

# FCC Part 15 Subpart B&C §15.247

## Test Report

|                      |                                  |
|----------------------|----------------------------------|
| Equipment Under Test | IoT(Internet of Things) terminal |
| Model Name           | DC-20A                           |
| Variant Model Name   | -                                |
| FCC ID               | 2A2H7-DC-20A                     |
| IC Number            | -                                |
| Applicant            | DASH COMPANY Inc.                |
| Manufacturer         | DASH COMPANY Inc.                |
| Date of Test(s)      | 2021. 07. 01 ~ 2021. 07. 07      |
| Date of Issue        | 2021. 07. 29                     |

In the configuration tested, the EUT complied with the standards specified above.

| Issue to                                                                                                                   | Issue by                                                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>DASH COMPANY Inc.</b><br><i>109, Teheran-ro, Gangnam-gu,<br/>Seoul, Republic of Korea</i><br><br>Tel.: +82-70-4252-8775 | <b>MOVON Test Lab Co., Ltd</b><br>498-2, Geumeo-ro, Pogok-eup,<br>Cheoin-gu, Yongin-si, Gyeonggi-do,<br>Korea, 17030<br><br>Tel.: +82-31-338-8837<br>Fax: +82-31-338-8847 |

### Revision history

| Revision | Date of issue | Description | Revised by |
|----------|---------------|-------------|------------|
| --       | 2021.07.29    | Initial     | -          |
|          |               |             |            |

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## 1. Applicant Information

### 1.1. Details of applicant

Applicant : DASH COMPANY Inc.  
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Contact Person : Ho Yang  
Telephone : +82-70-4252-8775  
Fax : -

### 1.2. Manufacturer Information

Manufacturer : DASH COMPANY Inc.  
Address : 109, Teheran-ro, Gangnam-gu, Seoul, Republic of Korea

## 2. Laboratory Information

Company name : MOVON Test Lab Co., Ltd  
Test site number : FCC (KR0151)  
Address : 498-2, Geumeo-ro, Pogok-eup, Cheoin-gu, Yongin-si, Gyeonggi-do, South Korea  
Web site : <http://www.movonlab.co.kr>  
Telephone : +82-31-338-8837  
Facsimile : +82-31-338-8847

### 3. Summary of test results

The EUT has been tested according to the following specifications:

| FCC Rule<br>FCC part 15             | Description                                                             | Result               |
|-------------------------------------|-------------------------------------------------------------------------|----------------------|
| 15.203<br>15.247(b)(4)              | Antenna requirement                                                     | C                    |
| 15.247(a)(2)                        | DTS Bandwidth & 99 % bandwidth                                          | N/A <sup>Note1</sup> |
| 15.247(b)(3)                        | Maximum peak conducted output power                                     | N/A <sup>Note1</sup> |
| 15.247(e)                           | Peak Power Spectral Density                                             | N/A <sup>Note1</sup> |
| 15.205(a)<br>15.209(a)<br>15.247(d) | Transmitter radiated spurious emissions,<br>Conducted spurious emission | C                    |
| 15.207(a)                           | AC Conducted power line test                                            | N/A <sup>Note2</sup> |

#### ※ Abbreviation

C Complied  
N/A Not applicable  
F Fail

#### ※ Note

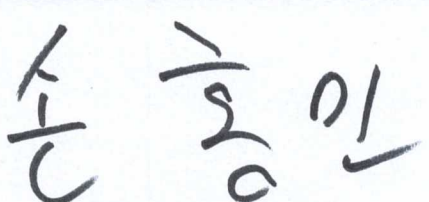
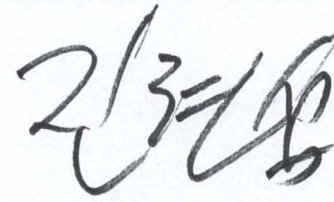
Note 1 : This test is not applicable because the EUT uses certified module

Note 2 : This test is not applicable because the EUT uses battery and it's not to be connected to the Public utility(AC) power line

#### The sample was tested according to the following specification:

FCC Parts 15.247; ANSI C63.4:2014, ANSI C63.10:2013  
FCC Public Notice KDB 558074 D01 v05r02

#### Approval Signatories

| Test and Report Completed by :                                                      | Report Approval by :                                                                 |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|  |  |
| Kin Son<br>Test Engineer<br>MOVON Test Lab Co., Ltd                                 | Issac Jin<br>Technical Manager<br>MOVON Test Lab Co., Ltd                            |

The above test certificate is a test report not related to the Korean Laboratory Accreditation Scheme.

#### 4. EUT Description

|                               |                                  |
|-------------------------------|----------------------------------|
| Kind of product               | IoT(Internet of Things) terminal |
| Model Name                    | DC-20A                           |
| Variant Model Name            | -                                |
| FCC ID                        | 2A2H7-DC-20A                     |
| IC Number                     | -                                |
| Power supply                  | DC 36.0 V                        |
| Frequency range               | 2 402 MHz ~ 2 480 MHz            |
| Modulation technique          | GFSK                             |
| Number of channels            | 40 ch                            |
| Antenna gain / Type           | 5.3 dB i / PCB Antenna           |
| Test Site Registration Number | └                                |
| H/W version / S/W version     | 1.0 / 1.0                        |
| Test S/W version              | v0.9.1 (nRF_DTM)                 |

##### 4.1. Table for Test Modes and Frequency

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

| Mode         | Data rate (Worst case) | Frequency (Freq. MHz)                             |
|--------------|------------------------|---------------------------------------------------|
| Bluetooth LE | 1 Mbps                 | Lowest (2 402) / Middle (2 440) / Highest (2 480) |

## 5. Measurement equipment

| Equipment             | Manufacturer | Model                        | Serial number         | Calibration Interval | Calibration date | Calibration due. |
|-----------------------|--------------|------------------------------|-----------------------|----------------------|------------------|------------------|
| Test Receiver         | R&S          | ESVS30                       | 829673/015            | 1 year               | 2020-11-23       | 2021-11-23       |
| Signal Generator      | R&S          | SMB100A                      | 178128                | 1 year               | 2021-05-17       | 2022-05-17       |
| Spectrum Analyzer     | R&S          | FSV-40                       | 100832                | 1 year               | 2021-05-17       | 2022-05-17       |
| DC Power Supply       | Agilent      | U8002A                       | MY56110033            | 1 year               | 2021-05-17       | 2022-05-17       |
| Power Meter           | Agilent      | E4416A                       | GB41290645            | 1 year               | 2021-05-18       | 2022-05-18       |
| Power Sensor          | Agilent      | 9327A                        | US40441490            | 1 year               | 2021-05-18       | 2022-05-18       |
| Horn Antenna          | R&S          | HF906                        | 100236                | 1 year               | 2021-06-25       | 2022-06-25       |
| Horn Antenna          | AH Systems   | SAS-572                      | 269                   | 1 year               | 2021-05-21       | 2022-05-21       |
| Horn Antenna          | AH Systems   | SAS-573                      | 164                   | 1 year               | 2021-04-29       | 2022-04-29       |
| Bi-Log Ant.           | S/B          | VULB 9161SE                  | 4159                  | 2 year               | 2020-03-30       | 2022-03-30       |
| Loop Antenna          | ETS LINDGREN | 6502                         | 00118166              | 2 year               | 2020-06-30       | 2022-06-30       |
| Power Amplifier       | TESTEK       | TK-PA18H                     | 170013-L              | 1 year               | 2021-05-17       | 2022-05-17       |
| Power Amplifier       | MITEQ        | AFS43-01002600               | 2048519               | 1 year               | 2021-05-18       | 2022-05-18       |
| Power Amplifier       | MITEQ        | AMF-6F-2600400<br>0-33-8P-HS | 1511665               | 1 year               | 2021-05-18       | 2022-05-18       |
| Step Attenuator       | Agilent      | 8494B                        | US37181955            | 1 year               | 2021-05-17       | 2022-05-17       |
| Controller            | INNCO        | CO2000                       | CO2000/064/6961003/L  | N/A                  | N/A              | N/A              |
| Antenna Master        | INNCO        | MA4000                       | MA4000/038/6961003/L  | N/A                  | N/A              | N/A              |
| Controller            | INNCO        | CO3000                       | CO3000/812/34240914/L | N/A                  | N/A              | N/A              |
| Antenna Master        | INNCO        | MA4640-XP-ET                 | None                  | N/A                  | N/A              | N/A              |
| RF Cable              | SUHNER       | SUCOFLEX100                  | 84047746              | 3 month              | 2021-06-04       | 2021-09-04       |
| RF Cable              | SUHNER       | SUCOFLEX102                  | 801270/2              | 3 month              | 2021-06-04       | 2021-09-04       |
| RF Cable              | SUHNER       | SUCOFLEX102                  | 801532/2              | 3 month              | 2021-06-04       | 2021-09-04       |
| Band Rejection Filter | Micro-Tonics | BRM50702                     | 064                   | 1 year               | 2021-05-18       | 2022-05-18       |

### ※ Remark

#### Support equipment

| Description       | Manufacturer | Model          | Serial number |
|-------------------|--------------|----------------|---------------|
| Notebook computer | DELL         | Lattitude D510 | -             |

## **6. Antenna requirement**

### **6.1. Standard applicable**

For intentional device, according to FCC 47 CFR Section §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section §15.247 (c) if transmitting antennas of directional gain greater than 6dBi are used.

### **6.2. Antenna connected construction**

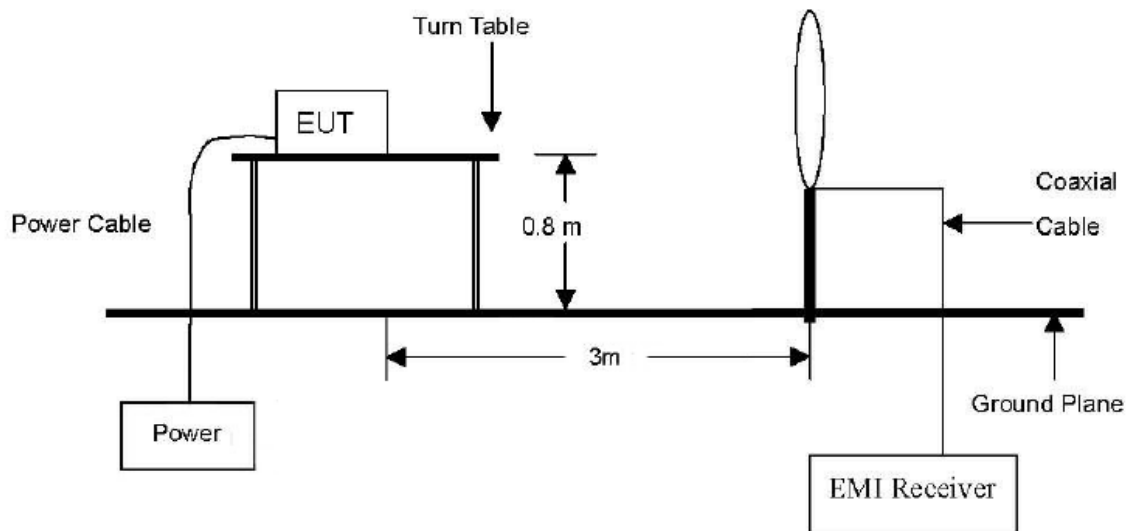
Antenna used in this product is PCB antenna,  
Antenna gain is 5.3 dBi.

## 7. Transmitter radiated spurious emissions

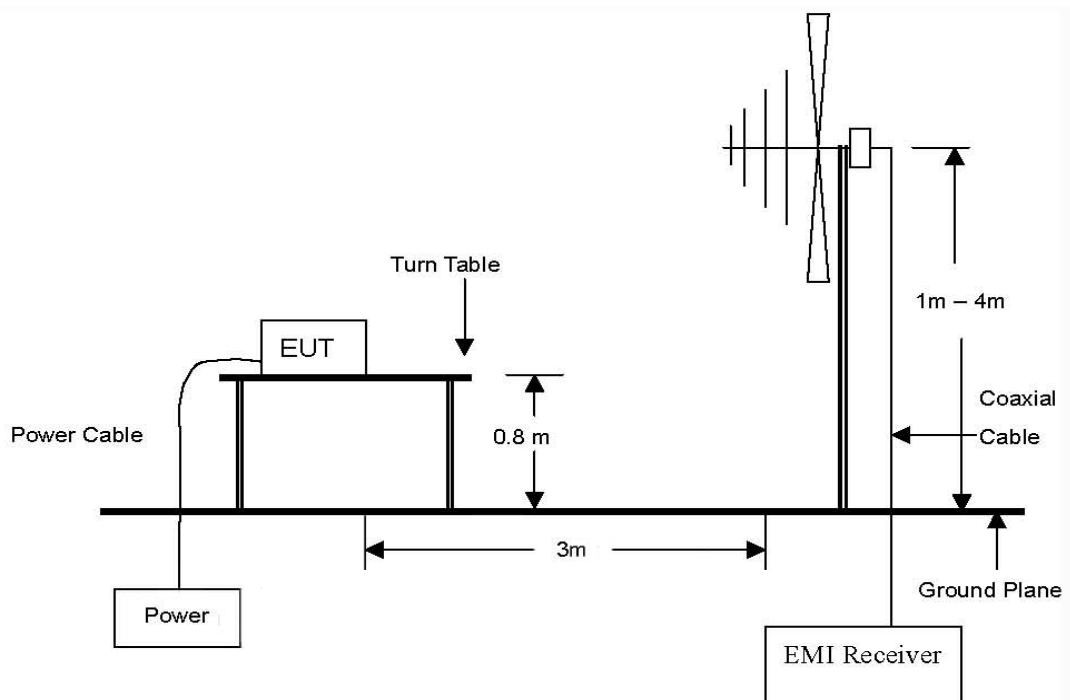
### 7.1. Test setup

#### 7.1.1. Transmitter radiated spurious emissions

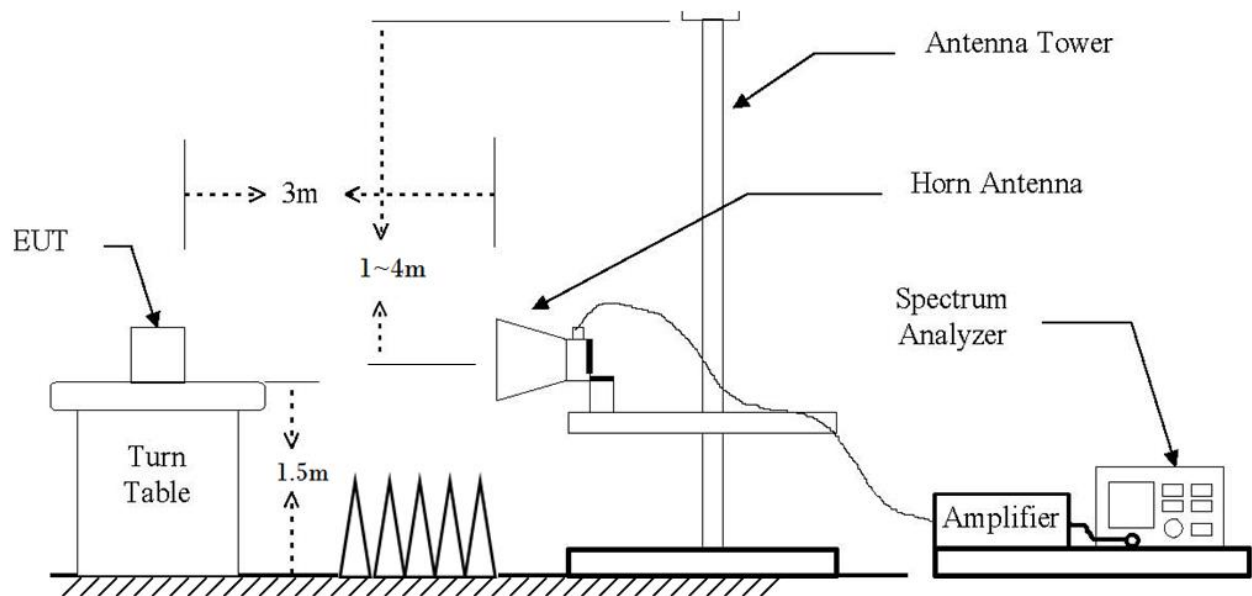
The diagram below shows the test setup that is utilized to make the measurements for emission from 9kHz to 30MHz Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 40 GHz emissions.



## 7.2. Limit

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph(b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in section §15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section §15.205(a), must also comply the radiated emission limits specified in section §15.209(a) (see section §15.205(c))

According to § 15.209(a), for an intentional radiator devices, the general required of field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values :

| Frequency (MHz) | Distance (Meters) | Radiated at 3M (dBμV/m) | Radiated (μV/m) |
|-----------------|-------------------|-------------------------|-----------------|
| 0.009–0.490     | 300               | See the remark          | 2400/F(kHz)     |
| 0.490–1.705     | 30                |                         | 24000/F(kHz)    |
| 1.705–30.0      | 30                |                         | 30              |
| 30 - 88         | 3                 | 40.0                    | 100             |
| 88 – 216        | 3                 | 43.52                   | 150             |
| 216 – 960       | 3                 | 46.02                   | 200             |
| Above 960       | 3                 | 53.97                   | 500             |

### ※Remark

1. Emission level in dB uV/m=20 log (uV/m)
2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
3. Distance extrapolation factor =20log(Specific distance/ test distance)(dB)  
Limit line=Specific limits(dB uV) + distance extrapolation factor.

### 7.3. Test procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.10:2013. In case of the air temperature of the test site is out of the range is 10 to 40°C before the testing proceeds the warm-up time of EUT maintain adequately.

#### 7.3.1. Test procedures for radiated spurious emissions

1. The EUT is placed on a turntable, which is 0.8 m (Below 1 GHz)/ 1.5 m (Above 1 GHz) above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.

#### ※ Remark

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 10 kHz for Peak detection (PK) at frequency below 30 MHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Peak detection (PK) or Quasi-peak detection (QP) at frequency below 1 GHz.
3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1 GHz.
4. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1 GHz.

## 7.4. Test results

### 7.4.1. Radiated spurious emissions (9 kHz to 30 MHz)

The frequency spectrum from 9kHz to 30MHz was investigated. Emission levels are not reported much lower than the limits by over 20 dB. All reading values are peak values.

To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes.

**Test mode : Bluetooth LE\_2 402 MHz (Worst case)**

| Frequency<br>(MHz)                                                         | Detector<br>Mode | Pol. | Result<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) |
|----------------------------------------------------------------------------|------------------|------|--------------------|-------------------|----------------|
| No other emissions were detected at a level greater than 20dB below limit. |                  |      |                    |                   |                |

#### ※Remark

1. Actual = Reading + Ant. factor - Amp + CL (Cable loss)
2. 15.31 Measurement standards.

The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.

**7.4.2. Radiated spurious emissions (30 MHz to 1 000 MHz)**

The frequency spectrum from 30 MHz to 1 000 MHz was investigated. Emission levels are not reported much lower than the limits by over 20 dB. All reading values are peak values.

To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes.

**Test mode : Bluetooth LE\_2 402 MHz (Worst case)**

| Frequency (MHz) | Detector Mode | Pol. | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|---------------|------|-----------------|----------------|-------------|
| 42.08           | QP            | V    | 31.1            | 40.0           | 8.9         |
| 237.14          | QP            | V    | 33.1            | 46.0           | 12.9        |
| 846.30          | QP            | V    | 33.8            | 46.0           | 12.2        |

**※Remark**

1. Actual = Reading + Ant. factor - Amp + CL (Cable loss)

2. 15.31 Measurement standards.

The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.

### 7.4.3. Radiated spurious emissions & Bandedge (Above 1 000 MHz)

The frequency spectrum above 1 000 MHz was investigated. Emission levels are not reported much lower than the limits by over 20 dB.

To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes.

**Test mode : Bluetooth LE**

#### A. Lowest Ch. (2 402 MHz)

| Frequency (MHz)              | Detector Mode | Pol. | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|------------------------------|---------------|------|-----------------|----------------|-------------|
| *2 335.69                    | Peak          | V    | 35.53           | 74.00          | 38.47       |
| Above 3 000 MHz Not detected |               |      |                 |                |             |

#### B. Middle Ch. (2 440 MHz)

| Frequency (MHz)                                                            | Detector Mode | Pol. | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|----------------------------------------------------------------------------|---------------|------|-----------------|----------------|-------------|
| No other emissions were detected at a level greater than 20dB below limit. |               |      |                 |                |             |

#### C. Highest Ch. (2 480 MHz)

| Frequency (MHz)              | Detector Mode | Pol. | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|------------------------------|---------------|------|-----------------|----------------|-------------|
| *2 494.83                    | Peak          | H    | 34.30           | 74.00          | 39.70       |
| Above 3 000 MHz Not detected |               |      |                 |                |             |

#### ※ Remark

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental Frequency.
2. Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using peak/average detector mode.
3. Actual = Reading + Ant. factor - Amp + CL (Cable loss)
4. 15.31 Measurement standards.  
The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.
5. \* is Restricted band.
6. Average measurement did not take place because the peak data did not exceed average limit