br>2. Patch Antenna , Gain: -1.5dBi, Model No.: UAT-006<br>3. Patch Antenna , Gain: 4.12dBi, Model No.: A6034_70809<br>4. Patch Antenna , Gain: 5.7dBi, Model No.: RAF2031 |

## 1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247

FCC KDB 558074 D01 15.247 Meas Guidance v05r02

ANSI C63.10:2013

## 1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory (TAF code 0513)
No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333

FCC Designation number: TW0002

## 1.4 Special Accessories

There is no special accessory used while test was conducted.

## 1.5 Equipment Modifications

There was no modification incorporated into the EUT.

# 2 SYSTEM TEST CONFIGURATION

## 2.1 EUT Configuration

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

## 2.2 EUT Exercise

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

## 2.3 Test Procedure

### 2.3.1 Conducted Emissions

The EUT is a placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz. The CISPR Quasi-Peak and Average detector mode is employed. The two LISNs provide 50uH/50 ohm of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

### 2.3.2 Conducted Test (RF)

The active antenna port of the unlicensed wireless device is connected to the spectrum analyzer with attenuator to protect the instrumentation. If a second antenna port is available, it is tested at one operating frequency, with other port(s) appropriately terminated, to verify it has similar output characteristics as the fully tested port.

### 2.3.3 Radiated Emissions

The EUT is a placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m 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 transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.

## 2.4 Measurement Results Explanation Example

### 2.4.1 Radiated Emission Test Sites For Measurements From 9 kHz To 30 MHz

Radiated emission below 30MHz is measured in a 9m*9m*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field test site.
There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

### 2.4.2 For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

## 2.5 Configuration of Tested System

**Fig. 2-1 Configuration of Tested System**


**Table 2-1 Equipment Used in Tested System**

| Item | Equipment | Mfr/Brand | Model/Type No. | Series No. | Data Cable | Power Cord |
|---|---|---|---|---|---|---|
| 1. | RFID Test Software | N/A | N/A | N/A | N/A | N/A |

# 3 SUMMARY OF TEST RESULTS

| FCC Rules | Description Of Test | Result |
|---|---|---|
| §15.247(b)(2) | Peak Output Power | Compliant |
| §15.205<br>§15.209<br>§15.247(d) | Radiated Spurious Emission | Compliant |
| §15.203 | Antenna Requirement | Compliant |

# 4 DESCRIPTION OF TEST MODES

## 4.1 Operated in 902.25 ~ 920.75MHz Band

Channel Low: channel 1 at 902.75MHz
Channel Mid: channel 25 at 914.75MHz
Channel High: channel 50 at 927.25MHz

50 channels are provided for RFID

| CH | FREQUENCY | CH | FREQUENCY | CH | FREQUENCY |
|---|---|---|---|---|---|
| 1 | 902.75MHz | 21 | 912.75MHz | 41 | 922.75MHz |
| 2 | 903.25MHz | 22 | 913.25MHz | 42 | 923.25MHz |
| 3 | 903.75MHz | 23 | 913.75MHz | 43 | 923.75MHz |
| 4 | 904.25MHz | 24 | 914.25MHz | 44 | 924.25MHz |
| 5 | 904.75MHz | 25 | 914.75MHz | 45 | 924.75MHz |
| 6 | 905.25MHz | 26 | 915.25MHz | 46 | 925.25MHz |
| 7 | 905.75MHz | 27 | 915.75MHz | 47 | 925.75MHz |
| 8 | 906.25MHz | 28 | 916.25MHz | 48 | 926.25MHz |
| 9 | 906.75MHz | 29 | 916.75MHz | 49 | 926.75MHz |
| 10 | 907.25MHz | 30 | 917.25MHz | 50 | 927.25MHz |
| 11 | 907.75MHz | 31 | 917.75MHz | | |
| 12 | 908.25MHz | 32 | 918.25MHz | | |
| 13 | 908.75MHz | 33 | 918.75MHz | | |
| 14 | 909.25MHz | 34 | 919.25MHz | | |
| 15 | 909.75MHz | 35 | 919.75MHz | | |
| 16 | 910.25MHz | 36 | 920.25MHz | | |
| 17 | 910.75MHz | 37 | 920.75MHz | | |
| 18 | 911.25MHz | 38 | 921.25MHz | | |
| 19 | 911.75MHz | 39 | 921.75MHz | | |
| 20 | 912.25MHz | 40 | 922.25MHz | | |

## 4.2 The Worst Test Modes and Channel Details

1 The EUT has been tested under operating condition.
2 Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.
3 Investigation has been done on all the possible configurations for searching the worst case.

| MODE | AVAILABLE FREQUENCY (MHz) | TESTED FREQUENCY (MHz) | MODULATION |
|---|---|---|---|
| **RADIATED EMISSION TEST (BELOW 1 GHz)** | | | |
| RFID | 902.75 to 927.25 | 902.75, 914.75, 927.25 | ASK |
| **RADIATED EMISSION TEST (ABOVE 1 GHz)** | | | |
| RFID | 902.75 to 927.25 | 902.75, 914.75, 927.25 | ASK |
| **Note:** The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for RFID Transmitter for channel Low, Mid and High, the worst case H position was reported. | | | |

Note: The completed set of measurement was done on the antenna RAF2031 to be presented on this test report.

| **ANTENNA PORT CONDUCTED TEST** | | | |
|---|---|---|---|
| MODE | AVAILABLE FREQUENCY (MHz) | TESTED FREQUENCY (MHz) | MODULATION |
| **Peak Output Power** | | | |
| RFID | 902.75 to 927.25 | 902.75, 914.75, 927.25 | ASK |

# 5 MEASUREMENT UNCERTAINTY

| Test Items | Uncertainty |
|---|---|
| AC Power Line Conducted Emission | +/- 2.586 dB |
| Peak Output Power | +/- 1.55 dB |
| 20dB Bandwidth | +/- 123.36 Hz |
| 100 KHz Bandwidth Of Frequency Band Edges | +/- 0.84 dB |
| Frequency Separation | +/- 123.36 Hz |
| Number of hopping frequency | +/- 123.36 Hz |
| Time of Occupancy | +/- 123.36 Hz |
| Temperature | +/- 0.65 °C |
| Humidity | +/- 4.6 % |
| DC / AC Power Source | DC= +/- 0.13%, AC= +/- 0.2% |

| Radiated Spurious Emission Measurement Uncertainty | |
|---|---|
| **Polarization: Vertical** | 9kHz~30MHz: +-2.3dB |
| | 30MHz - 180MHz: +/- 3.37dB |
| | 180MHz -417MHz: +/- 3.19dB |
| | 0.417GHz-1GHz: +/- 3.19dB |
| | 1GHz - 18GHz: +/- 4.04dB |
| | 18GHz - 40GHz: +/- 4.04dB |
| **Polarization: Horizontal** | 9kHz~30MHz: +-2.3dB |
| | 30MHz - 167MHz: +/- 4.22dB |
| | 167MHz -500MHz: +/- 3.44dB |
| | 0.5GHz-1GHz: +/- 3.39dB |
| | 1GHz - 18GHz: +/- 4.08dB |
| | 18GHz - 40GHz: +/- 4.08dB |

***Note:***

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

# 6 PEAK OUTPUT POWER MEASUREMENT

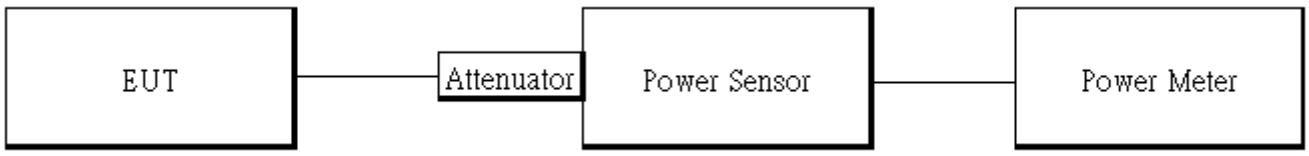
## 6.1 Standard Applicable

For frequency hopping systems operating in the 902-928 MHz band employing at least 50 hopping channels, conducted output power shall not exceed 1Watt.
For systems employing less than 50 hopping channels, conducted output power shall not exceed 0.25Watt.

## 6.2 Measurement Equipment Used

| Conducted Emission Test Site | | | | | |
|---|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Date** | **Calibration Due** |
| Power Meter | Anritsu | ML2496A | 1326001 | 08/05/2019 | 08/04/2020 |
| Power Sensor | Anritsu | MA2411B | 1315048 | 08/05/2019 | 08/04/2020 |
| Power Sensor | Anritsu | MA2411B | 1315049 | 08/05/2019 | 08/04/2020 |
| Attenuator | Woken | WATT-218FS-10 | RF23 | 11/20/2019 | 11/19/2020 |
| DC Block | PASTERNACK | PE8210 | RF32 | 11/20/2019 | 11/19/2020 |
| Attenuator | Marvelous | WATT-218FS-10 | RF270 | 11/20/2019 | 11/19/2020 |

## 6.3 Test Set-up:




## 6.4 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter or spectrum. (Max Hold, Detector = Peak, RBW >=20dB bandwidth)
4. Record the max. reading.
5. Repeat above procedures until all default test channel is completed.

## 6.5 Measurement Result

| RFID | | | | | | | |
|---|---|---|---|---|---|---|---|
| CH | Freq. (MHz) | Peak Output Power (dBm) | Peak Output Power (mW) | Limit | | | RESULT |
| 1 | 902.75 | 28.90 | 776.25 | 1 Watt = | 30.00 | dBm | PASS |
| 25 | 914.75 | **28.99** | **792.50** | 1 Watt = | 30.00 | dBm | PASS |
| 50 | 927.25 | 28.85 | 767.36 | 1 Watt = | 30.00 | dBm | PASS |
| **RFID** | | | | | | | |
| CH | Freq. (MHz) | Avg. Output Power (dBm) | Avg. Output Power (mW) | Limit | | | RESULT |
| 1 | 902.75 | 26.91 | 490.91 | 1 Watt = | 30.00 | dBm | PASS |
| 25 | 914.75 | **26.93** | **493.17** | 1 Watt = | 30.00 | dBm | PASS |
| 50 | 927.25 | 26.86 | 485.29 | 1 Watt = | 30.00 | dBm | PASS |

# 7 SPURIOUS RADIATED EMISSION TEST

## 7.1 Standard Applicable

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. In addition, radiated emissions which fall in the restricted bands must also comply with the §15.209 limit as below.
And according to §15.33(a) (1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

| Frequency (MHz) | Field strength (microvolts/meter) | Distance (meters) |
|---|---|---|
| 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 |

**Note:**

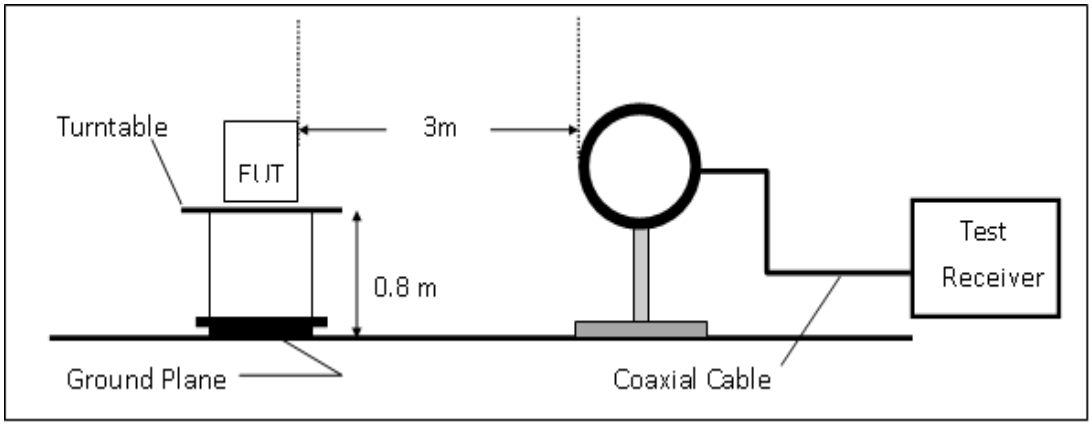
1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBμV/m) = 20 log Emission level (μV/m)

## 7.2 Measurement Equipment Used:

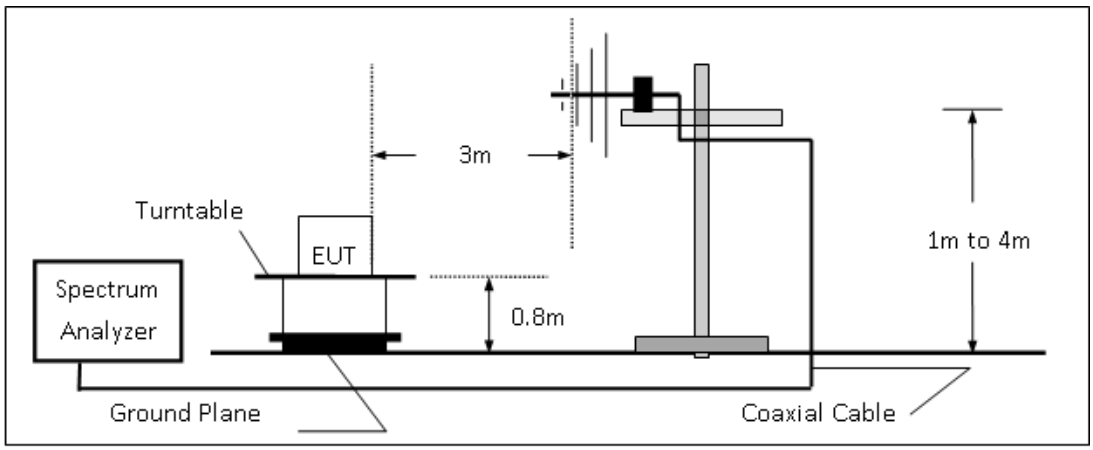
| 966 Chamber | | | | | |
|---|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Date** | **Calibration Due** |
| Broadband Antenna | TESEQ | CBL 6112D | 35240 | 09/09/2019 | 09/08/2020 |
| Horn Antenna | Schwarzbeck | BBHA9120D | 1187 | 01/10/2020 | 01/09/2021 |
| Loop Antenna | ETS.LINDGREN | 6502 | 148045 | 10/15/2019 | 10/14/2020 |
| Spectrum Analyzer | KEYSIGHT | N9010A | MY57120200 | 03/17/2020 | 03/16/2021 |
| Pre-Amplifier | EMC Instruments | EMC330 | 980096 | 11/20/2019 | 11/19/2020 |
| Pre-Amplifier | EMC Instruments | EMC0011830 | 980199 | 11/20/2019 | 11/19/2020 |
| Pre-Amplifier | EMC Instruments | EMC184045B | 980135 | 11/20/2019 | 11/19/2020 |
| Attenuator | Woken | WATT-218FS-10 | RF25 | 11/20/2019 | 11/19/2020 |
| Highpass Filter | Micro Tronics | BRM50701-01 | G008 | 11/20/2019 | 11/19/2020 |
| Coaxial Cable | Huber Suhner | SUCOFLEX 104 | MY17388/4 | 11/20/2019 | 11/19/2020 |
| Coaxial Cable | Huber Suhner | RG 214/U | W22.03 | 11/20/2019 | 11/19/2020 |

## 7.3 Test SET-UP:

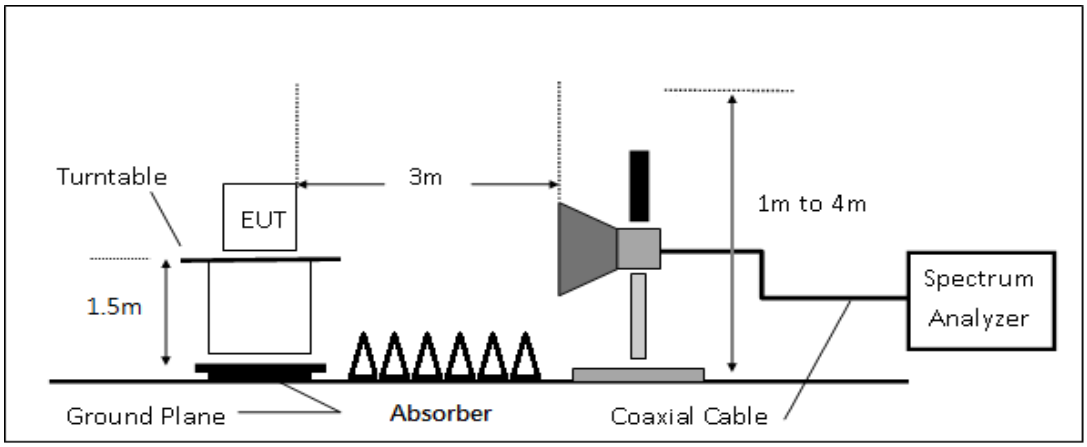
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.




(B) Radiated Emission Test Set-Up, Frequency form 30MHz to 1000MHz




(C) Radiated Emission Test Set-UP Frequency Over 1 GHz



## 7.4 Measurement Procedure:

### Radiated Emission:

1. The testing follows ANSI C63.10:2013.
2. The EUT was placed on a turn table with 0.8m for frequency< 1GHz and 1.5m for frequency> 1GHz above ground plan.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
5. Set the spectrum analyzer as RBW=120 kHz and VBW=300 kHz for Peak Detector (PK) and Quasi-peak (QP) at frequency below 1 GHz.
6. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Peak Detector at frequency above 1 GHz.
7. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Detector at frequency above 1 GHz.
8. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.
9. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
10. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
11. Repeat above procedures until all default test channel measured were complete.

## 7.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

**FS = RA + AF + CL - AG**

| | |
|---|---|
| Where FS = Field Strength | CL = Cable Attenuation Factor (Cable Loss) |
| RA = Reading Amplitude | AG = Amplifier Gain |
| AF = Antenna Factor | |

The limit of the emission level is expressed in dBuV/m, which converts 20*log(uV/m)

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

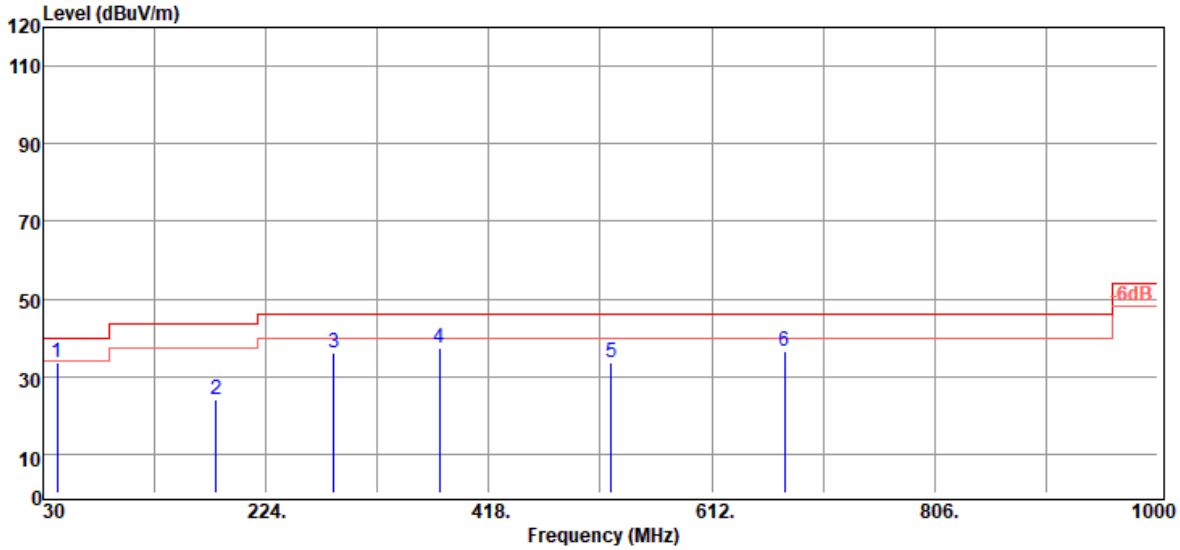
## 7.6 Test Results of Radiated Spurious Emissions form 9 KHz to 30 MHz

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit per 15.31(o) was not reported.

## 7.7 Measurement Result:

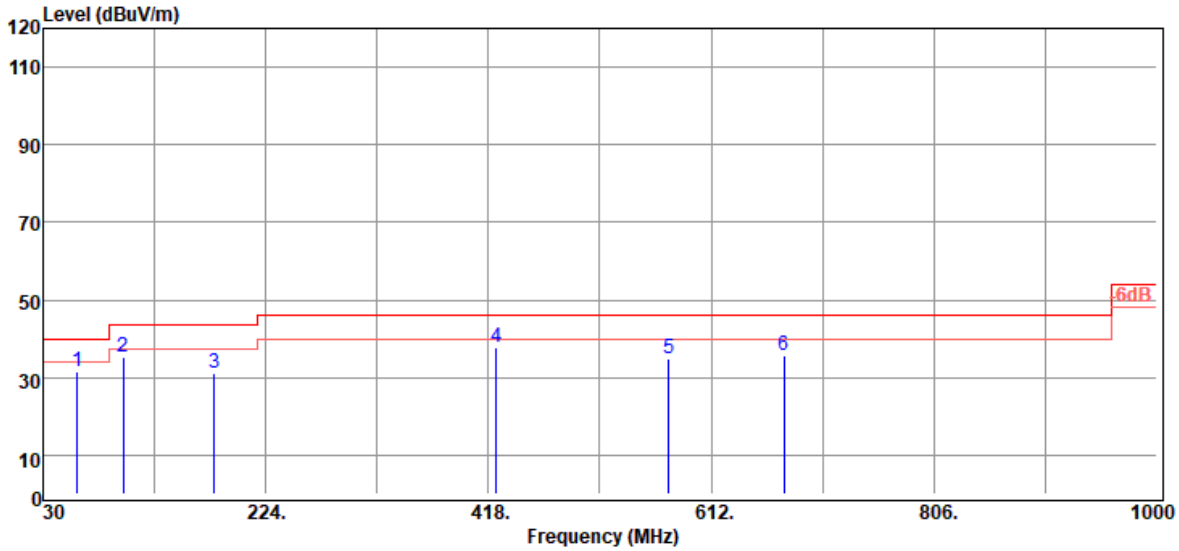
### 7.7.1 Radiated Spurious Emission form 30MHz to 1000MHz:

| | | | |
|---|---|---|---|
| Report Number | :E2/2020/40028 | Test Date | :2020-04-27 |
| Operation Mode | :RFID | Temp./Humi. | :21.2/69 |
| Test Frequency | :902.75 MHz | Antenna Pol. | :VERTICAL |
| Test Mode | :TX CH LOW | Engineer | :Enzo |
| EUT Pol | :H Plan | | |



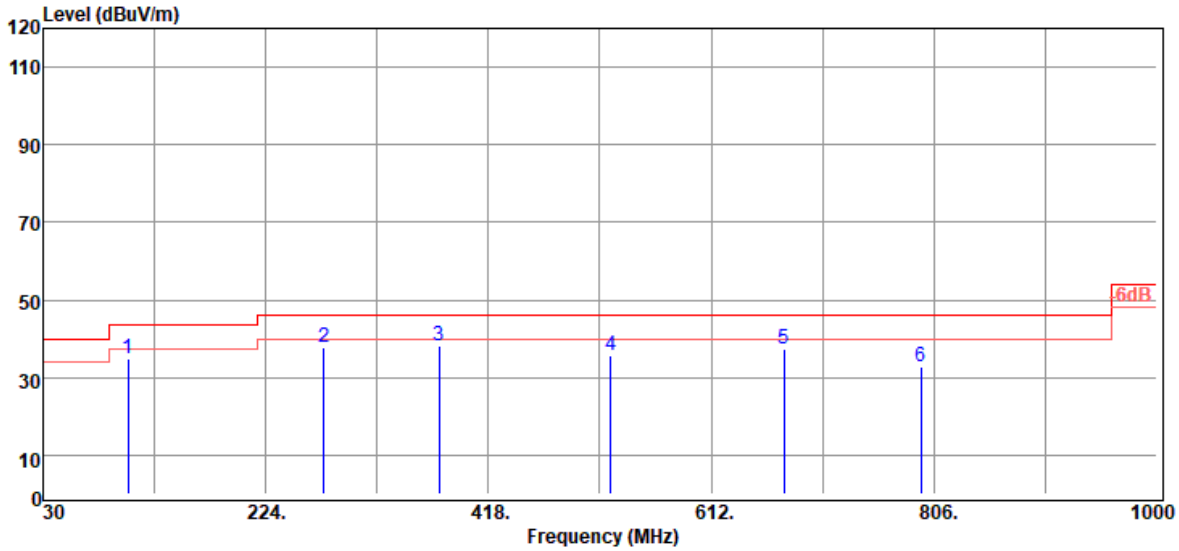

| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 42.61 | Peak | 43.99 | -10.46 | 33.53 | 40.00 | -6.47 |
| 180.35 | Peak | 39.78 | -15.57 | 24.21 | 43.50 | -19.29 |
| 283.17 | Peak | 47.06 | -10.81 | 36.25 | 46.00 | -9.75 |
| 375.32 | Peak | 45.70 | -8.28 | 37.42 | 46.00 | -8.58 |
| 524.70 | Peak | 38.49 | -4.86 | 33.63 | 46.00 | -12.37 |
| 675.05 | Peak | 38.92 | -2.20 | 36.72 | 46.00 | -9.28 |

| | | | |
|---|---|---|---|
| Report Number | :E2/2020/40028 | Test Date | :2020-04-27 |
| Operation Mode | :RFID | Temp./Humi. | :21.2/69 |
| Test Frequency | :902.75 MHz | Antenna Pol. | :HORIZONTAL |
| Test Mode | :TX CH LOW | Engineer | :Enzo |
| EUT Pol | :H Plan | | |



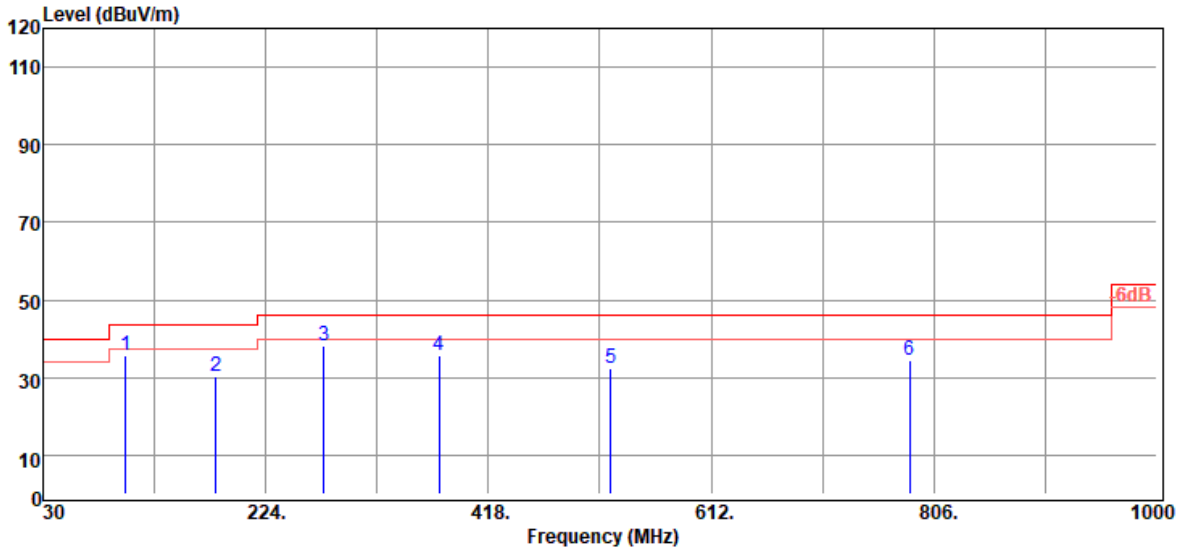

| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 60.07 | Peak | 51.59 | -20.22 | 31.37 | 40.00 | -8.63 |
| 99.84 | Peak | 50.79 | -15.66 | 35.13 | 43.50 | -8.37 |
| 179.38 | Peak | 46.85 | -15.53 | 31.32 | 43.50 | -12.18 |
| 424.79 | Peak | 44.04 | -6.20 | 37.84 | 46.00 | -8.16 |
| 575.14 | Peak | 38.28 | -3.31 | 34.97 | 46.00 | -11.03 |
| 675.05 | Peak | 37.93 | -2.20 | 35.73 | 46.00 | -10.27 |

| | | | |
|---|---|---|---|
| Report Number | :E2/2020/40028 | Test Date | :2020-04-27 |
| Operation Mode | :RFID | Temp./Humi. | :21.2/69 |
| Test Frequency | :914.75 MHz | Antenna Pol. | :VERTICAL |
| Test Mode | :TX CH MID | Engineer | :Enzo |
| EUT Pol | :H Plan | | |



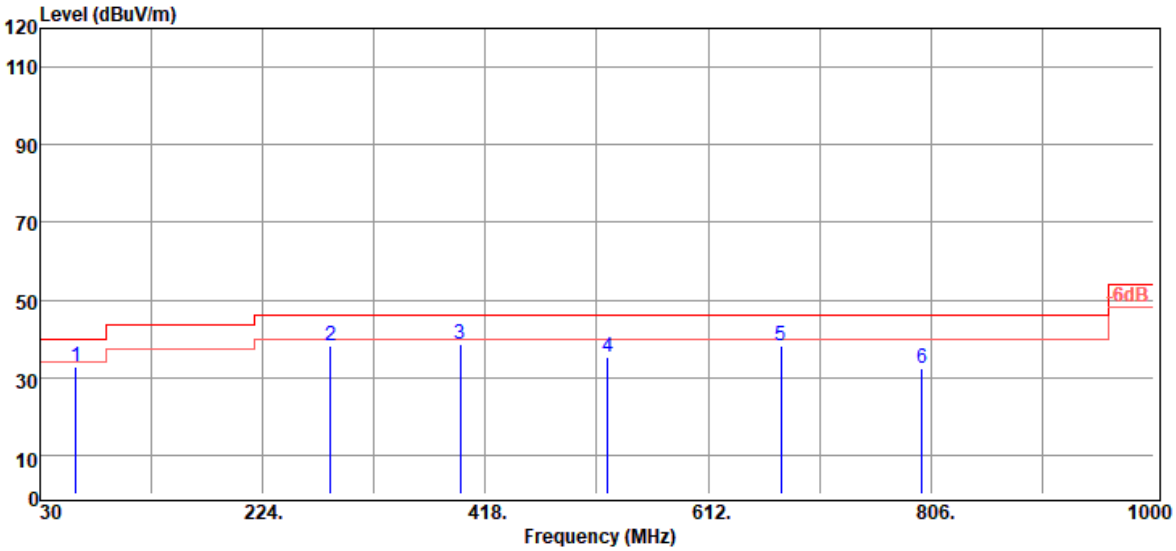

| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 103.72 | Peak | 49.87 | -15.01 | 34.86 | 43.50 | -8.64 |
| 274.44 | Peak | 48.87 | -11.10 | 37.77 | 46.00 | -8.23 |
| 375.32 | Peak | 46.66 | -8.28 | 38.38 | 46.00 | -7.62 |
| 524.70 | Peak | 40.60 | -4.86 | 35.74 | 46.00 | -10.26 |
| 675.05 | Peak | 39.74 | -2.20 | 37.54 | 46.00 | -8.46 |
| 794.36 | Peak | 32.45 | 0.24 | 32.69 | 46.00 | -13.31 |

| | | | |
|---|---|---|---|
| Report Number | :E2/2020/40028 | Test Date | :2020-04-27 |
| Operation Mode | :RFID | Temp./Humi. | :21.2/69 |
| Test Frequency | :914.75 MHz | Antenna Pol. | :HORIZONTAL |
| Test Mode | :TX CH MID | Engineer | :Enzo |
| EUT Pol | :H Plan | | |



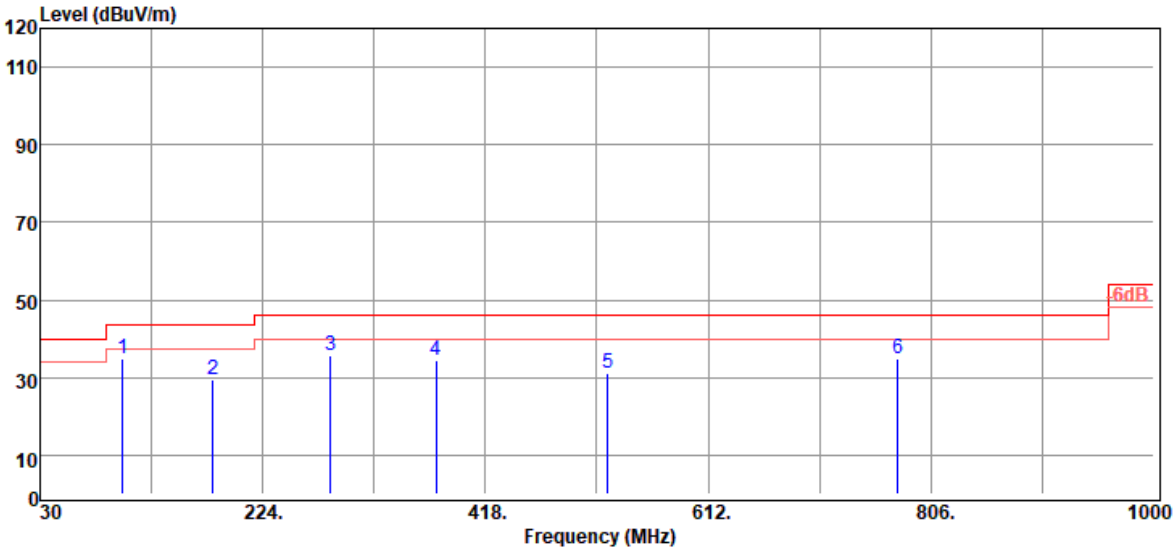

| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 101.78 | Peak | 50.89 | -15.21 | 35.68 | 43.50 | -7.82 |
| 180.35 | Peak | 46.06 | -15.57 | 30.49 | 43.50 | -13.01 |
| 274.44 | Peak | 49.42 | -11.10 | 38.32 | 46.00 | -7.68 |
| 375.32 | Peak | 44.18 | -8.28 | 35.90 | 46.00 | -10.10 |
| 524.70 | Peak | 37.16 | -4.86 | 32.30 | 46.00 | -13.70 |
| 784.66 | Peak | 34.11 | 0.21 | 34.32 | 46.00 | -11.68 |

| | | | |
|---|---|---|---|
| Report Number | :E2/2020/40028 | Test Date | :2020-04-27 |
| Operation Mode | :RFID | Temp./Humi. | :21.2/69 |
| Test Frequency | :927.25 MHz | Antenna Pol. | :VERTICAL |
| Test Mode | :TX CH HIGH | Engineer | :Enzo |
| EUT Pol | :H Plan | | |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 61.04 | Peak | 52.88 | -20.14 | 32.74 | 40.00 | -7.26 |
| 283.17 | Peak | 48.90 | -10.81 | 38.09 | 46.00 | -7.91 |
| 395.69 | Peak | 46.37 | -7.68 | 38.69 | 46.00 | -7.31 |
| 524.70 | Peak | 40.28 | -4.86 | 35.42 | 46.00 | -10.58 |
| 675.05 | Peak | 40.41 | -2.20 | 38.21 | 46.00 | -7.79 |
| 798.24 | Peak | 32.32 | 0.12 | 32.44 | 46.00 | -13.56 |

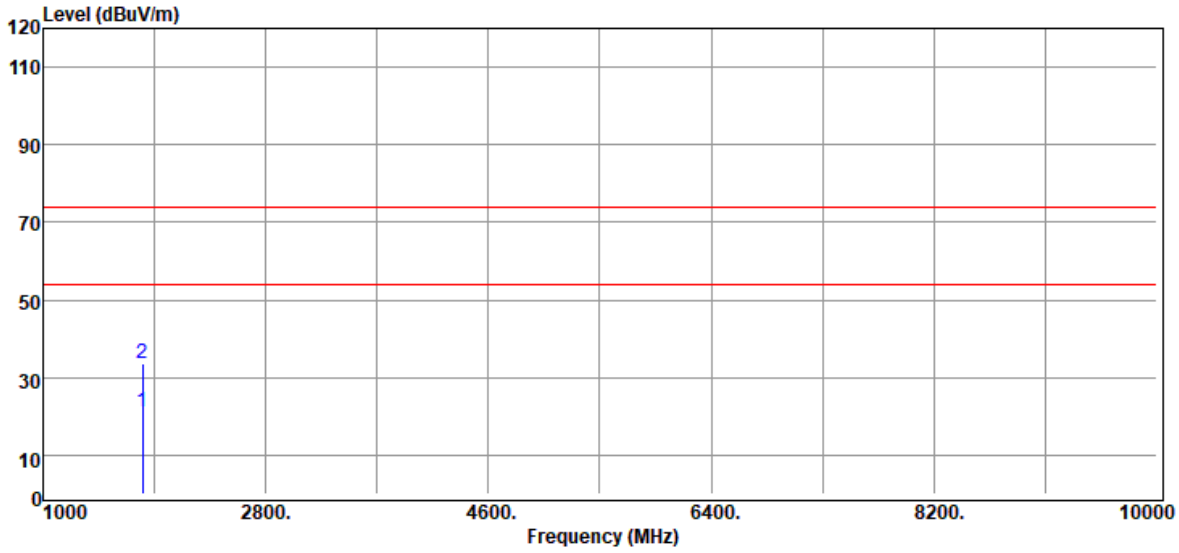
| | | | |
|---|---|---|---|
| Report Number | :E2/2020/40028 | Test Date | :2020-04-27 |
| Operation Mode | :RFID | Temp./Humi. | :21.2/69 |
| Test Frequency | :927.25 MHz | Antenna Pol. | :HORIZONTAL |
| Test Mode | :TX CH HIGH | Engineer | :Enzo |
| EUT Pol | :H Plan | | |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 101.78 | Peak | 50.24 | -15.21 | 35.03 | 43.50 | -8.47 |
| 180.35 | Peak | 45.05 | -15.57 | 29.48 | 43.50 | -14.02 |
| 283.17 | Peak | 46.69 | -10.81 | 35.88 | 46.00 | -10.12 |
| 375.32 | Peak | 42.89 | -8.28 | 34.61 | 46.00 | -11.39 |
| 524.70 | Peak | 36.16 | -4.86 | 31.30 | 46.00 | -14.70 |
| 776.90 | Peak | 34.78 | 0.03 | 34.81 | 46.00 | -11.19 |

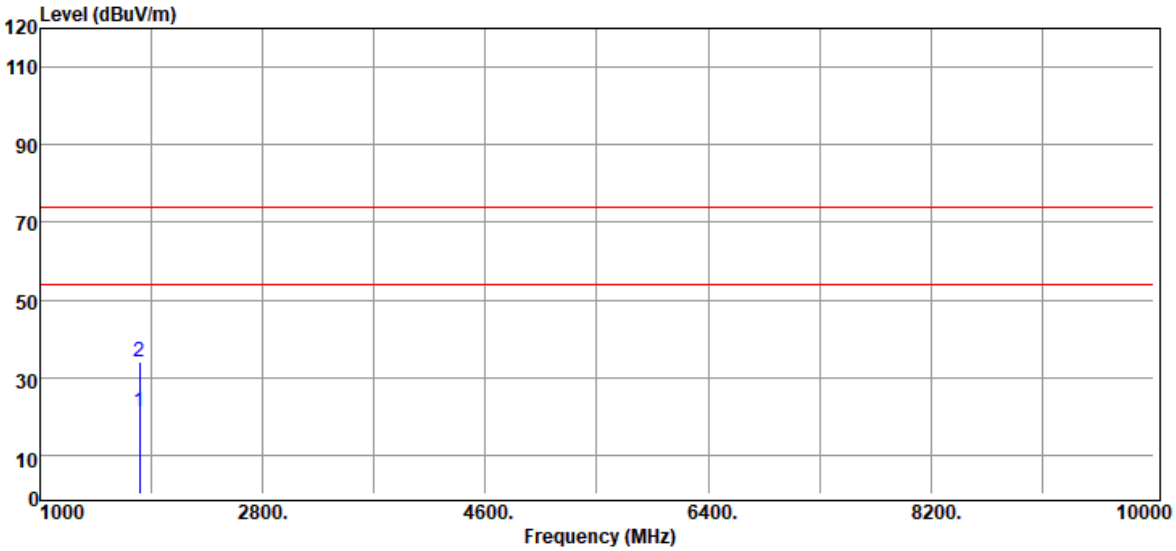
### 7.7.2 Radiated Spurious Emission above 1 GHz:

| | | | |
|---|---|---|---|
| Report Number | :E2/2020/40028 | Test Date | :2020-04-27 |
| Operation Mode | :RFID | Temp./Humi. | :21.2/69 |
| Test Frequency | :902.75 MHz | Antenna Pol. | :VERTICAL |
| Test Mode | :TX CH LOW | Engineer | :Enzo |
| EUT Pol | :H Plan | | |



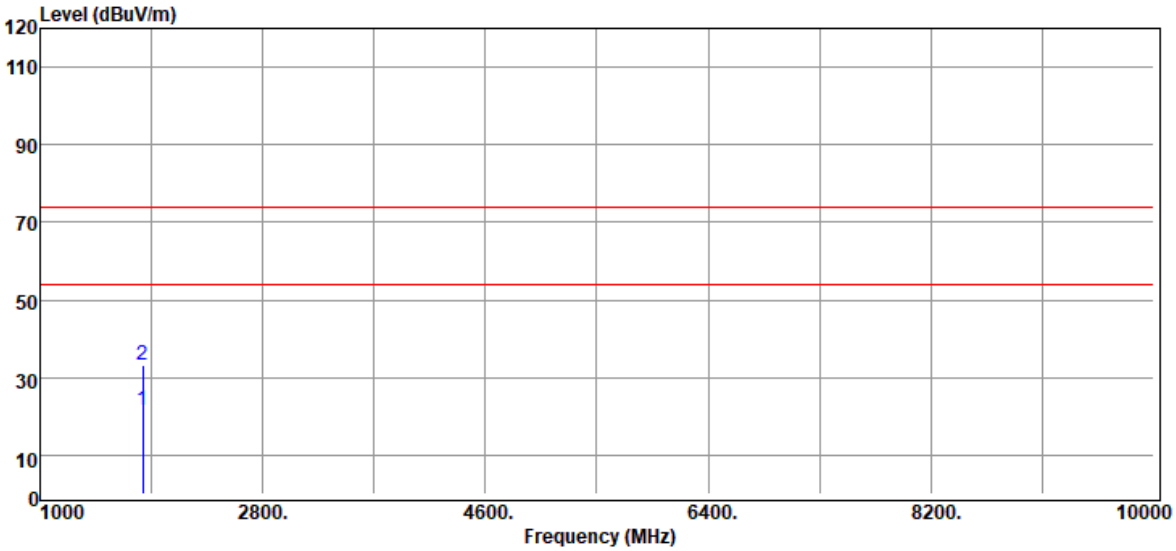

| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 1805.50 | Average | 20.25 | 1.09 | 21.34 | 54.00 | -32.66 |
| 1805.50 | Peak | 32.50 | 1.09 | 33.59 | 74.00 | -40.41 |

| | | | |
|---|---|---|---|
| Report Number | :E2/2020/40028 | Test Date | :2020-04-27 |
| Operation Mode | :RFID | Temp./Humi. | :21.2/69 |
| Test Frequency | :902.75 MHz | Antenna Pol. | :HORIZONTAL |
| Test Mode | :TX CH LOW | Engineer | :Enzo |
| EUT Pol | :H Plan | | |



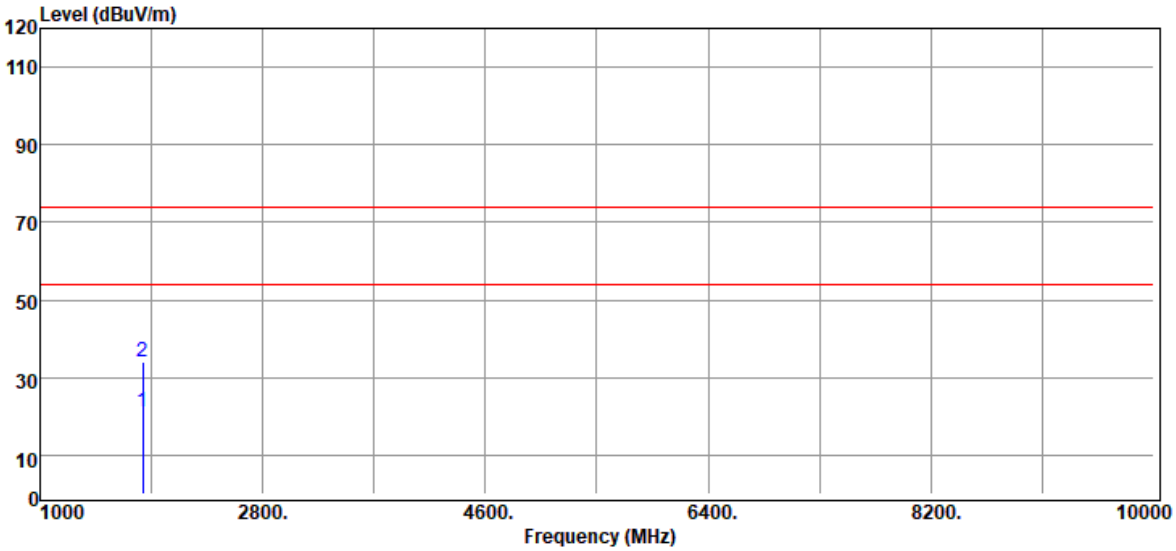

| Freq. | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|
| MHz | PK/QP/AV | dBµV | dB | dBµV/m | dBµV/m | dB |
| 1805.50 | Average | 19.92 | 1.09 | 21.01 | 54.00 | -32.99 |
| 1805.50 | Peak | 32.78 | 1.09 | 33.87 | 74.00 | -40.13 |

| | | | |
|---|---|---|---|
| Report Number | :E2/2020/40028 | Test Date | :2020-04-27 |
| Operation Mode | :RFID | Temp./Humi. | :21.2/69 |
| Test Frequency | :914.75 MHz | Antenna Pol. | :VERTICAL |
| Test Mode | :TX CH MID | Engineer | :Enzo |
| EUT Pol | :H Plan | | |



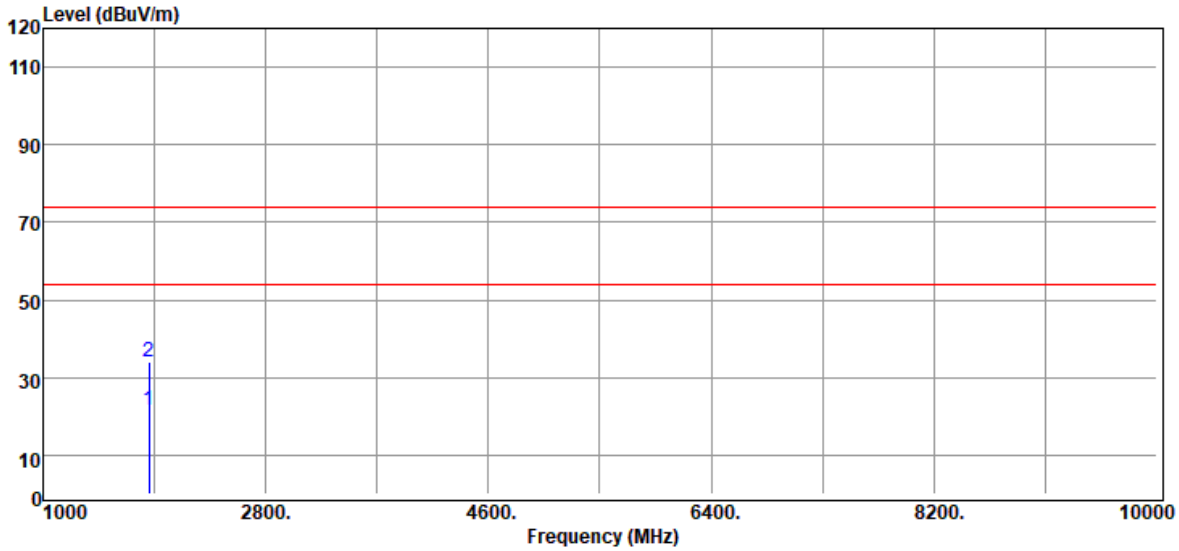

| Freq. | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|
| MHz | PK/QP/AV | dBµV | dB | dBµV/m | dBµV/m | dB |
| 1829.50 | Average | 20.31 | 1.18 | 21.49 | 54.00 | -32.51 |
| 1829.50 | Peak | 31.94 | 1.18 | 33.12 | 74.00 | -40.88 |

| | | | |
|---|---|---|---|
| Report Number | :E2/2020/40028 | Test Date | :2020-04-27 |
| Operation Mode | :RFID | Temp./Humi. | :21.2/69 |
| Test Frequency | :914.75 MHz | Antenna Pol. | :HORIZONTAL |
| Test Mode | :TX CH MID | Engineer | :Enzo |
| EUT Pol | :H Plan | | |



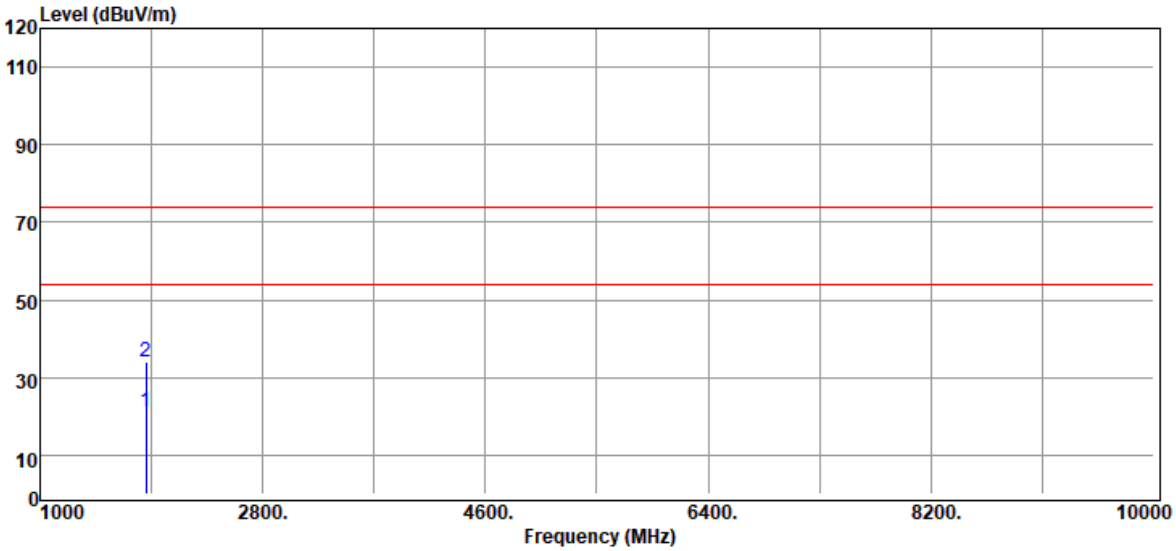

| Freq. | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|
| MHz | PK/QP/AV | dBµV | dB | dBµV/m | dBµV/m | dB |
| 1829.50 | Average | 19.98 | 1.18 | 21.16 | 54.00 | -32.84 |
| 1829.50 | Peak | 32.77 | 1.18 | 33.95 | 74.00 | -40.05 |

| | | | |
|---|---|---|---|
| Report Number | :E2/2020/40028 | Test Date | :2020-04-27 |
| Operation Mode | :RFID | Temp./Humi. | :21.2/69 |
| Test Frequency | :927.25 MHz | Antenna Pol. | :VERTICAL |
| Test Mode | :TX CH HIGH | Engineer | :Enzo |
| EUT Pol | :H Plan | | |




| Freq. | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|
| MHz | PK/QP/AV | dBµV | dB | dBµV/m | dBµV/m | dB |
| 1854.50 | Average | 20.21 | 1.25 | 21.46 | 54.00 | -32.54 |
| 1854.50 | Peak | 32.72 | 1.25 | 33.97 | 74.00 | -40.03 |

| | | | |
|---|---|---|---|
| Report Number | :E2/2020/40028 | Test Date | :2020-04-27 |
| Operation Mode | :RFID | Temp./Humi. | :21.2/69 |
| Test Frequency | :927.25 MHz | Antenna Pol. | :HORIZONTAL |
| Test Mode | :TX CH HIGH | Engineer | :Enzo |
| EUT Pol | :H Plan | | |




| Freq. | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---|---|---|---|---|---|---|
| MHz | PK/QP/AV | dBµV | dB | dBµV/m | dBµV/m | dB |
| 1854.50 | Average | 19.98 | 1.25 | 21.23 | 54.00 | -32.77 |
| 1854.50 | Peak | 32.92 | 1.25 | 34.17 | 74.00 | -39.83 |

# 8 ANTENNA REQUIREMENT

## 8.1 Standard Applicable

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

## 8.2 Antenna Connected Construction

The antenna is designed with unique RF connector and no consideration of replacement. Please see EUT photo for details.

***~ End of Report ~***