



# TEST REPORT

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Report Number : SZXX1220301-06489E-RF  
FCC ID: 2ATUKBN-311

## Test Standard (s)

FCC PART 22H; FCC PART 24E

## Sample Description

Product Type: GPS TRACKER  
Model No.: 311,311ABC,311A,311B,311C,GPS-311A,GPS-311B,GPS-311C,  
GPS-311ABC,BN-311,BN-311A,BN-311B,BN-311C,BN-311ABC  
Trade Mark: BAANOOL, DI QIU TU XING  
Date Received: 2022-03-01  
Report Date: 2022-04-13

|              |       |
|--------------|-------|
| Test Result: | Pass* |
|--------------|-------|

\* In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:

Approved By:

*Black Ding*

*Candy Li*

Black Ding  
EMC Engineer

Candy Li  
EMC Engineer

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★".

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**GENERAL INFORMATION****Product Description for Equipment under Test (EUT)**

|                                           |                                                                                                                                           |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Product                                   | GPS TRACKER                                                                                                                               |
| Trade Mark                                | BAANOOL, DI QIU TU XING<br>                              |
| Tested Model                              | 311                                                                                                                                       |
| Multiple Model                            | 311ABC,311A,311B,311C,GPS-311A,GPS-311B,GPS-311C,<br>GPS-311ABC,BN-311,BN-311A,BN-311B,BN-311C,BN-311ABC                                  |
| Model difference                          | Please refer to DOS letter.                                                                                                               |
| Frequency Range                           | GSM 850: 824-849MHz(TX); 869-894MHz(RX)<br>PCS 1900: 1850-1910MHz(TX); 1930-1990MHz(RX)                                                   |
| Maximum Output Power<br>(Conducted power) | GSM 850: 33.26dBm<br>PCS 1900: 29.78dBm                                                                                                   |
| Modulation Technique                      | GMSK                                                                                                                                      |
| Antenna Specification*                    | Internal Antenna: 0 dBi*                                                                                                                  |
| Voltage Range                             | DC12V-24V or DC3.7V backup by battery.<br>Typical testing voltage:<br>Normal Voltage 12V DC; Low Voltage 10.8 V DC; High Voltage 13.2V DC |
| Sample serial number                      | SZXX1220301-06489E-RF-S1 (Assigned by ATC)                                                                                                |
| Received date                             | 2022-03-01                                                                                                                                |
| Sample/EUT Status                         | Good condition                                                                                                                            |

**Objective**

This test report is in accordance with Part 2-Subpart J, Part 22-Subpart H, and Part 24-Subpart E of the Federal Communication Commission's rules.

The objective is to determine the compliance of the EUT with FCC rules for output power, modulation characteristic, occupied bandwidth, and spurious emission at antenna terminal, spurious radiated emission, frequency stability and band edge.

**Test Methodology**

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2-Subpart J as well as the following parts:

Part 22 Subpart H - Public Mobile Services  
Part 24 Subpart E - Personal Communication Services

ANSI C63.26-2015: American National Standard for Compliance Testing of Transmitters Used in  
Licensed Radio Services

All emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

## Measurement Uncertainty

| Parameter                    |                 | Uncertainty             |
|------------------------------|-----------------|-------------------------|
| Occupied Channel Bandwidth   |                 | ±5%                     |
| RF output power, conducted   |                 | ±0.73dB                 |
| Unwanted Emission, conducted |                 | ±1.6dB                  |
| RF Frequency                 |                 | ±0.082*10 <sup>-7</sup> |
| Emissions,<br>Radiated       | 30MHz - 1GHz    | ±4.28dB                 |
|                              | 1GHz - 18GHz    | ±4.98dB                 |
|                              | 18GHz - 26.5GHz | ±5.06dB                 |
| Temperature                  |                 | ±1 °C                   |
| Humidity                     |                 | ±6%                     |
| Supply voltages              |                 | ±0.4%                   |

*Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.*

## Test Facility

The test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189.

Accredited by American Association for Laboratory Accreditation (A2LA). The Certificate Number is 4297.01

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0016. The Registration Number is 5077A.

## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

The final qualification test was performed with the EUT operating at normal mode.

The test items were performed with the EUT operating at testing mode. Test was performed with channels as below table:

| Band     | Channel Bandwidth | Frequency                       |
|----------|-------------------|---------------------------------|
| GSM 850  | 0.3 MHz           | 824.2MHz, 836.6MHz, 848.8MHz    |
| PCS 1900 | 0.3 MHz           | 1850.2MHz, 1880.0MHz, 1909.8MHz |

### Equipment Modifications

No modification was made to the EUT.

### Support Equipment List and Details

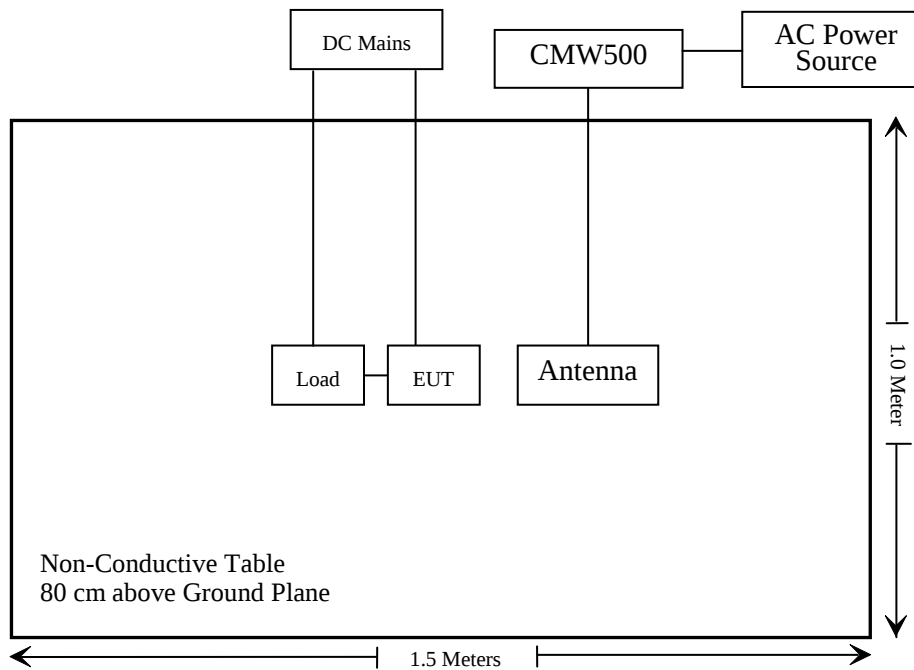
| Manufacturer                       | Description                         | Model   | Serial Number |
|------------------------------------|-------------------------------------|---------|---------------|
| Rohde & Schwarz                    | Wideband Radio Communication Tester | CMW500  | 154606        |
| Shenzhen Coban Electronics Co.,Ltd | Load                                | Unknown | Unknown       |

### Support Cable Description

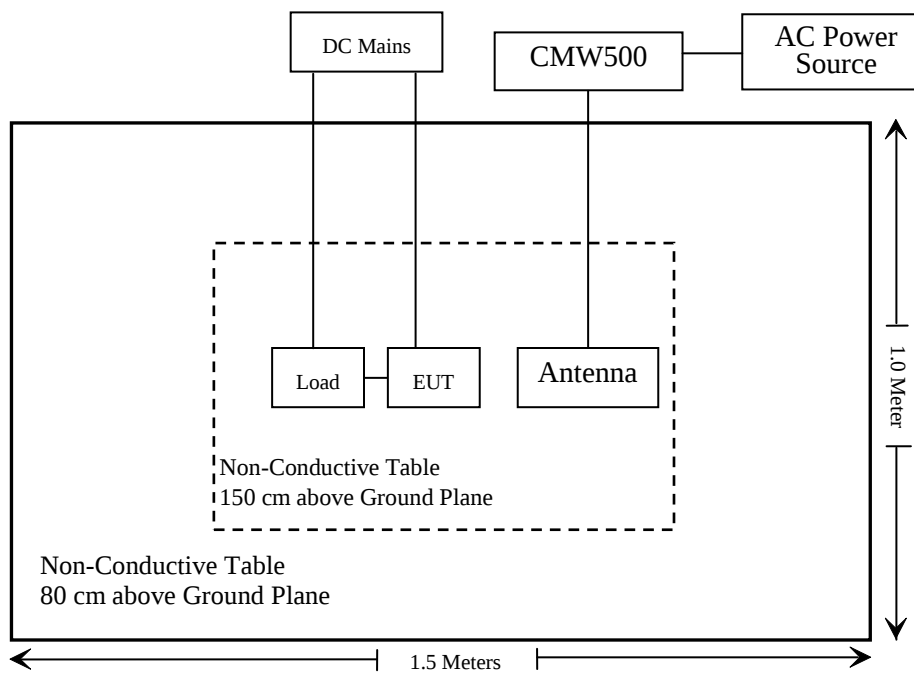
| Cable Description              | Length (m) | From / Port | To     |
|--------------------------------|------------|-------------|--------|
| Unshielded Detachable AC cable | 1.2        | AC Power    | CMW500 |
| Unshielded Detachable DC cable | 2.0        | DC Power    | EUT    |
| Unshielded Detachable DC cable | 0.5        | Load        | EUT    |
| Unshielded Detachable DC cable | 2.0        | DC Power    | Load   |

**Block Diagram of Test Setup**

For Below 1GHz:



For Above 1GHz:



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**SUMMARY OF TEST RESULTS**

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| FCC Rules                                  | Description of Test                    | Result         |
|--------------------------------------------|----------------------------------------|----------------|
| §1.1307 (b)                                | RF Exposure                            | Compliant      |
| §2.1046; § 22.913 (a);<br>§ 24.232 (c);    | RF Output Power                        | Compliant      |
| § 2.1047                                   | Modulation Characteristics             | Not Applicable |
| § 2.1049; § 22.905;<br>§ 22.917; § 24.238; | Occupied Bandwidth                     | Compliant      |
| § 2.1051; § 22.917 (a);<br>§ 24.238 (a);   | Spurious Emissions at Antenna Terminal | Compliant      |
| § 2.1053; § 22.917 (a);<br>§ 24.238 (a);   | Field Strength of Spurious Radiation   | Compliant      |
| § 22.917 (a);<br>§ 24.238 (a);             | Band Edge                              | Compliant      |
| § 2.1055; § 22.355;<br>§ 24.235;           | Frequency stability                    | Compliant      |

**TEST EQUIPMENT LIST**

| Manufacturer                                   | Description                         | Model               | Serial Number          | Calibration Date | Calibration Due Date |
|------------------------------------------------|-------------------------------------|---------------------|------------------------|------------------|----------------------|
| <b>Radiated Emission Test</b>                  |                                     |                     |                        |                  |                      |
| Rohde & Schwarz                                | Spectrum Analyzer                   | FSV-40              | 101949                 | 2021/12/13       | 2022/12/12           |
| Rohde & Schwarz                                | Wideband Radio Communication Tester | CMW500              | 154606                 | 2021/12/13       | 2022/12/12           |
| Agilent                                        | Signal Generator                    | N5183A              | MY51040755             | 2021/12/13       | 2022/12/12           |
| A.H. Systems, inc.                             | Preamplifier                        | PAM-0118P           | 135                    | 2021/11/09       | 2022/11/08           |
| Quinstar                                       | Amplifier                           | QLW-184055<br>36-J0 | 15964001002            | 2021/11/11       | 2022/11/10           |
| Rohde& Schwarz                                 | Test Receiver                       | ESR                 | 102725                 | 2021/12/13       | 2022/12/12           |
| SONOMA<br>INSTRUMENT                           | Amplifier                           | 310 N               | 186131                 | 2021/11/09       | 2022/11/08           |
| Schwarzbeck                                    | Bilog Antenna                       | VULB9163            | 9163-194               | 2020/01/05       | 2023/01/04           |
| Schwarzbeck                                    | Bilog Antenna                       | VULB9163            | 9163-323               | 2021/07/06       | 2024/07/05           |
| Schwarzbeck                                    | Horn Antenna                        | BBHA9120D           | 9120D-655              | 2020/01/05       | 2023/01/04           |
| Schwarzbeck                                    | Horn Antenna                        | BBHA9120D           | 9120D-1067             | 2020/01/05       | 2023/01/04           |
| PASTERNAK                                      | Horn Antenna                        | PE9852/2F-20        | 1120<br>(ATC-BA-024-1) | 2020/01/05       | 2023/01/04           |
| PASTERNAK                                      | Horn Antenna                        | PE9852/2F-20        | 1120<br>(ATC-BA-025-1) | 2020/01/05       | 2023/01/04           |
| Unknown                                        | RF Coaxial Cable                    | No.10               | N050                   | 2021/12/14       | 2022/12/13           |
| Unknown                                        | RF Coaxial Cable                    | No.11               | N1000                  | 2021/12/14       | 2022/12/13           |
| Unknown                                        | RF Coaxial Cable                    | No.12               | N040                   | 2021/12/14       | 2022/12/13           |
| Unknown                                        | RF Coaxial Cable                    | No.13               | N300                   | 2021/12/14       | 2022/12/13           |
| Unknown                                        | RF Coaxial Cable                    | No.14               | N800                   | 2021/12/14       | 2022/12/13           |
| Unknown                                        | RF Coaxial Cable                    | No.15               | N600                   | 2021/12/14       | 2022/12/13           |
| Unknown                                        | RF Coaxial Cable                    | No.16               | N650                   | 2021/12/14       | 2022/12/13           |
| Radiated Emission Test Software: e3 19821b(V9) |                                     |                     |                        |                  |                      |

| Manufacturer                  | Description                               | Model                   | Serial Number | Calibration Date | Calibration Due Date |
|-------------------------------|-------------------------------------------|-------------------------|---------------|------------------|----------------------|
| <b>Radiated Emission Test</b> |                                           |                         |               |                  |                      |
| Unknown                       | Band Reject Filter                        | MSF1850-191<br>OMS-1148 | ATCE-142      | 2021/12/14       | 2022/12/13           |
| Unknown                       | Band Reject Filter                        | MSF824-862<br>MS-1147   | ATCE-141      | 2021/12/14       | 2022/12/13           |
| Unknown                       | High Pass Filter                          | HPM-1.2/18G<br>-60      | 110           | 2021/12/14       | 2022/12/13           |
| <b>RF Conducted Test</b>      |                                           |                         |               |                  |                      |
| Rohde & Schwarz               | Spectrum Analyzer                         | FSV-40                  | 101495        | 2021/12/13       | 2022/12/12           |
| Rohde& Schwarz                | Test Receiver                             | ESR                     | 101817        | 2021/12/13       | 2022/12/12           |
| Rohde & Schwarz               | Wideband Radio<br>Communication<br>Tester | CMW500                  | 154606        | 2021/12/13       | 2022/12/12           |
| Mini-Circuits                 | Power Splitter                            | DC-18000MHz             | SF10944151S   | 2021/12/13       | 2022/12/12           |
| UNI-T                         | DC Power Supply                           | UTP8305B                | 10584         | NCR              | NCR                  |
| Gongwen                       | Temp. & Humid.<br>Chamber                 | HSD-500                 | 109           | 2021/12/14       | 2022/12/13           |
| Unknown                       | RF Coaxial Cable                          | No.32                   | RF-02         | Each time        |                      |
| Unknown                       | RF Coaxial Cable                          | No.33                   | RF-03         | Each time        |                      |
| Fluke                         | Desktop Multi Meter                       | 45                      | 7664009       | 2021/12/14       | 2022/12/13           |
| WEINSCHL                      | 10dB Attenuator                           | 5324                    | AU 3842       | 2021/12/14       | 2022/12/13           |

\* Statement of Traceability: Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

## FCC §1.1307 (b) – RF EXPOSURE

### Applicable Standard

According to §1.1307(b), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB 447498 D04 Interim General RF Exposure Guidance v01, clause 2.1.3.1-SAR-Based Exemption:

A more comprehensive exemption, considering a variable power threshold that depends on both the separation distance and power, is provided in § 1.1307(b)(3)(i)(B). This exemption is applicable to the frequency range between 300 MHz and 6 GHz, with test separation distances between 0.5 cm and 40 cm, and for all RF sources in fixed, mobile, and portable device exposure conditions.

Accordingly, a RF source is considered an RF exempt device if its available maximum time-averaged (matched conducted) power or its effective radiated power (ERP), whichever is greater, are below a specified threshold. This exemption threshold was derived based on general population 1-g SAR requirements and is detailed in Appendix C.

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}}(d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left( \frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

$d$  = the separation distance (cm);

**Result**

For worst case:

| Mode           | Frequency | Maximum Time based Average Power | Antenna Gain |       | ERP          | ERP <sub>20cm</sub> | Distance | SAR-Based Exclusion Threshold |              | SAR-Based Exclusion |
|----------------|-----------|----------------------------------|--------------|-------|--------------|---------------------|----------|-------------------------------|--------------|---------------------|
|                | (MHz)     | (dBm)                            | (dBi)        | (dBd) | (dBm)        | (mW)                | (mm)     | (mW)                          | (dBm)        |                     |
| <b>GSM850</b>  | 824-849   | <b>26</b>                        | 0            | -2.15 | <b>23.85</b> | 2040f               | 200      | 1680                          | <b>32.25</b> | Yes                 |
| <b>PCS1900</b> | 1850-1910 | <b>23</b>                        | 0            | -2.15 | <b>20.85</b> | 3060                | 200      | 3060                          | <b>34.85</b> | Yes                 |

Note 1: 0dBd=2.15dBi.

Note 2: f = frequency in GHz.

Note 3: The tune-up power was declared by the applicant.

| Mode     | Tune-up Conducted Power (dBm) | Time based Average Power (dBm) |
|----------|-------------------------------|--------------------------------|
| GSM 850  | 33.5                          | 24.5                           |
| PCS 1900 | 30                            | 21                             |

| Mode      | Tune-up Conducted Power (dBm) |         |         |         | Time based Average Power (dBm) |           |         |           |
|-----------|-------------------------------|---------|---------|---------|--------------------------------|-----------|---------|-----------|
|           | 1 slot                        | 2 slots | 3 slots | 4 slots | 1 slot                         | 2 slots   | 3 slots | 4 slots   |
| GPRS 850  | 33                            | 32      | 30      | 29      | 24                             | <b>26</b> | 25.75   | <b>26</b> |
| GPRS 1900 | 30                            | 29      | 27      | 26      | 21                             | <b>23</b> | 22.75   | <b>23</b> |

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliant.

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## **FCC §2.1047 - MODULATION CHARACTERISTIC**

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According to FCC § 2.1047(d), Part 22H & 24E there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

**FCC § 2.1046, § 22.913 (a) & § 24.232 (c) - RF OUTPUT POWER****Applicable Standard**

According to FCC §2.1046 and §22.913 (a), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

According to FCC §2.1046 and §24.232 (c), mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB.

**Test Procedure***Conducted method:*

The RF output of the transmitter was connected to the CMW500 through sufficient attenuation.

*Radiated method:*

ANSI C63.26-2015 Section 5.5.

**Test Data****Environmental Conditions**

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 24 °C     |
| <b>Relative Humidity:</b> | 52 %      |
| <b>ATM Pressure:</b>      | 101.1 kPa |

*The testing was performed by Key. Pei on 2022-04-12.*

**Conducted Power****Cellular Band (Part 22H)**

| Mode | Channel | Frequency (MHz) | Average Output Power (dBm) | ERP(dBm)     | Limit (dBm) |
|------|---------|-----------------|----------------------------|--------------|-------------|
| GSM  | 128     | 824.2           | 33.26                      | <b>31.11</b> | 38.45       |
|      | 190     | 836.6           | 33.19                      | 31.04        | 38.45       |
|      | 251     | 848.8           | 33.03                      | 30.88        | 38.45       |

| Mode | Channel | Frequency (MHz) | Average Output Power (dBm) |         |         |         | ERP(dBm) |         |         |         | Limit (dBm) |
|------|---------|-----------------|----------------------------|---------|---------|---------|----------|---------|---------|---------|-------------|
|      |         |                 | 1 slot                     | 2 slots | 3 slots | 4 slots | 1 slot   | 2 slots | 3 slots | 4 slots |             |
| GPRS | 128     | 824.2           | 32.85                      | 31.60   | 29.71   | 28.45   | 30.7     | 29.45   | 27.56   | 26.3    | 38.45       |
|      | 190     | 836.6           | 32.65                      | 31.46   | 29.54   | 28.48   | 30.5     | 29.31   | 27.39   | 26.33   | 38.45       |
|      | 251     | 848.8           | 32.58                      | 31.40   | 29.26   | 28.70   | 30.43    | 29.25   | 27.11   | 26.55   | 38.45       |

Note: ERP(dBm) = Conducted Power(dBm) + Antenna Gain(dBd)  
 For GPRS 850: Antenna Gain = 0dBi\* = -2.15dBd (0dBd=2.15dBi)  
 Limit: ERP ≤ 38.45dBm

**PCS Band (Part 24E)**

| Mode | Channel | Frequency (MHz) | Average Output Power (dBm) | EIRP(dBm)    | Limit (dBm) |
|------|---------|-----------------|----------------------------|--------------|-------------|
| GSM  | 512     | 1850.2          | 29.59                      | 29.59        | 33          |
|      | 661     | 1880.0          | 29.61                      | 29.61        | 33          |
|      | 810     | 1909.8          | 29.78                      | <b>29.78</b> | 33          |

| Mode | Channel | Frequency (MHz) | Average Output Power (dBm) |         |         |         | EIRP(dBm) |         |         |         | Limit (dBm) |
|------|---------|-----------------|----------------------------|---------|---------|---------|-----------|---------|---------|---------|-------------|
|      |         |                 | 1 slot                     | 2 slots | 3 slots | 4 slots | 1 slot    | 2 slots | 3 slots | 4 slots |             |
| GPRS | 512     | 1850.2          | 29.20                      | 28.18   | 26.20   | 25.10   | 29.20     | 28.18   | 26.20   | 25.10   | 33          |
|      | 661     | 1880.0          | 29.21                      | 28.21   | 26.22   | 25.12   | 29.21     | 28.21   | 26.22   | 25.12   | 33          |
|      | 810     | 1909.8          | 29.40                      | 28.42   | 26.45   | 25.31   | 29.40     | 28.42   | 26.45   | 25.31   | 33          |

Note: EIRP(dBm) = Conducted Power(dBm) + Antenna Gain(dBi)  
 For GPRS 1900: Antenna Gain = 0dBi\*  
 Limit: EIRP ≤ 33dBm

**Peak-to-average ratio (PAR)****Cellular Band**

| Mode | Channel | PAR (dB) | Limit (dB) |
|------|---------|----------|------------|
| GSM  | Low     | 3.14     | 13         |
|      | Middle  | 3.51     | 13         |
|      | High    | 3.21     | 13         |

**PCS Band (Part 24E)**

| Mode | Channel | PAR (dB) | Limit (dB) |
|------|---------|----------|------------|
| GSM  | Low     | 3.22     | 13         |
|      | Middle  | 3.11     | 13         |
|      | High    | 3.45     | 13         |

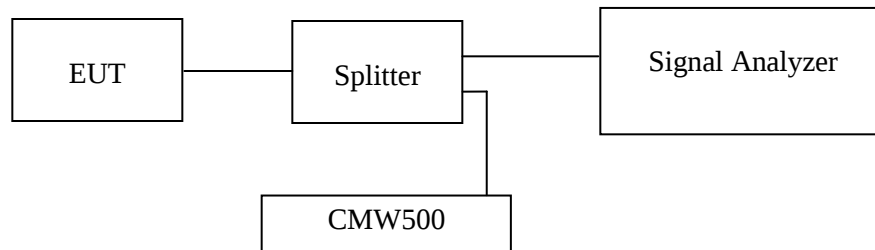
**FCC §2.1049, §22.917, §22.905 & §24.238 - OCCUPIED BANDWIDTH****Applicable Standard**

FCC 47 §2.1049, §22.917, §22.905, and §24.238.

**Test Procedure**

The RF output of the transmitter was connected to the simulator and the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 1% to 5% of the anticipated emission bandwidth and the 26 dB & 99% bandwidth was recorded.

**Test Data****Environmental Conditions**

|                    |           |
|--------------------|-----------|
| Temperature:       | 24 °C     |
| Relative Humidity: | 52 %      |
| ATM Pressure:      | 101.1 kPa |

*The testing was performed by Key.Pei on 2022-04-13.*

*EUT operation mode: Transmitting*

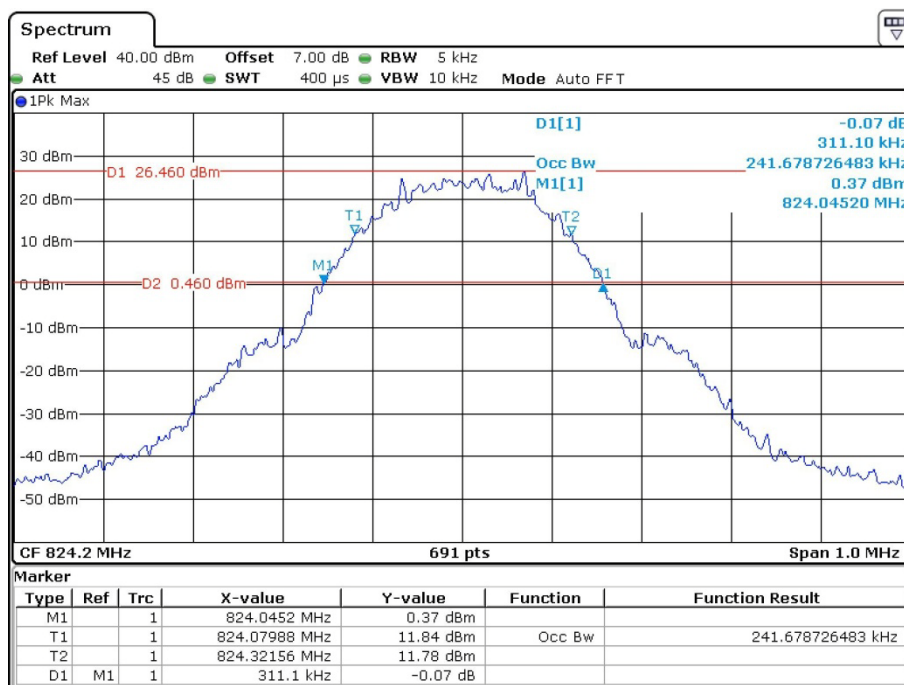
**Test Result: Pass**

**Cellular Band (Part 22H)**

| Mode       | Channel | Frequency (MHz) | 99% Occupied Bandwidth (kHz) | 26 dB Emission Bandwidth (kHz) |
|------------|---------|-----------------|------------------------------|--------------------------------|
| GSM (GMSK) | 128     | 824.2           | 241.68                       | 311.10                         |
|            | 190     | 836.6           | 241.68                       | 308.20                         |
|            | 251     | 848.8           | 240.23                       | 303.90                         |

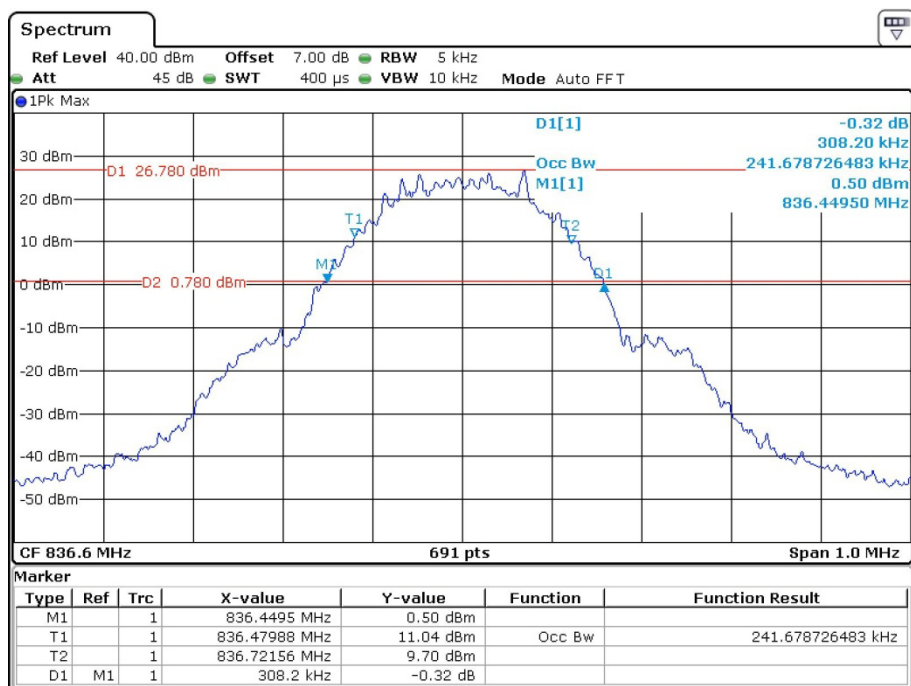
**PCS Band (Part 24E)**

| Mode       | Channel | Frequency (MHz) | 99% Occupied Bandwidth (kHz) | 26 dB Emission Bandwidth (kHz) |
|------------|---------|-----------------|------------------------------|--------------------------------|
| GSM (GMSK) | 512     | 1850.2          | 241.68                       | 315.50                         |
|            | 661     | 1880.0          | 243.13                       | 315.50                         |
|            | 810     | 1909.8          | 243.13                       | 314.00                         |

**Cellular Band (Part 22H)****26 dB Emissions & 99% Occupied Bandwidth for GSM(GMSK) Mode, Low channel**

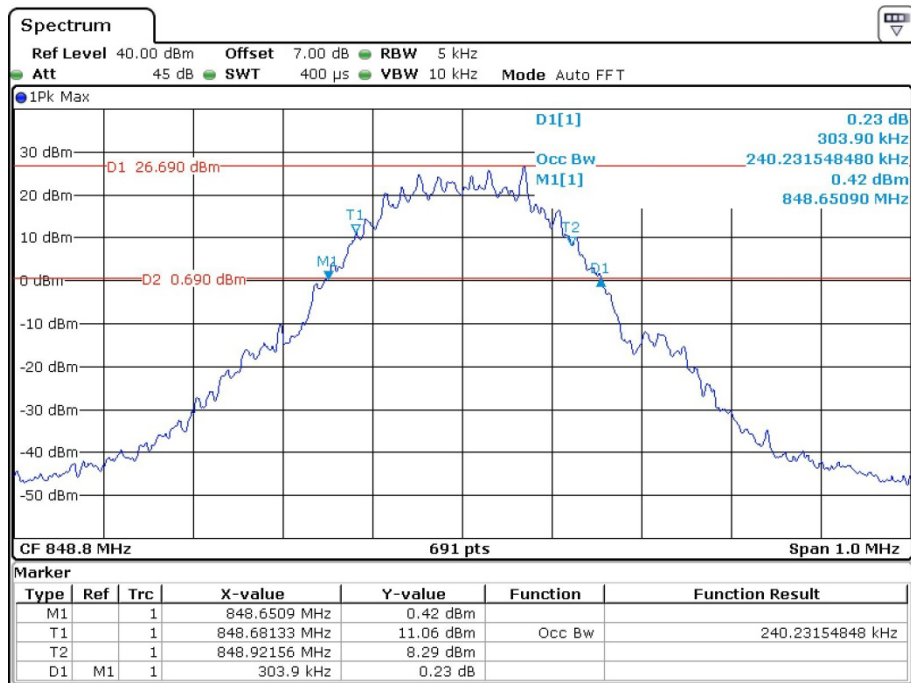
Date: 13.APR.2022 19:54:15

## 26 dB Emissions &amp; 99% Occupied Bandwidth for GSM(GMSK) Mode, Middle channel



Date: 13.APR.2022 19:55:28

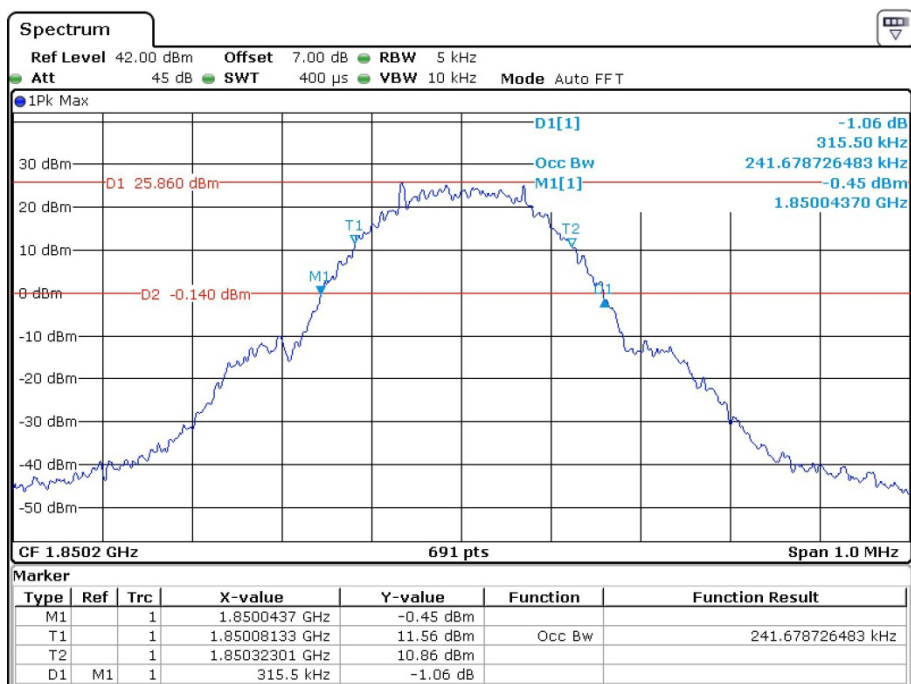
## 26 dB Emissions &amp; 99% Occupied Bandwidth for GSM(GMSK) Mode, High channel



Date: 13.APR.2022 19:56:36

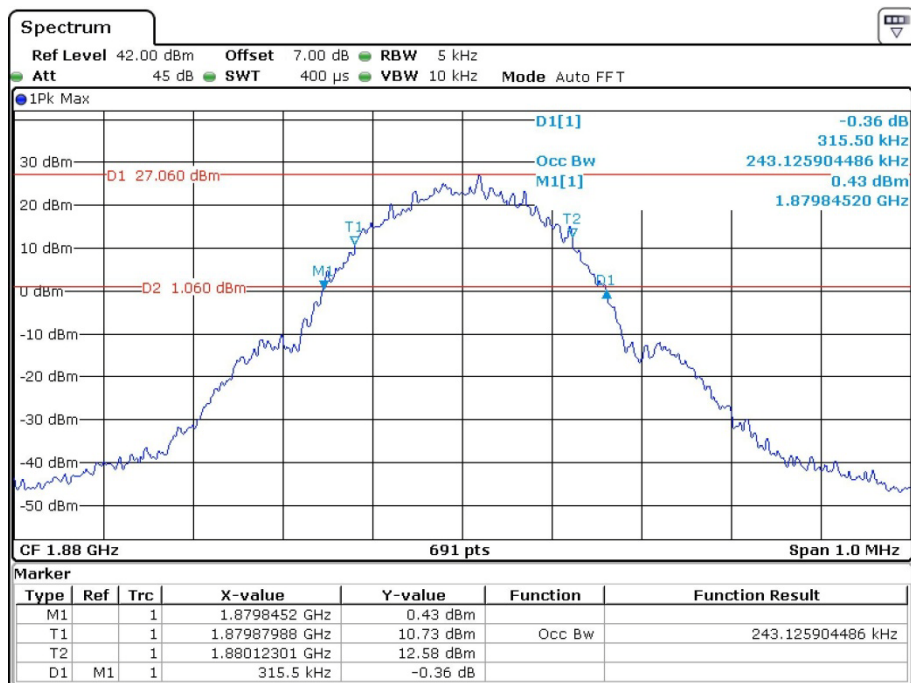
## PCS Band (Part 24E)

## 26 dB Emissions &amp; 99% Occupied Bandwidth for GSM(GMSK) Mode, Low channel



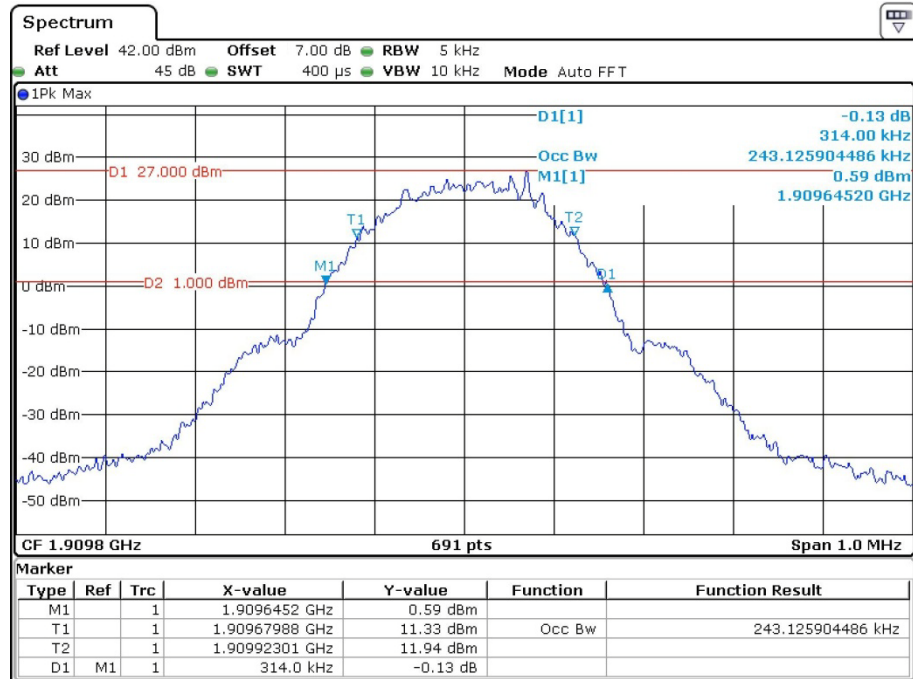
Date: 13.APR.2022 20:01:12

## 26 dB Emissions &amp; 99% Occupied Bandwidth for GSM(GMSK) Mode, Middle channel



Date: 13.APR.2022 20:02:08

## 26 dB Emissions &amp; 99% Occupied Bandwidth for GSM(GMSK) Mode, High channel



Date: 13.APR.2022 20:03:04

## FCC §2.1051, §22.917(a) & §24.238(a) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

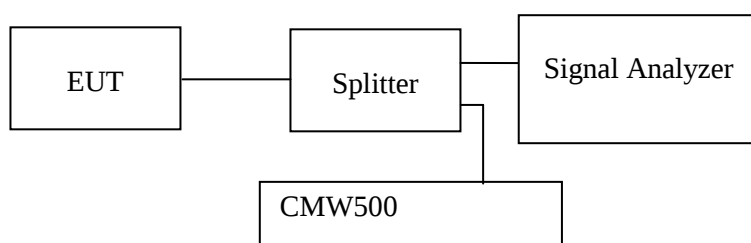
### Applicable Standard

FCC §2.1051, §22.917(a) & §24.238(a).

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1051.

### Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 1MHz. Sufficient scans were taken to show any out of band emissions up to 10<sup>th</sup> harmonic.



### Test Data

#### Environmental Conditions

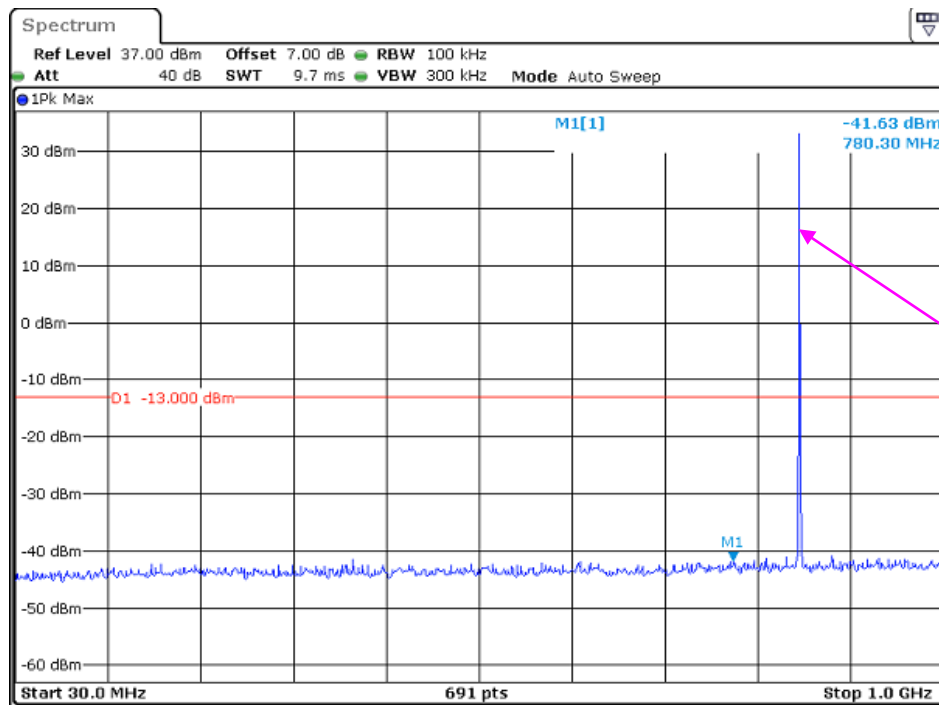
|                    |           |
|--------------------|-----------|
| Temperature:       | 24 °C     |
| Relative Humidity: | 52 %      |
| ATM Pressure:      | 101.1 kPa |

*The testing was performed by Key.Pei on 2022-04-12.*

*EUT operation mode: Transmitting*

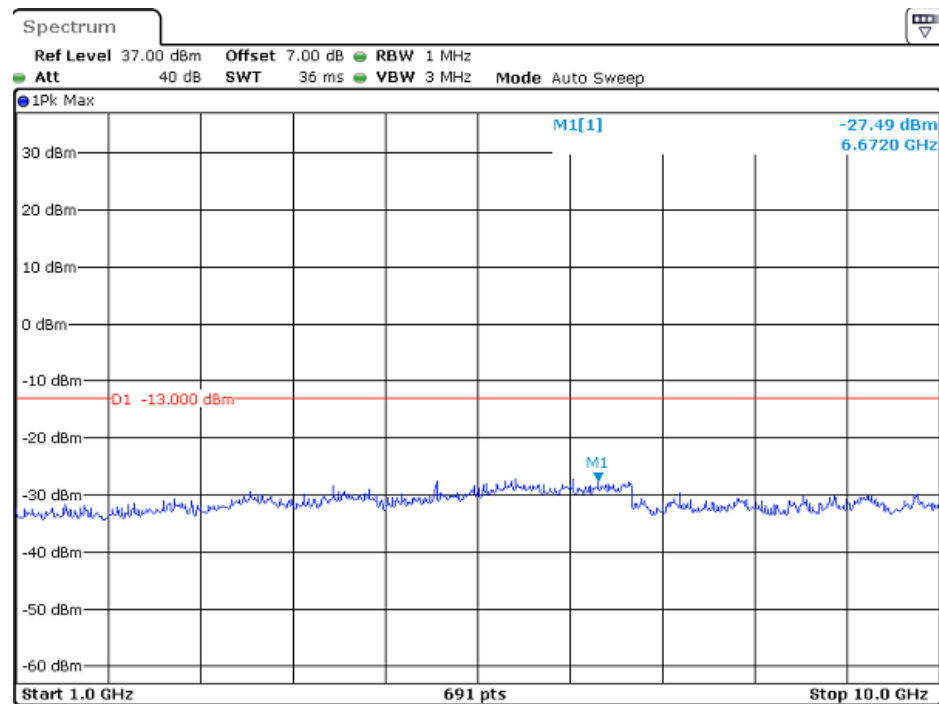
**Test result: Pass**

**Cellular Band (Part 22H)**  
**GSM Mode**  
**30 MHz – 1 GHz -Low channel**



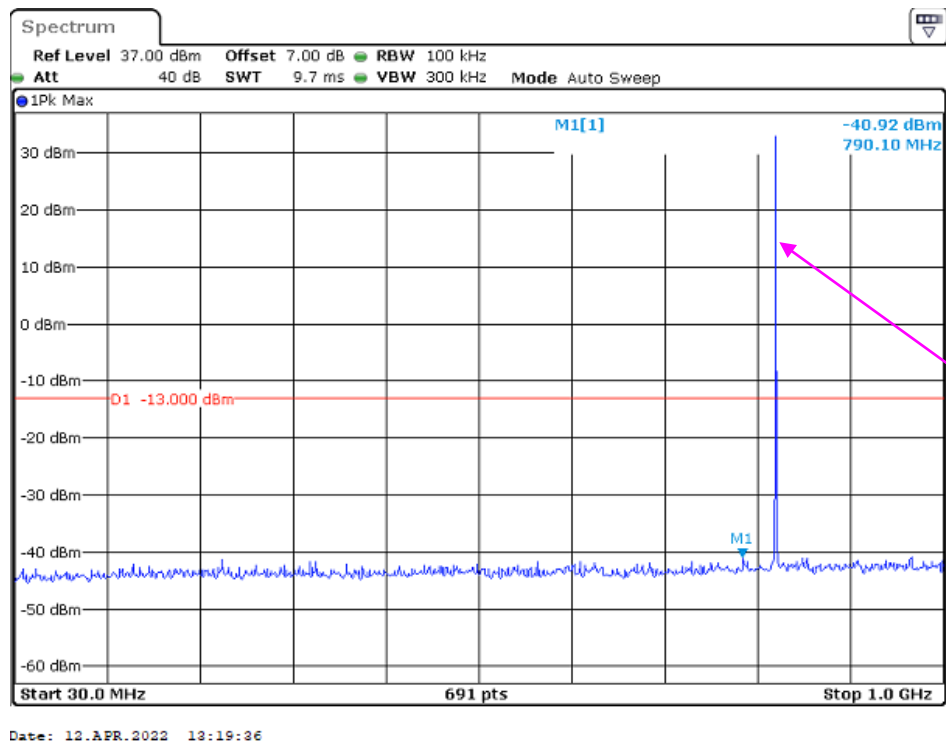
Date: 12.APR.2022 13:15:49

**1 GHz – 10 GHz -Low channel**

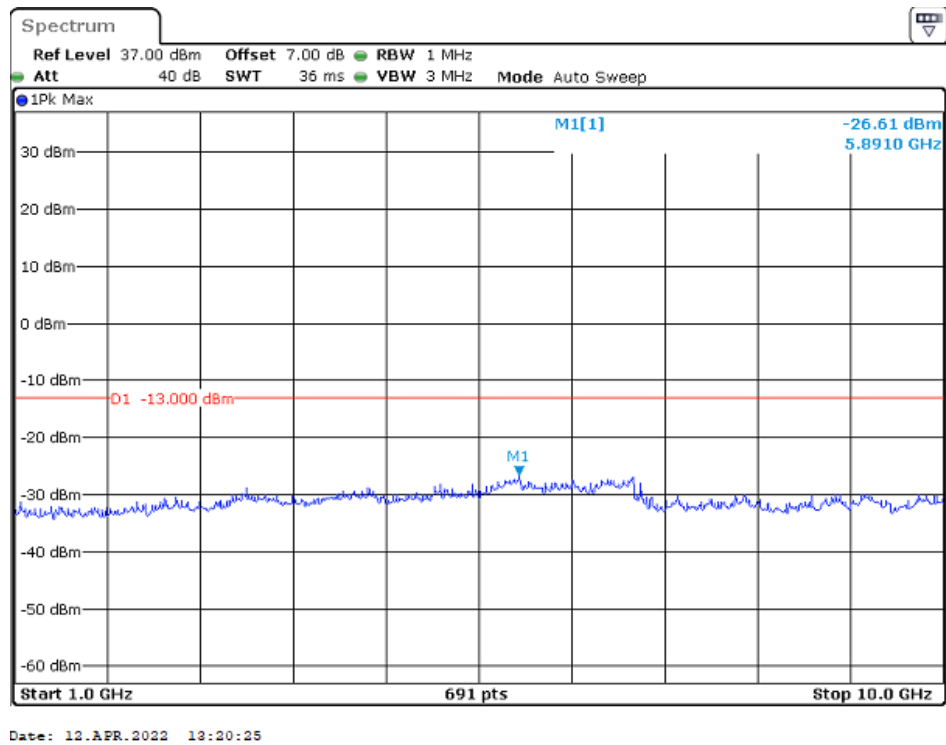


Date: 12.APR.2022 13:17:18

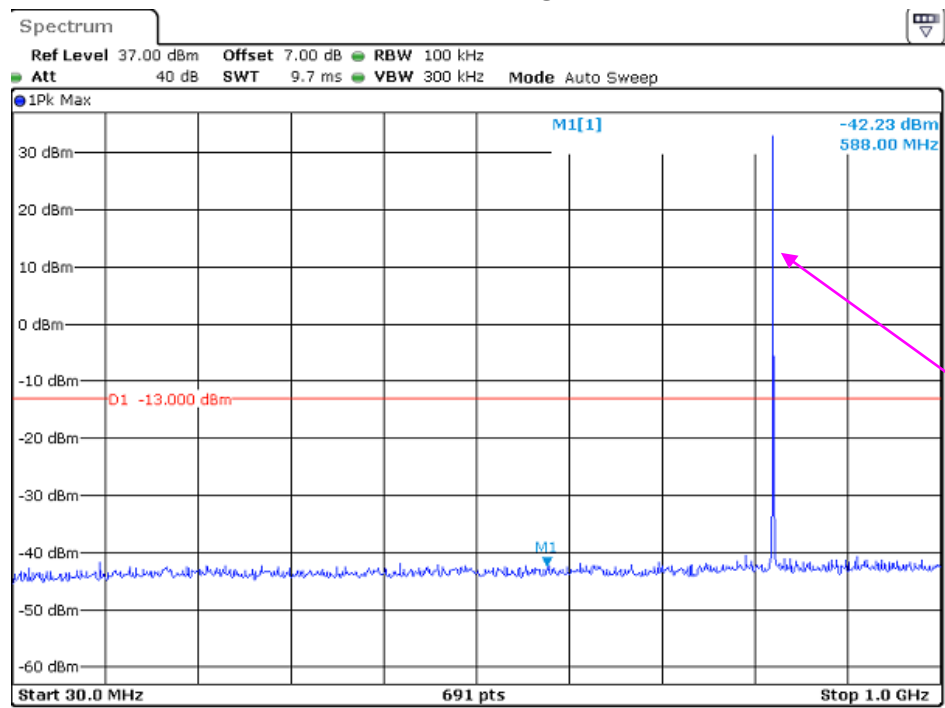
## 30 MHz – 1 GHz -Middle channel



## 1 GHz – 10 GHz - Middle channel

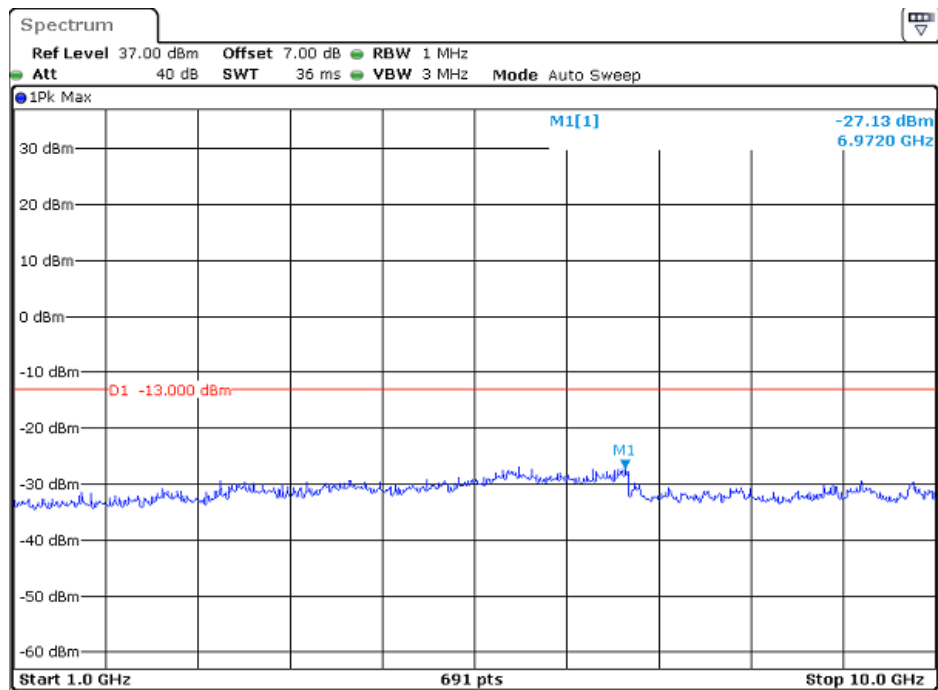


## 30 MHz – 1 GHz -High channel

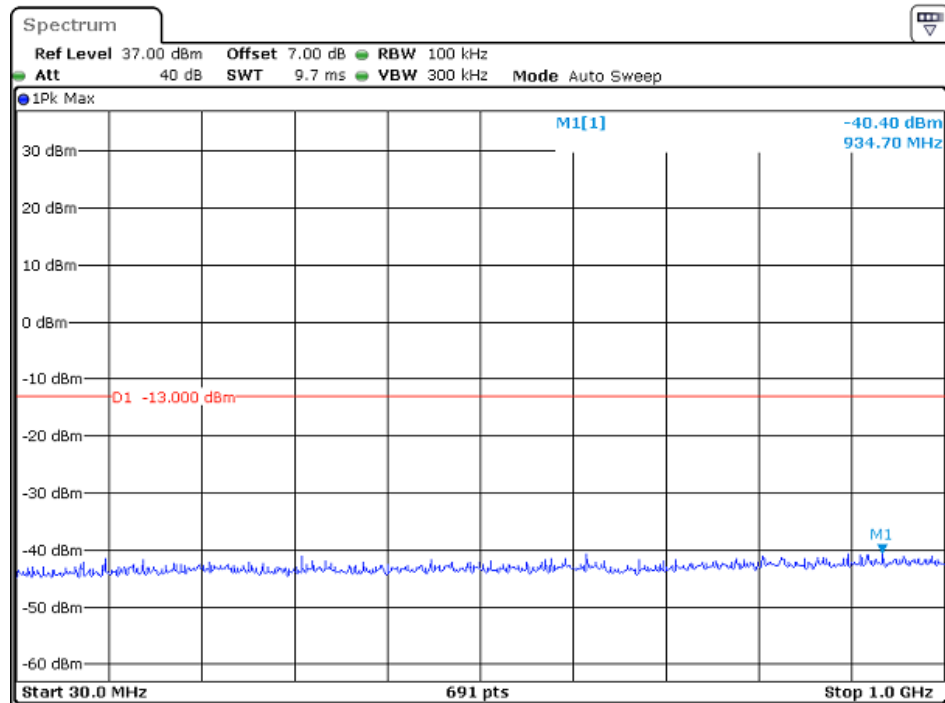


Date: 12.APR.2022 13:21:37

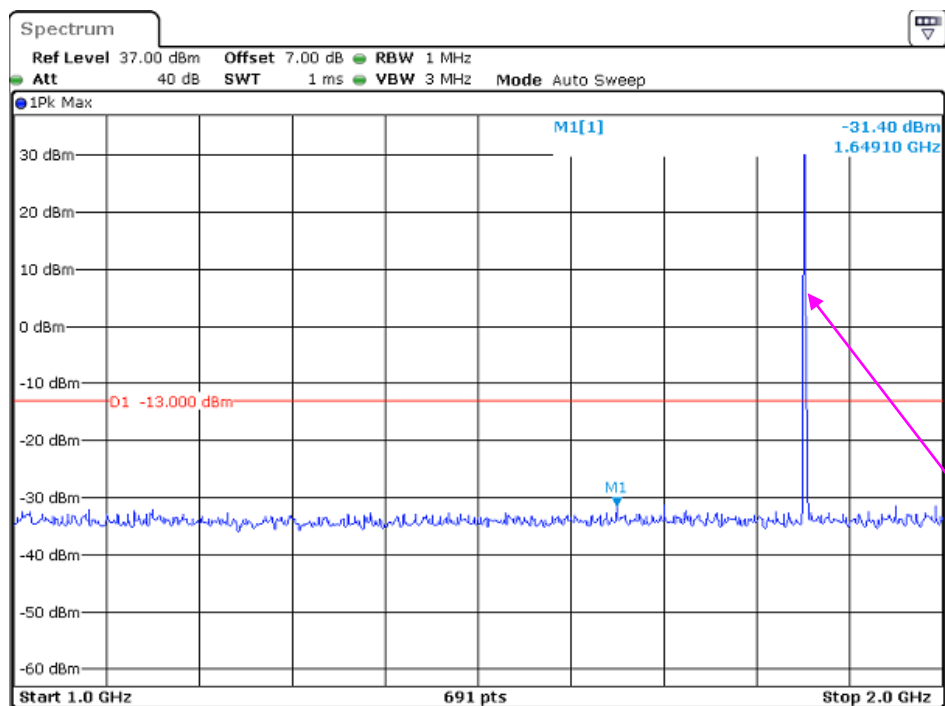
## 1 GHz – 10 GHz - High channel



Date: 12.APR.2022 13:23:50

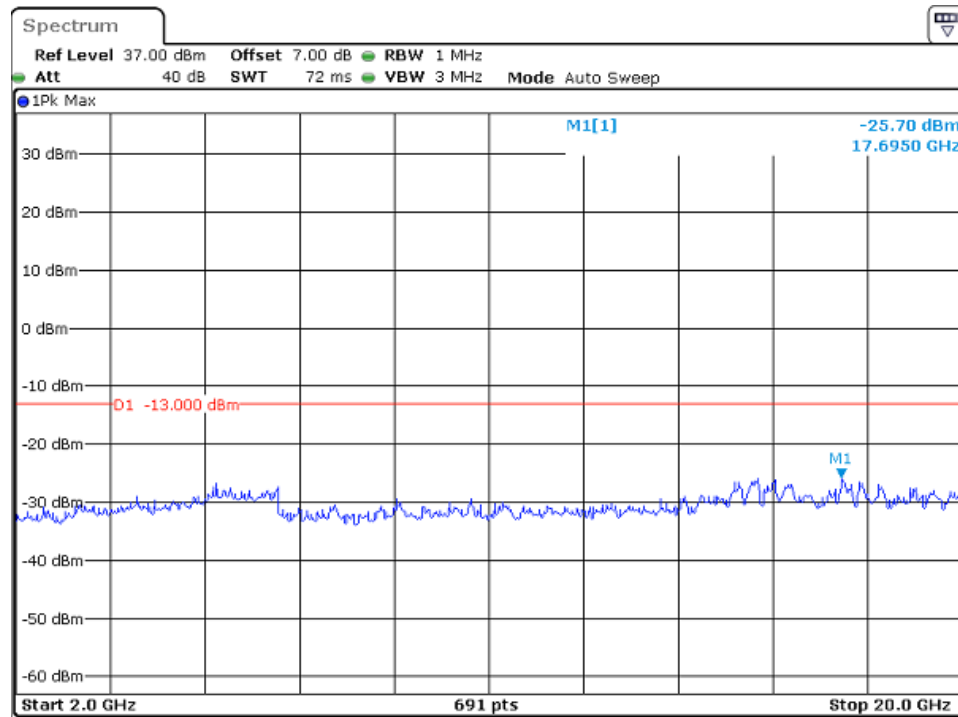
**PCS Band (Part 24E)****GSM Mode****30 MHz – 1 GHz -Low channel**

Date: 12.APR.2022 13:35:07

**1 GHz – 2 GHz -Low channel**

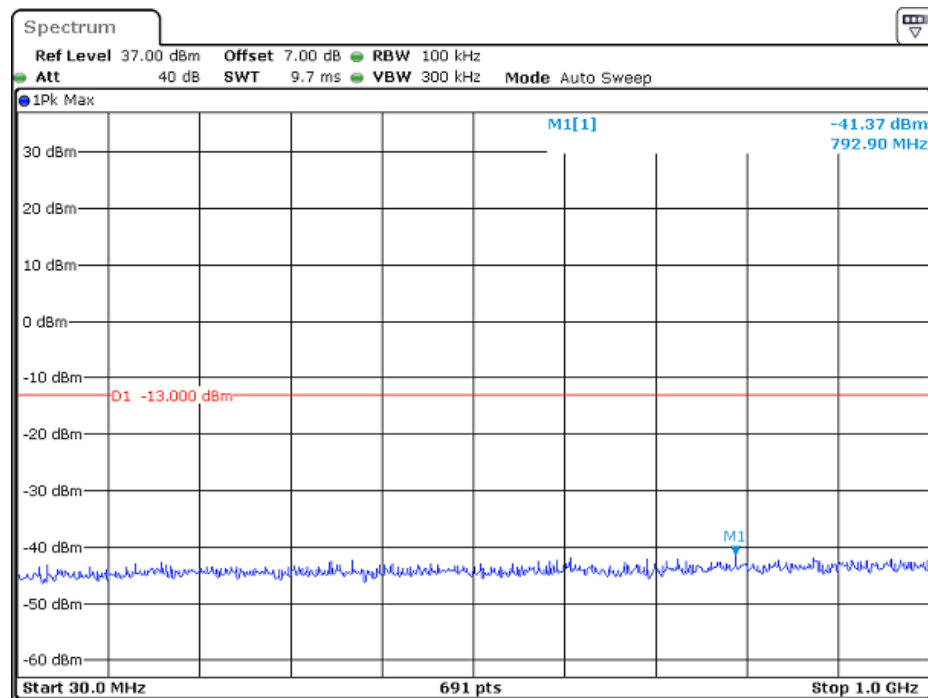
Date: 12.APR.2022 13:36:45

## 2.0 GHz – 20 GHz -Low channel



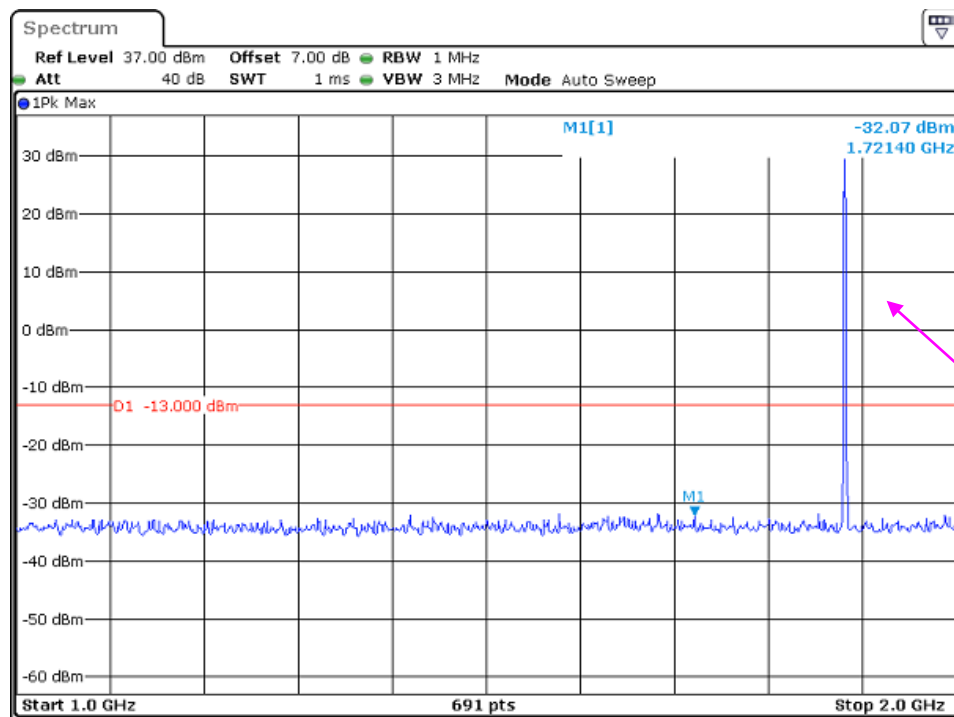
Date: 12.APR.2022 13:37:52

## 30 MHz – 1 GHz - Middle channel



Date: 12.APR.2022 13:40:25

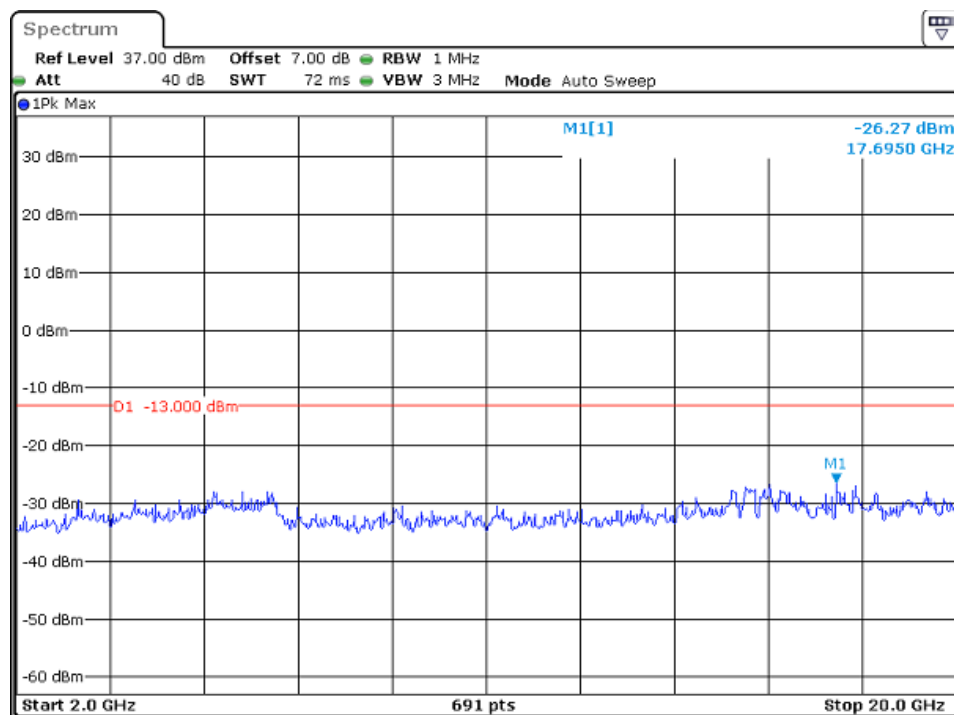
## 1 GHz – 2 GHz Middle channel



Date: 12.APR.2022 13:41:17

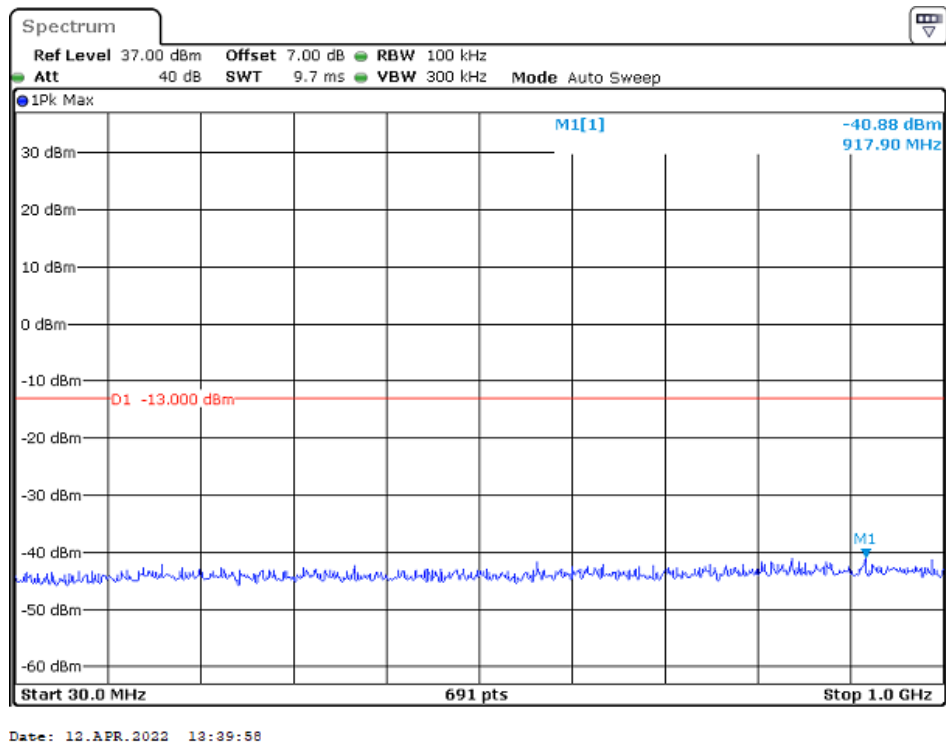
Fundamental test

## 2 GHz – 20 GHz Middle channel

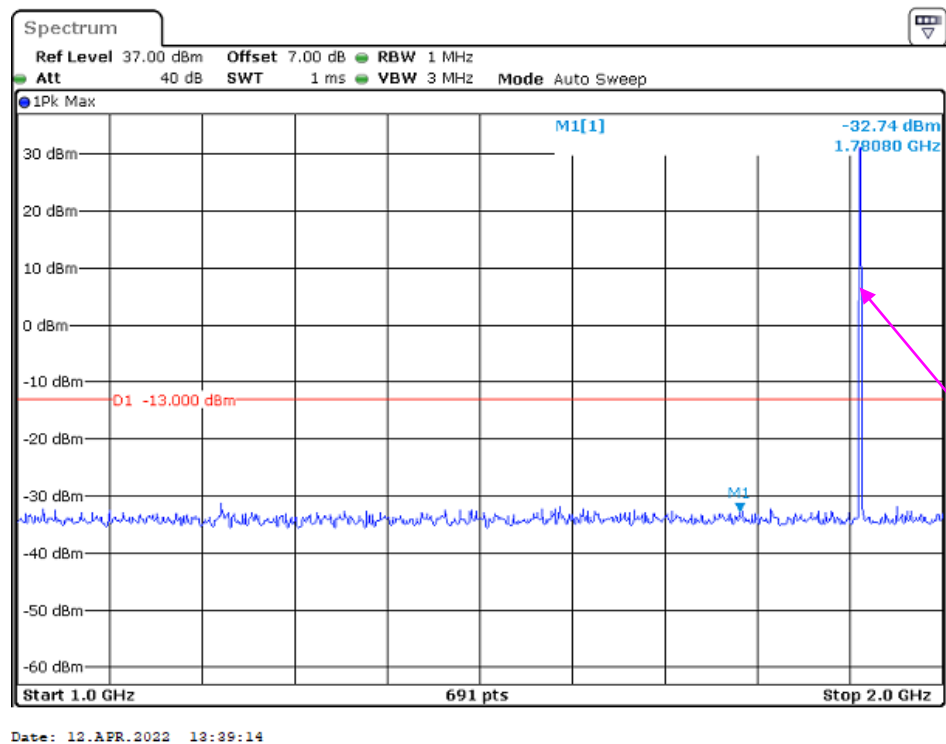


Date: 12.APR.2022 13:41:43

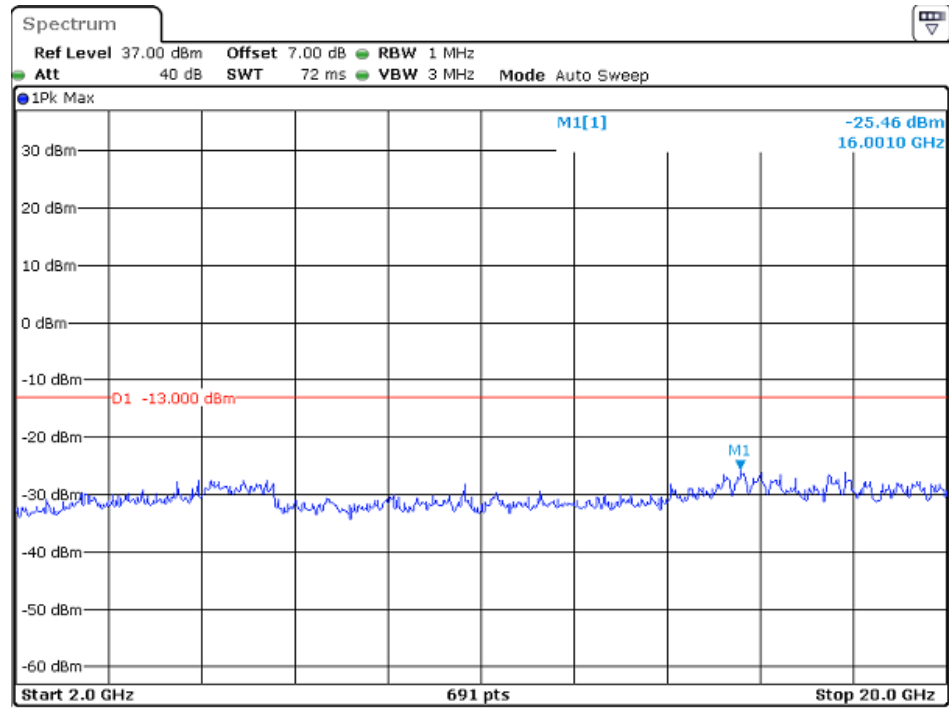
## 30 MHz – 1 GHz - High channel



## 1 GHz – 20 GHz - High channel



## 2 GHz – 20 GHz -High channel



Date: 12.APR.2022 13:38:25

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**FCC § 2.1053; § 22.917 (a); § 24.238 (a) - SPURIOUS RADIATED EMISSIONS**

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**Applicable Standard**

FCC § 2.1053, §22.917(a) & § 24.238(a).

**Test Procedure**

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the receiving antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

**Test Data****Environmental Conditions**

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 24 °C     |
| <b>Relative Humidity:</b> | 52 %      |
| <b>ATM Pressure:</b>      | 101.1 kPa |

*The testing was performed by Key.Pei on 2022-04-12.*

*EUT operation mode: Transmitting (Worst case record in the reports)*

*The worst case is as below:*

**30MHz - 20GHz:**

| Frequency<br>(MHz)       | Receiver         |                | Turntable<br>Degree | Rx Antenna    |                | Substituted<br>Factor<br>(dB) | Absolute<br>Level<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|--------------------------|------------------|----------------|---------------------|---------------|----------------|-------------------------------|----------------------------|----------------|----------------|
|                          | Reading<br>(dBm) | PK/QP/<br>Ave. |                     | Height<br>(m) | Polar<br>(H/V) |                               |                            |                |                |
| GSM 850,Low Channel      |                  |                |                     |               |                |                               |                            |                |                |
| 629.75                   | -74.49           | PK             | 113                 | 1.8           | H              | 10.26                         | -64.23                     | -13            | -51.23         |
| 171.69                   | -60.37           | PK             | 71                  | 1.7           | V              | 0.84                          | -59.53                     | -13            | -46.53         |
| 1648.4                   | -44.93           | PK             | 129                 | 1.4           | H              | 3.52                          | -41.41                     | -13            | -28.41         |
| 1648.4                   | -45.43           | PK             | 267                 | 1.6           | V              | 3.1                           | -42.33                     | -13            | -29.33         |
| GSM 850, Middle Channel  |                  |                |                     |               |                |                               |                            |                |                |
| 629.75                   | -73.48           | PK             | 40                  | 1.5           | H              | 10.26                         | -63.22                     | -13            | -50.22         |
| 171.69                   | -61.19           | PK             | 184                 | 1.6           | V              | 0.84                          | -60.35                     | -13            | -47.35         |
| 1673.2                   | -45.75           | PK             | 2                   | 1.9           | H              | 3.78                          | -41.97                     | -13            | -28.97         |
| 1673.2                   | -46.51           | PK             | 128                 | 1.8           | V              | 3.1                           | -43.41                     | -13            | -30.41         |
| GSM 850, High Channel    |                  |                |                     |               |                |                               |                            |                |                |
| 629.75                   | -74.00           | PK             | 140                 | 1.8           | H              | 10.26                         | -63.74                     | -13            | -50.74         |
| 171.69                   | -62.53           | PK             | 19                  | 1.9           | V              | 0.84                          | -61.69                     | -13            | -48.69         |
| 1697.6                   | -45.69           | PK             | 261                 | 1.3           | H              | 4.07                          | -41.62                     | -13            | -28.62         |
| 1697.6                   | -45.51           | PK             | 195                 | 1.4           | V              | 3.1                           | -42.41                     | -13            | -29.41         |
| PCS 1900, Low Channel    |                  |                |                     |               |                |                               |                            |                |                |
| 629.75                   | -74.54           | PK             | 116                 | 1.5           | H              | 10.26                         | -64.28                     | -13            | -51.28         |
| 171.69                   | -62.58           | PK             | 192                 | 1.7           | V              | 0.84                          | -61.74                     | -13            | -48.74         |
| 3700.4                   | -48.97           | PK             | 316                 | 1.3           | H              | 4.72                          | -44.25                     | -13            | -31.25         |
| 3700.4                   | -50.29           | PK             | 154                 | 1.6           | V              | 4.61                          | -45.68                     | -13            | -32.68         |
| PCS 1900, Middle Channel |                  |                |                     |               |                |                               |                            |                |                |
| 629.75                   | -73.68           | PK             | 154                 | 1.7           | H              | 10.26                         | -63.42                     | -13            | -50.42         |
| 171.69                   | -62.13           | PK             | 177                 | 2.0           | V              | 0.84                          | -61.29                     | -13            | -48.29         |
| 3760                     | -50.35           | PK             | 102                 | 1.4           | H              | 4.94                          | -45.41                     | -13            | -32.41         |
| 3760                     | -50.33           | PK             | 357                 | 1.1           | V              | 4.85                          | -45.48                     | -13            | -32.48         |
| PCS 1900, High Channel   |                  |                |                     |               |                |                               |                            |                |                |
| 629.75                   | -74.34           | PK             | 343                 | 1.5           | H              | 10.26                         | -64.08                     | -13            | -51.08         |
| 171.69                   | -61.50           | PK             | 278                 | 1.2           | V              | 0.84                          | -60.66                     | -13            | -47.66         |
| 3819.6                   | -50.73           | PK             | 194                 | 1.3           | H              | 5.25                          | -45.48                     | -13            | -32.48         |
| 3819.6                   | -50.90           | PK             | 95                  | 2.1           | V              | 5.08                          | -45.82                     | -13            | -32.82         |

**Note:**

Absolute Level = Reading Level + Substituted Factor

Substituted Factor contains: SG Level - Cable loss+ Antenna Gain

Margin = Absolute Level - Limit

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**FCC § 22.917 (a);§ 24.238 (a) - BAND EDGES**

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**Applicable Standard**

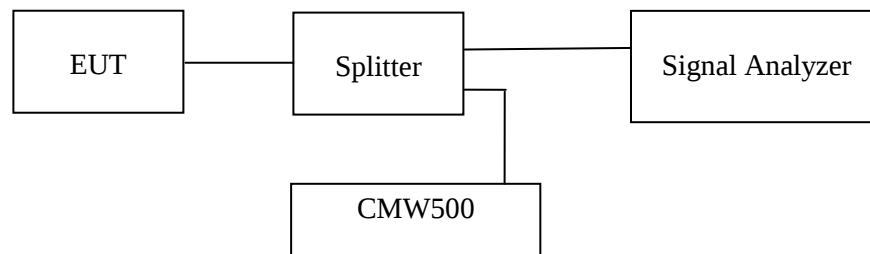
According to § 22.917(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

According to §24.238(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

**Test Procedure**

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The center of the spectrum analyzer was set to block edge frequency



## Environmental Conditions

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 24 °C     |
| <b>Relative Humidity:</b> | 52 %      |
| <b>ATM Pressure:</b>      | 101.1 kPa |

*EUT operation mode: Transmitting (Worst case)*

## Cellular Band (Part 22H)

**Spectrum**

Ref Level 37.00 dBm Offset 7.00 dB RBW 5 kHz  
Att 45 dB SWT 400  $\mu$ s VBW 10 kHz Mode Auto FFT

1Pk Max

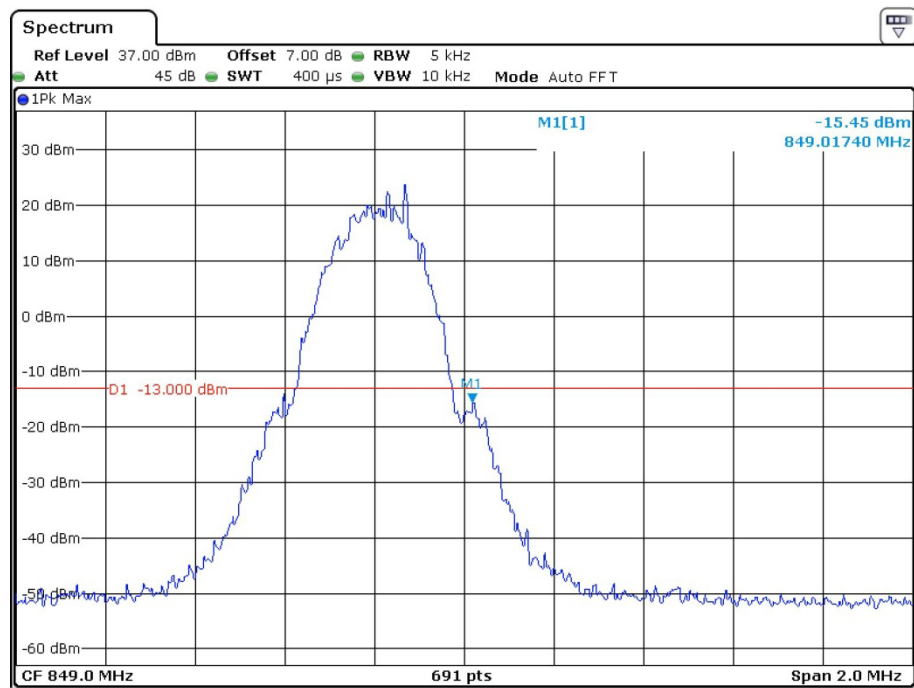
M1[1] -13.55 dBm  
823.99710 MHz

D1 -13.000 dBm

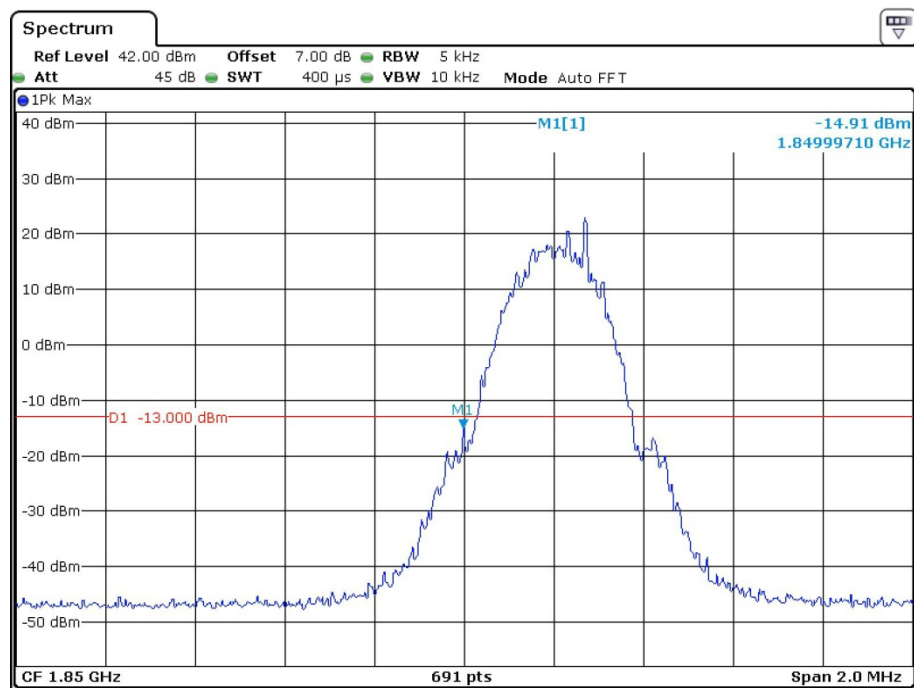
CF 824.0 MHz 691 pts Span 2.0 MHz

The image displays a spectrum plot with a blue trace representing the signal. The x-axis is labeled 'CF 824.0 MHz' and 'Span 2.0 MHz', indicating a frequency range from 822.0 MHz to 824.0 MHz. The y-axis is labeled 'dBm' and ranges from -60 dBm to 30 dBm. A prominent peak is visible at 823.99710 MHz, reaching a power level of -13.55 dBm. A red horizontal line is drawn at -13.000 dBm, labeled 'D1 -13.000 dBm'. The peak is labeled 'M1[1]' and '1Pk Max'. The plot also shows a noise floor around -50 dBm. The bottom of the plot indicates '691 pts' and 'Span 2.0 MHz'.

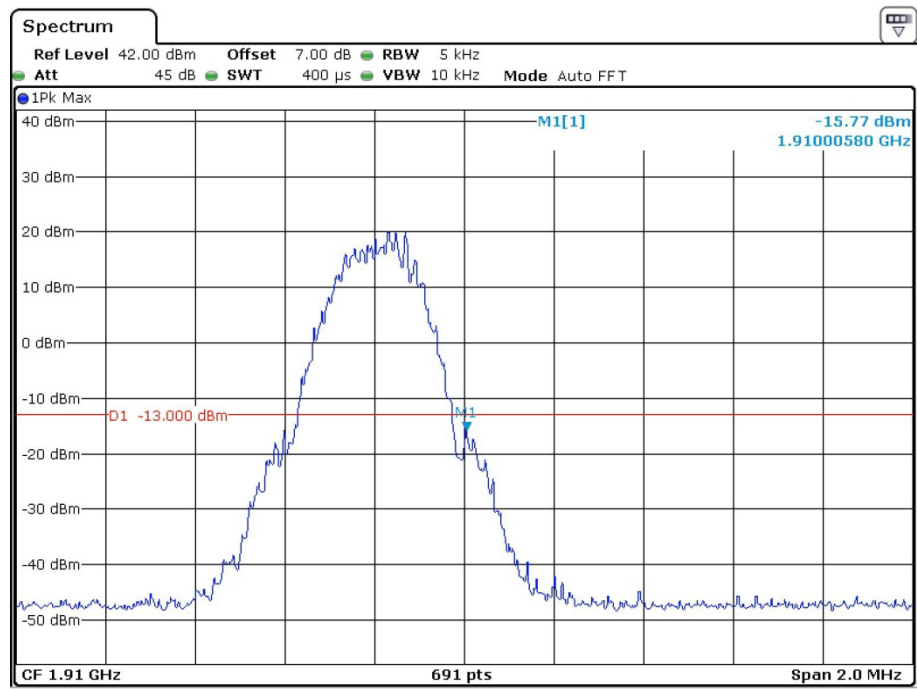
Date: 13.APR.2022 19:52:19

**Right Band Edge for GSM(GMSK) Mode**

Date: 13.APR.2022 19:51:39

**PCS Band (Part 24E)****Left Band Edge for GSM(GMSK)Mode**

Date: 13.APR.2022 20:06:16

**Right Band Edge for GSM (GMSK) Mode**

Date: 13.APR.2022 20:07:11

**FCC § 2.1055; § 22.355; § 24.235 - FREQUENCY STABILITY****Applicable Standard**

FCC § 2.1055, §22.355, §24.235.

According to FCC §2.1055, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

According to §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table below:

Frequency Tolerance for Transmitters in the Public Mobile Services

| Frequency Range (MHz) | Base, fixed (ppm) | Mobile ≤ 3 watts (ppm) | Mobile > 3 watts (ppm) |
|-----------------------|-------------------|------------------------|------------------------|
| 25 to 50              | 20.0              | 20.0                   | 50.0                   |
| 50 to 450             | 5.0               | 5.0                    | 50.0                   |
| 450 to 512            | 2.5               | 5.0                    | 5.0                    |
| 821 to 896            | 1.5               | 2.5                    | 2.5                    |
| 928 to 929.           | 5.0               | N/A                    | N/A                    |
| 929 to 960.           | 1.5               | N/A                    | N/A                    |
| 2110 to 2220          | 10.0              | N/A                    | N/A                    |

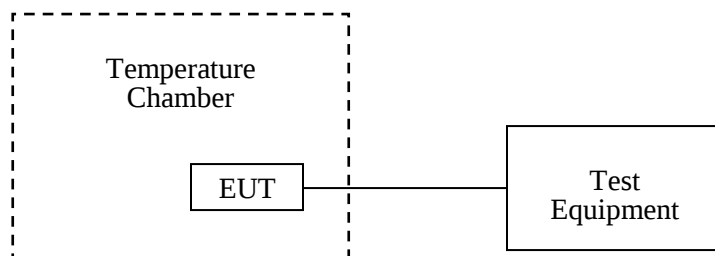
According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

**Test Procedure**

Frequency Stability vs. Temperature: The equipment under test was connected to an external AC power supply and the RF output was connected to communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The AC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the communication test set.

Frequency Stability vs. Voltage: For hand carried, battery powered equipment; reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.



**Test Data****Environmental Conditions**

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 24 °C     |
| <b>Relative Humidity:</b> | 52 %      |
| <b>ATM Pressure:</b>      | 101.1 kPa |

The testing was performed by Key.Pei on 2022-04-12.

EUT operation mode: Transmitting

**Test Result: Pass**

Please refer to the following tables.

Note: The worst case was DC 12V was recorded.

**Cellular Band (Part 22H)****GSM Mode**

| Middle Channel, $f_o = 836.6\text{MHz}$ |                               |                      |                       |             |
|-----------------------------------------|-------------------------------|----------------------|-----------------------|-------------|
| Temperature (°C)                        | Voltage Supplied ( $V_{DC}$ ) | Frequency Error (Hz) | Frequency Error (ppm) | Limit (ppm) |
| -30                                     | 12V                           | 4                    | 0.0048                | 2.5         |
| -20                                     |                               | 5                    | 0.0060                | 2.5         |
| -10                                     |                               | 7                    | 0.0084                | 2.5         |
| 0                                       |                               | 4                    | 0.0048                | 2.5         |
| 10                                      |                               | 6                    | 0.0072                | 2.5         |
| 20                                      |                               | 5                    | 0.0060                | 2.5         |
| 30                                      |                               | 7                    | 0.0084                | 2.5         |
| 40                                      |                               | 6                    | 0.0072                | 2.5         |
| 50                                      |                               | 8                    | 0.0096                | 2.5         |
| 20                                      | 10.8V                         | 4                    | 0.0048                | 2.5         |
|                                         | 13.2V                         | 6                    | 0.0072                | 2.5         |

**PCS Band (Part 24E)****GSM Mode**

| <b>Middle Channel, <math>f_o = 1880.0</math> MHz</b> |                                                  |                                     |                                      |               |
|------------------------------------------------------|--------------------------------------------------|-------------------------------------|--------------------------------------|---------------|
| <b>Temperature<br/>(°C)</b>                          | <b>Voltage<br/>Supplied<br/>(V<sub>DC</sub>)</b> | <b>Frequency<br/>Error<br/>(Hz)</b> | <b>Frequency<br/>Error<br/>(ppm)</b> | <b>Result</b> |
| -30                                                  | 12V                                              | -2                                  | -0.0011                              | pass          |
| -20                                                  |                                                  | -6                                  | -0.0032                              | pass          |
| -10                                                  |                                                  | -5                                  | -0.0027                              | pass          |
| 0                                                    |                                                  | -7                                  | -0.0037                              | pass          |
| 10                                                   |                                                  | -4                                  | -0.0021                              | pass          |
| 20                                                   |                                                  | -1                                  | -0.0005                              | pass          |
| 30                                                   |                                                  | -3                                  | -0.0016                              | pass          |
| 40                                                   |                                                  | -5                                  | -0.0027                              | pass          |
| 50                                                   |                                                  | -4                                  | -0.0021                              | pass          |
| 20                                                   | 10.8V                                            | -3                                  | -0.0016                              | pass          |
|                                                      | 13.2V                                            | -6                                  | -0.0032                              | pass          |

**\*\*\*\*\* END OF REPORT \*\*\*\*\***