

RF Test Report

For

Applicant name: Shenzhen Eview GPS Technology
Address: Rm 201, building 1-A, Nankechuang Yuangu, Dalang, Longhua District, Shenzhen, China
EUT name: Personal Mobile Alarm System
Brand name: N/A
Model number: EV-12X
Series model number: EV-12X-A, EV-12
FCC ID: 2AUMJEV-12X-A

Issued By

Company name: BTF Testing Lab (Shenzhen) Co., Ltd.
Address: 101/201/301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China
Report number: BTF250224R00103
Test standards: FCC CFR Title 47 Part 2
FCC CFR Title 47 Part24
FCC CFR Title 47 Part27
Test conclusion: Pass
Date of sample receipt: 2025-02-25
Test date: 2025-04-16 to 2025-05-06
Date of issue: 2025-05-06
Test by: Sean He
Sean He / Tester
Prepared by: Chris Liu
Chris Liu / Project engineer

Approved
by:



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Revision History		
Version	Issue date	Revisions content
R_V0	2025-05-06	Original

Note:
Once the revision has been made, then previous versions reports are invalid.

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1 Introduction

1.1 Laboratory Location

Test location:	BTF Testing Lab (Shenzhen) Co., Ltd.
Address:	101/201/301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Subdistrict, Bao'an District, Shenzhen, China
Phone number:	+86-0755-23146130
Fax number:	+86-0755-23146130

1.2 Laboratory Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **FCC - Designation No.: CN1409**

BTF Testing Lab (Shenzhen) Co., Ltd. has been accredited as a testing laboratory by FCC (Federal Communications Commission). The test firm Registration No. is 518915.

- **CNAS - Registration No.: CNAS L17568**

BTF Testing Lab (Shenzhen) Co., Ltd. is accredited to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L17568.

- **A2LA - Registration No.: 6660.01**

BTF Testing Lab (Shenzhen) Co., Ltd. is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories.

1.3 Announcement

- (1) The test report reference to the report template version v0.
- (2) The test report is invalid if not marked with the signatures of the persons responsible for preparing, reviewing and approving the test report.
- (3) The test report is invalid if there is any evidence and/or falsification.
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- (6) The laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant.

2 Product Information

2.1 Application Information

Company name:	Shenzhen Eview GPS Technology
Address:	Rm 201, building 1-A, Nankechuang Yuangu, Dalang, Longhua District, Shenzhen, China

2.2 Manufacturer Information

Company name:	Shenzhen Eview GPS Technology
Address:	Rm 201, building 1-A, Nankechuang Yuangu, Dalang, Longhua District, Shenzhen, China

2.3 Factory Information

Company name:	Shenzhen Eview GPS Technology
Address:	Rm 201, building 1-A, Nankechuang Yuangu, Dalang, Longhua District, Shenzhen, China

2.4 General Description of Equipment under Test (EUT)

EUT name	Personal Mobile Alarm System
Under test model name	EV-12X
Series model name	EV-12X-A, EV-12
Description of model name differentiation	Only the model name is different, the others are the same.
Hardware Version	V1.2
Software Version	V1.0.44.11
Rating:	Rechargeable Li-ion polymer Battery DC 3.85V/ 720mAh

2.5 Technical Information

Operation frequency:	FDD LTE Band 2: 1850.7 MHz ~ 1909.3 MHz FDD LTE Band 4: 1710.7 MHz ~ 1754.3 MHz FDD LTE Band 12: 699.7 MHz ~ 715.3 MHz	
Modulation Type:	LTE	QPSK 16QAM
Antenna type:	Internal Antenna	
Antenna gain:	FDD LTE Band 2: 0.92dBi FDD LTE Band 4: -0.10dBi FDD LTE Band 12: -6.51 dBi (declare by Applicant)	
Power Class	FDD LTE Band 2: 3 FDD LTE Band 4: 3 FDD LTE Band 12: 3	

Maximum conducted power	LTE Band 2: 22.69dBm LTE Band 4: 23.4dBm LTE Band 12: 23.65dBm
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3 Test Information

3.1 Test Standards

Identity	Document Title
FCC CFR Title 47 Part 2	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
FCC CFR Title 47 Part 24 Subpart E	Broadband PCS
FCC CFR Title 47 Part 27 Subpart H	Competitive Bidding Procedures for the 698-746 MHz Band
FCC CFR Title 47 Part 27 Subpart L	1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 2110-2155MHz, 2155-2180 MHz, 2180-2200 MHz Bands
ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
ANSI/TIA-603-E-2016	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

3.2 Summary of Test

Clauses	Test Items	Result
§ 2.1046 § 24.232(c) –PCS/WCDMA1900 & LTE B2/B25 § 27.50(c)(10) –LTE B12/B17 § 27.50(d)(4) –WCDMA1700 & LTE B4/B66	RF Output Power	Pass
§ 24.232(d) –PCS/WCDMA1900 & LTE B2/B25 § 27.50(d)(5) –WCDMA1700 & LTE B4/B66	Peak-to-Average Power Ratio	Pass
§ 2.1047	Modulation Characteristics	Pass
§ 2.1049	26dB Emission Bandwidth 99% Occupied Bandwidth	Pass
§ 2.1051 § 24.238(a) –PCS/WCDMA1900 & LTE B2/B25 § 27.53(g) –LTE B12/B17 § 27.53(h) –LTE B4/B66	Out of Band Emission at Antenna Terminals	Pass
§ 2.1053 § 24.238(a) –PCS/WCDMA1900 & LTE B2/B25 § 27.53(g) –LTE B12/B17 § 27.53(h) –LTE B4/B66	Field Strength of Spurious Radiation	Pass
§ 2.1055 § 24.235 –PCS/WCDMA1900 & LTE B2/B25 § 27.54 –LTE	Frequency Stability	Pass

B4/B7/B12/B17/B38/B41/B66		
Remark:		
1. Pass: met the requirements. 2. N/A: not applicable.		

3.3 Uncertainty of Test

Measurement	Value
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±1.5 dB
Power Spectral Density, conducted	±3.0 dB
Unwanted Emissions, conducted	±3.0 dB
Supply voltages	±3 %
Time	±5 %
Conducted Emission for LISN (9kHz ~ 150kHz)	±2.97 dB
Conducted Emission for LISN (150kHz ~ 30MHz)	±2.45 dB
Radiated Emission (30MHz ~ 1000MHz)	±4.80 dB
Radiated Emission (1GHz ~ 18GHz)	±4.82 dB
The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	

3.4 Additions to, deviations, or exclusions from the method

None

3.5 Test Auxiliary Equipment

Description	Manufacturer	Model	Serial No.	Length	Description
/	/	/	/	/	/

3.6 Test Equipment List

Radiated test method					
Test Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
EMI Receiver	Rohde & Schwarz	ESCI7	101032	2024/10/25	2025/10/24
Signal Analyzer	Rohde & Schwarz	FSQ40	100010	2024/10/25	2025/10/24
Log periodic antenna	Schwarzbeck	VULB 9168	01328	2024/10/28	2025/10/27
Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	61997	2024/10/25	2025/10/24
Preamplifier (30MHz ~ 1GHz)	Schwarzbeck	BBV9744	00246	2024/09/24	2025/09/23
Horn Antenna (1GHz ~ 18GHz)	Schwarzbeck	BBHA9120D	2597	2024/10/30	2025/10/29
Horn Antenna (15GHz ~ 40GHz)	SCHWARZBECK	BBHA9170	1157	2024/10/24	2025/10/23

Preamplifier (1GHz ~ 40GHz)	TST Pass	LNA10180G45	246	2024/09/24	2025/09/23
Test Software	Frad	EZ_EMCA	Version: FA-03A2 RE+		

Conducted test method					
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	Keysight	N9020A	MY50410020	2024/10/25	2025/10/24
ESG Vector Signal Generator	Agilent	E4438C	MY45094854	2024/10/25	2025/10/24
MXG Vector Signal Generator	Agilent	N5182A	MY46240163	2024/10/25	2025/10/24
Wideband Radio Communication Tester	Rohde&Schwarz	CMW500	61997	2024/10/25	2025/10/24
Temperature Humidity Chamber	ZZCKONG	ZZ-K02A	20210928007	2024/10/25	2025/10/24
DC Power Supply	Tongmen	etm-6050c	20211026123	2024/10/25	2025/10/24
RF Control Unit	Techy	TR1029-1	/	2024/10/25	2025/10/24
RF Sensor Unit	Techy	TR1029-2	/	2024/10/25	2025/10/24
Test Software	TST Pass	/	Version: 2.0		

4 Test Configuration

4.1 Environment Condition

Selected Values During Tests		
Temperature	Relative Humidity	Ambient Pressure
Normal: +15°C to +35°C		
Extreme: -30°C to +50°C	20% to 75%	86 kPa to 106 kPa

4.2 Test mode

16QAM mode:	Keep the EUT communication with simulated station in 16QAM mode
64QAM mode:	Keep the EUT communication with simulated station in 64QAM mode
Remark: Per-scan all kind of data rate, and report only reflects the test data of worst data rate mode.	

4.3 Test Channel of EUT

Regards to the operating frequency range over 10 MHz, the lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

LTE Band 2					
Channels	Channel No.	Frequency (MHz)	Channels	Channel No.	Frequency (MHz)
1.4 MHz			3 MHz		
Lowest	18607	1850.7	Lowest	18915	1851.5
Middle	18900	1880.0	Middle	18900	1880.0
Highest	19193	1909.3	Highest	19185	1908.5
5 MHz			10 MHz		
Lowest	18625	1852.5	Lowest	18650	1855.0
Middle	18900	1880.0	Middle	18900	1880.0
Highest	19175	1907.5	Highest	19150	1905.0
15 MHz			20 MHz		
Lowest	18675	1857.5	Lowest	18700	1860.0
Middle	18900	1880.0	Middle	18900	1880.0
Highest	19125	1902.5	Highest	19100	1900.0
LTE Band 4					
Channels	Channel No.	Frequency (MHz)	Channels	Channel No.	Frequency (MHz)
1.4 MHz			3 MHz		
Lowest	19957	1710.7	Lowest	19965	1711.5
Middle	20175	1732.5	Middle	20175	1732.5
Highest	20393	1754.3	Highest	20385	1753.5
5 MHz			10 MHz		
Lowest	19975	1712.5	Lowest	20000	1715.0
Middle	20175	1732.5	Middle	20175	1732.5
Highest	20375	1752.5	Highest	20350	1750.0
15 MHz			20 MHz		
Lowest	20025	1717.5	Lowest	20050	1720.0
Middle	20175	1732.5	Middle	20175	1732.5
Highest	20325	1747.5	Highest	20300	1745.0

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Version: 1/00

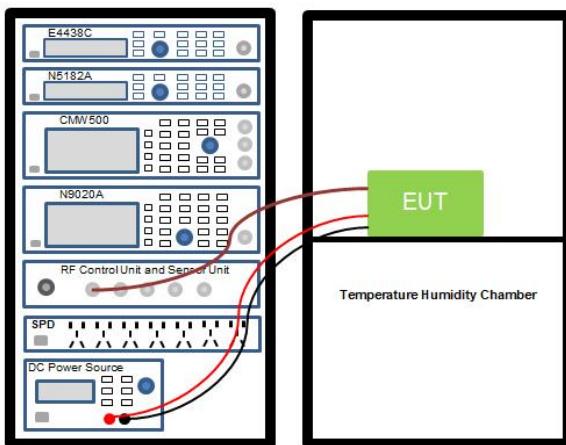
LTE Band 12					
Channels	Channel No.	Frequency (MHz)	Channels	Channel No.	Frequency (MHz)
1.4 MHz			3 MHz		
Lowest	23017	699.70	Lowest	23025	700.50
Middle	23095	707.50	Middle	23095	707.50
Highest	23173	715.30	Highest	23165	714.50
5 MHz			10 MHz		
Lowest	23035	701.50	Lowest	23060	704.00
Middle	23095	707.50	Middle	23095	707.50
Highest	23155	713.50	Highest	23130	711.00

4.4 Test procedure

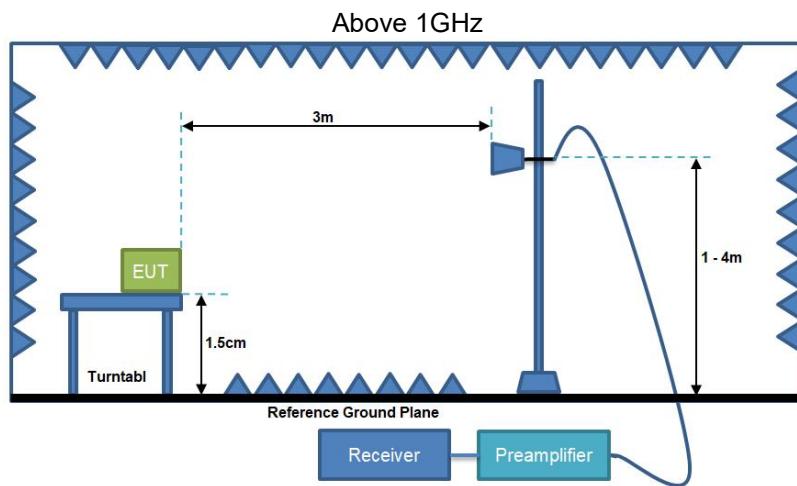
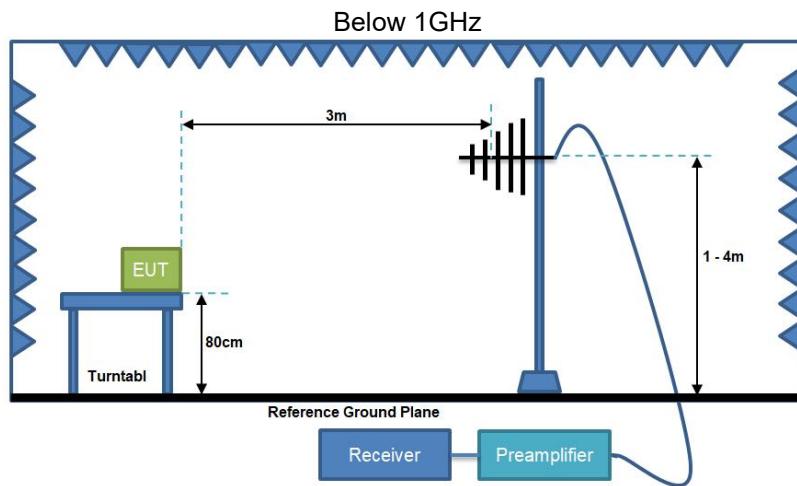
Radiated test method
For below 1GHz: 1. The EUT was placed on the tabletop of a rotating table 0.8 m the ground at a 3 m semi anechoic chamber. The measurement distance from the EUT to the receiving antenna is 3 m. 2. EUT works in each mode of operation that needs to be tested. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations. 3. Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data.
For above 1GHz: 1. The EUT was placed on the tabletop of a rotating table 1.5 m the ground at a 3 m semi anechoic chamber. The measurement distance from the EUT to the receiving antenna is 3 m. 2. EUT works in each mode of operation that needs to be tested. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations. 3. Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data.
Conducted test method
1. The GSM/WCDMA/LTE antenna port of EUT was connected to the test port of the test system through an RF cable. 2. The EUT is keeping in continuous transmission mode and tested in all modulation modes. 3. Open the test software, prepare a test plan, and control the system through the software. After the test is completed, the test report is exported through the test software.

4.5 Test Setup Block

1) Conducted test method:



2) Radiated test method:



5 Technical requirements specification

5.1 Transmitter Radiated Power (EIRP/ERP)

5.1.1 Limit

FCC § 2.1046 & 22.913(a) & 24.232(c) & 27.50(a) & 27.50(b) & 27.50(c) & 27.50(d) & 27.50(h) & 90.635(b) & 90.542(a); RSS-103 4.6; RSS-132 5.4, RSS-133 6.4, RSS-139 6.5, RSS199 4.4

According to FCC section 22.913(a) (5), the Effective Radiated Power (ERP) of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

According to FCC section 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.

According to FCC section 27.50(a) (3), for mobile and portable stations transmitting in the 2305-2315MHz band or the 2350-2360MHz band, the average EIRP must not exceed 50 milliwatts within any 1 megahertz of authorized bandwidth, except that for mobile and portable stations compliant with 3GPP LTE standards.

FCC section 27.50(b) (10), portable stations (hand-held devices) transmitting in the 746-757MHz, 776-788MHz, and 805-806MHz bands are limited to 3 watts ERP.

FCC section 27.50(c) (10), portable stations (hand-held devices) in the 600MHz uplink band and the 698-746MHz band, and fixed and mobile stations in the 600MHz uplink band are limited to 3 watts ERP.

FCC section 27.50(d) (4), fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP. Fixed stations operating in the 1710-1755 MHz band are limited to a maximum antenna height of 10 meters above ground. Mobile and portable stations operating in these bands must employ a means for limiting power to the minimum necessary for successful communications.

(7) Fixed, mobile, and portable (hand-held) stations operating in the 2000-2020 MHz band are limited to 2 watts EIRP.

And FCC section 27.50(h) (2), for mobile and other user stations, mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.

According to FCC section 90.635(b), the maximum output power of the transmitter for mobile stations is 100 watts (20dBW).

According to FCC section 90.542(a) (7), portable stations (hand-held devices) transmitting in the 758-768 MHz band and the 788-798 MHz band are limited to 3 watts ERP.

5.1.2 Test Setup

The section 4.4 test setup 4 description is used for conducted test, and the test setup description is used for radiated test. The photo of test setup please refer to Appendix I Test Setup Photos

5.1.3 Test Procedure

Description of the Conducted Output Power Measurement

The EUT is coupled to the SS with attenuator through power splitter; the RF load attached to EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. A system simulator is used to establish communication with the EUT, and its parameters are set to force the EUT transmitting at maximum output power. The measured power in the radio frequency on the transmitter output terminals shall be reported.

The relevant equation for determining the conducted measured value is:

$$\text{Conducted Output Power Value (dBm)} = \text{Measured Value (dBm)} + \text{Path Loss (dB)}$$

where:

Conducted Output Power Value = final conducted measured value in the conducted power test, in dBm;

Measured Value = measured conducted power received by spectrum analyzer or power meter, in dBm;

Path Loss = signal attenuation in the connecting cable between the transmitter and spectrum analyzer or power meter, including external cable loss, in dB;

During the test, the data of Path Loss (dB) is added in the spectrum analyzer or power meter, so Measured Value (dBm) is the final values which contains the data of Path Loss (dB).

For example:

In the conducted output power test, when measured value for GSM850 is 24.7 dBm, and path loss is 8.5 dB, then final conducted output power value is:

$$\text{Conducted Output Power Value (dBm)} = 24.7 \text{ dBm} + 8.5 \text{ dB} = 33.2 \text{ dBm}$$

Description of the Transmitter Radiated Power Measurement

In many cases, the RF output power limits for licensed digital transmission devices is specified in terms of effective radiated power (ERP) or equivalent isotropic radiated power (EIRP). Typically, ERP is specified when the operating frequency is less than or equal to 1 GHz and EIRP is specified when the operating frequency is greater than 1 GHz. Both are determined by adding the transmit antenna gain to the conducted RF output power with the primary difference between the two being that when determining the ERP, the transmit antenna gain is referenced to a dipole antenna (i.e., dBd) whereas when determining the EIRP, the transmit antenna gain is referenced to an isotropic antenna (dBi).

Final measurement calculation as below:

The relevant equation for determining the ERP or EIRP from the conducted RF output power measured using the guidance provided above is:

$$\text{ERP/EIRP} = \text{PMeas} + \text{GT} - \text{LC}$$

where:

ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as PMeas, typically dBW or dBm);

PMeas = measured transmitter output power or PSD, in dBm or dBW; GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP); dBd (ERP)=dBi (EIRP) -2.15 dB
LC = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

For devices utilizing multiple antennas, KDB 662911 provides guidance for determining the effective array transmit antenna gain term to be used in the above equation.

For example:

In the EIRP test, when PMeas value for GSM1900 is 30.2 dBm, LC is 0.6 dB, and GT is -3.4 dB, then final EIRP value is:

$$\text{EIRP for GSM1900} = 30.2 \text{ dBm} - 3.4 \text{ dBi} - 0.6 \text{ dB} = 26.2 \text{ dBm}$$

The relevant equation for determining the ERP/EIRP from the radiated RF output power is:

$$\text{ERP/EIRP (dBm)} = \text{SA Read Value (dBm)} + \text{Correction Factor (dB)}$$

where:

ERP/EIRP = effective or equivalent radiated power, in dBm;

SA Read Value = measured transmitter power received by EMI receiver or spectrum analyzer, in dBm;

Correction Factor = total correction factor including cable loss, in dB;

During the test, the data of Correction Factor (dB) is added in the EMI receiver or spectrum analyzer, so SA Read Value (dBm) is the final values which contains the data of Correction Factor (dB).

For example:

In the ERP test, when SA read value for GSM850 is 21dBm, and correction factor is 8dB, then final ERP value for GSM850 is:

$$\text{ERP (dBm)} = 21 \text{ dBm} + 8 \text{ dB} = 29 \text{ dBm}$$

5.1.4 Test Result

Please refer to the appendix report

5.2 Peak to Average Ratio

5.2.1 Limit

FCC § 2.1046 & 24.232(d) & 27.50(d); RSS-130 4.6.1, RSS-133 6.4, RSS-139 6.5, RSS199 4.4

In addition, when the transmitter power is measured in terms of average value, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time using a signal corresponding to the highest PAPR during periods of continuous transmission.

According to FCC section 24.232(d); RSS-133 6.4, power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with 24.232 (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of § 24.51. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

FCC section 24.232(e)); RSS-133 6.4,, peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

According to FCC section 27.50(d) (5); RSS-139 6.5, in measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13dB.

According to RSS-19 4.4, In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the highest PAPR during periods of continuous transmission.

5.2.2 Test Setup

The section 4.5 test setup 5 description is used for conducted test, and the test setup description is used for radiated test. The photo of test setup please refer to Appendix I Test Setup Photos

5.2.3 Test Procedure

Here the lowest, middle and highest channels are selected to perform testing to verify the peak-to-average ratio.

According to KDB 971168 D01, there is CCDF procedure for PAPR:

- a) Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;
- b) Set resolution/measurement bandwidth \geq signal's occupied bandwidth;
- c) Set the number of counts to a value that stabilizes the measured CCDF curve;
- d) Set the measurement interval as follows:
 - 1)for continuous transmissions, set to 1 ms,

2) for burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize and set the measurement interval to a time that is less than or equal to the burst duration.

e) Record the maximum PAPR level associated with a probability of 0.1%.

Alternate procedure for PAPR:

Use one of the procedures presented in 4.1 to measure the total peak power and record as PPk. Use one of the applicable procedures presented 4.2 to measure the total average power and record as PAvg. Both the peak and average power levels must be expressed in the same logarithmic units (e.g., dBm). Determine the PAPR from:

$$\text{PAPR (dB)} = \text{PPk (dBm)} - \text{PAvg (dBm)}.$$

5.2.4 Test Result

Please refer to the appendix report

5.3 Occupied Bandwidth

5.3.1 Limit

FCC § 2.1049, RSS-Gen 6.7

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.

Many of the individual rule parts specify a relative OBW in lieu of the 99% OBW. In such cases, the OBW is defined as the width of the signal between two points, one below the carrier center frequency and on above the carrier center frequency, outside of which all emissions are attenuated by at least X dB below the transmitter power, where the value of X is typically specified as 26.

5.3.2 Test Setup

The section 4.5 test setup 5 description is used for conducted test, and the test setup description is used for radiated test. The photo of test setup please refer to Appendix I Test Setup Photos

5.3.3 Test Procedure

The following procedure shall be used for measuring power bandwidth.

- a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (i.e., two to five times the anticipated OBW).
- b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.
- c) Set the reference level of the instrument as required to keep the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope must be at least $10\log(\text{OBW} / \text{RBW})$ below the reference level.
- d) NOTE—Steps a) through c) may require iteration to adjust within the specified tolerances.
- e) For -26 dB OBW, the dynamic range of the spectrum analyzer at the selected RBW shall be at least 10dB below the target “-X dB down” requirement, e.g. -26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be 36dB below the reference value.
- f) Set the detection mode to peak, and the trace mode to max hold.
- g) For 99% OBW, use the 99 % power bandwidth function of the spectrum analyzer (if available) and report the measured bandwidth.
If the instrument does not have a 99 % power bandwidth function, the trace data points are to be recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99 % power bandwidth is the difference between these two frequencies.
- h) For -26 dB OBW, determine the reference value: Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).

Determine the “-X dB down amplitude” as equal to (reference value -X). Alternatively, this calculation can be performed by the analyzer by using the marker-delta function.

Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below “-X dB down amplitude” determined in step g). If a marker is below this “-X dB down amplitude” value it shall be placed as close as possible to this value. The OBW is the positive frequency difference between the two markers.

- i) The OBW shall be reported by providing plot(s) of the measuring instrument display. The frequency and amplitude axes and scale shall be clearly labeled. Tabular data may be reported in addition to the plot(s).
- j) Change variable modulations, coding, or channel bandwidth settings, then repeat above test procedures.

5.3.4 Test Result

Please refer to the appendix report

5.4 Frequency Stability

5.4.1 Limit

FCC § 2.1055 & 22.355 & 24.235 & 27.54 & 90.213; RSS-130 4.5, RSS-132 5.3, RSS-133 6.3, RSS-139 6.4, RSS199 4.3

The frequency stability shall be measured with variation of ambient temperature as follows:

- (1) The temperature is varied from -30°C to +50°C.
- (2) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10°C through the range.

The frequency stability shall be measured with variation of primary supply voltage as follows:

- (1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than carried battery equipment.
- (2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating and point which shall be specified by the manufacturer.
- (3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided.

FCC § 22.355, RSS-132 5.3

Except as otherwise provided in this part, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table C-1 of this section.

Table C-1—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

FCC § 24.235, RSS-133 6.3

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

FCC § 27.54, RSS-139 6.4

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

FCC § 90.213, RSS199 4.3

The frequency stability shall not depart from the reference frequency in excess of ±2.5ppm for mobile stations.

5.4.2 Test Setup

The section 4.5 test setup 6 description is used for conducted test, and the test setup description is used for radiated test. The photo of test setup please refer to Appendix I Test Setup Photos

5.4.3 Test Procedure

1. The EUT is placed in a temperature chamber.
2. The temperature is set to 25°C and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured.
3. The temperature is increased by not more than 10 degrees, allowed to stabilize and soak, and then repeat the frequency error measurement.
4. Repeat procedure 3 until +50°C and -30°C is reached.
5. Change supply voltage, and repeat measurement until extreme voltage is reached.

5.4.4 Test Result

Please refer to the appendix report

5.5 Spurious Emission at Antenna Terminals

5.5.1 Limit

FCC § 2.1051 & 22.917(a) & 24.238(a) & 27.53(a) & 27.53(c) & 27.53(f) & 27.53(g) & 27.53(h) & 27.53(m) & 90.691 & 90.543; RSS-130 4.7, RSS-132 5.5, RSS-133 6.5, RSS-139 6.6, RSS199 4.5

In the 1 MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

FCC § 22.917(a) & 24.238(a), RSS-132 5.5, RSS-133 6.5

The power of any emission 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. This is calculated to be -13 dBm.

FCC § 27.53(a) (4), RSS-139 6.6

For mobile and portable stations operating in the 2305-2315MHz and 2350-2360MHz bands:

- (1) By a factor of not less than: $43 + 10 \log(P)$ dB on all frequencies between 2305 and 2320MHz and on all frequencies between 2345 and 2360MHz that are outside the licensed band(s) of operation, not less than 55 + $10 \log(P)$ dB on all frequencies between 2320 and 2324MHz and on all frequencies between 2341 and 2345MHz, not less than $61 + 10 \log(P)$ dB on all frequencies between 2324 and 2328MHz and on all frequencies between 2337 and 2341MHz, and not less than $67 + 10 \log(P)$ dB on all frequencies between 2328 and 2337MHz.
- (2) By a factor of not less than $43 + 10 \log(P)$ dB on all frequencies between 2300 and 2305MHz, $55 + 10 \log(P)$ dB on all frequencies between 2296 and 2300MHz, $61 + 10 \log(P)$ dB on all frequencies between 2292 and 2296MHz, $67 + 10 \log(P)$ dB on all frequencies between 2288 and 2292MHz, and $70 + 10 \log(P)$ dB below 2288MHz.
- (3) By a factor of not less than $43 + 10 \log(P)$ dB on all frequencies between 2360 and 2365MHz, and not less than $70 + 10 \log(P)$ dB above 2365MHz.

FCC § 27.53(c), RSS-139 6.6

For operations in the 746–758 MHz band and the 776–788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

- (1) On any frequency outside the 746–758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log(P)$ dB;
- (2) On any frequency outside the 776–788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log(P)$ dB;
- (3) On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than $76 + 10 \log(P)$ dB in a 6.25 kHz band segment, for base and fixed stations;
- (4) On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than $65 + 10 \log(P)$ dB in a 6.25 kHz band segment, for mobile and portable stations;

(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

(6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

FCC § 27.53(f) , RSS-139 6.6

For operations in the 746–758 MHz, 775–788 MHz, and 805–806 MHz bands, emissions in the band 1559–1610 MHz shall be limited to - 70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

FCC § 27.53(g) , RSS-139 6.6

For operations in the 600MHz band and the 698-746MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43+10\log(P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

FCC § 27.53(h) (1) , RSS-139 6.6

Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ dB.

FCC § 27.53(m) (4) , RSS-139 6.6

For mobile digital stations (BRS and EBS stations), the attenuation factor shall be not less than:

- $40+10\log P$ dB (-10 dBm, 100 nW) on all frequencies between the channel edge and 5 MHz from the channel edge.
- $43+10\log P$ dB (-13 dBm, 50 nW) on all frequencies between 5 MHz and X MHz from the channel edge,
- $55+10\log P$ dB (-25 dBm, 3 nW) on all frequencies more than X MHz from the channel edge, where X is the greater of 6 MHz or the actual emission bandwidth (26 dB).

In addition, the attenuation factor shall not be less than $43 + 10 \log (P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10 \log (P)$ dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or

EBS licensees.

FCC § 90.691

- (a) Out-of-band emission requirement shall apply only to the "outer" channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:
 - (1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $116 \text{ Log10}(f/6.1)$ decibels or $50 + 10 \text{ Log10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.
 - (2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \text{ Log10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.
- (b) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

FCC § 90.543

- (e) For operations in the 758–768 MHz and the 788–798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:
 - (1) On all frequencies between 769–775 MHz and 799–805 MHz, by a factor not less than $76 + 10 \log(P)$ dB in a 6.25 kHz band segment, for base and fixed stations.
 - (2) On all frequencies between 769–775 MHz and 799–805 MHz, by a factor not less than $65 + 10 \log(P)$ dB in a 6.25 kHz band segment, for mobile and portable stations.
 - (3) On any frequency between 775–788 MHz, above 805 MHz, and below 758 MHz, by at least $43 + 10 \log(P)$ dB.
 - (4) Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.
- (f) For operations in the 758–775 MHz and 788–805 MHz bands, all emissions including harmonics in the band 1559–1610 MHz shall be limited to -70 dBW/ MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

RSS199 4.5

- (a) for base station and fixed subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least $43 + 10 \log10 p$.
- (b) for mobile subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least:
 - (i) $40 + 10 \log10 p$ from the channel edges to 5 MHz away
 - (ii) $43 + 10 \log10 p$ between 5 MHz and X MHz from the channel edges, and
 - (iii) $55 + 10 \log10 p$ at X MHz and beyond from the channel edges

In addition, the attenuation shall not be less than $43 + 10 \log10 p$ on all frequencies between 2490.5 MHz and 2496 MHz, and $55 + 10 \log10 p$ at or below 2490.5 MHz.

In (a) and (b), p is the transmitter power measured in watts and X is 6 MHz or the equipment occupied bandwidth, whichever is greater.

5.5.2 Test Setup

The section 4.5 test setup 5 description is used for conducted test, and the test setup description is used for radiated test. The photo of test setup please refer to Appendix I Test Setup Photos

5.5.3 Test Procedure

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log(P)$ dB. Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency blocks a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

The EUT is coupled to the system simulator and spectrum analyzer; the RF load attached to EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

CMW500 is used to establish communication with the EUT, and its parameters are set to force the EUT transmitting at maximum output power.

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

Spurious emissions are tested with 0.001MHz RBW for frequency less than 150kHz, 0.01MHz RBW for frequency less than 30MHz, 0.1MHz RBW for frequency less than 1GHz, and 1MHz RBW for frequency above 1GHz. And sweep point number are at least 401, referring to following formula.

Sweep point number = Span/RBW VBW=3*RBW

Detector Mode=mean or average power

Record the frequencies and levels of spurious emissions.

5.5.4 Test Result

Please refer to the appendix report

5.6 Band Edge Emission

5.6.1 Limit

FCC § 2.1051 & 22.917(a) & 24.238(a) & 27.53(a) & 27.53(c) & 27.53(g) & 27.53(h) & 27.53(m) & 90.691 & 90.543; RSS-130 4.7, RSS-132 5.5, RSS-133 6.5, RSS-139 6.6, RSS199 4.5

In the 1 MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

FCC § 22.917(a) & 24.238(a), RSS-132 5.5, RSS-133 6.5

The power of any emission 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. This is calculated to be -13 dBm.

FCC § 27.53(a) (4), RSS-139 6.6

For mobile and portable stations operating in the 2305-2315MHz and 2350-2360MHz bands:

- (1) By a factor of not less than: $43 + 10 \log(P)$ dB on all frequencies between 2305 and 2320MHz and on all frequencies between 2345 and 2360MHz that are outside the licensed band(s) of operation, not less than 55 + $10 \log(P)$ dB on all frequencies between 2320 and 2324MHz and on all frequencies between 2341 and 2345MHz, not less than $61 + 10 \log(P)$ dB on all frequencies between 2324 and 2328MHz and on all frequencies between 2337 and 2341MHz, and not less than $67 + 10 \log(P)$ dB on all frequencies between 2328 and 2337MHz.
- (2) By a factor of not less than $43 + 10 \log(P)$ dB on all frequencies between 2300 and 2305MHz, 55 + $10 \log(P)$ dB on all frequencies between 2296 and 2300MHz, $61 + 10 \log(P)$ dB on all frequencies between 2292 and 2296MHz, $67 + 10 \log(P)$ dB on all frequencies between 2288 and 2292MHz, and $70 + 10 \log(P)$ dB below 2288MHz.
- (3) By a factor of not less than $43 + 10 \log(P)$ dB on all frequencies between 2360 and 2365MHz, and not less than $70 + 10 \log(P)$ dB above 2365MHz.

FCC § 27.53(c), RSS-139 6.6

For operations in the 746–758 MHz band and the 776–788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

- (1) On any frequency outside the 746–758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log(P)$ dB;
- (2) On any frequency outside the 776–788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log(P)$ dB;
- (3) On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than $76 + 10 \log(P)$ dB in a 6.25Hz band segment, for base and fixed stations;

- (4) On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than $65 + 10 \log (P)$ dB in a 6.25kHz band segment, for mobile and portable stations;
- (5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater.

However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

- (6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

FCC § 27.53(g), RSS-139 6.6

For operations in the 600MHz band and the 698-746MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43+10*\log(P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

FCC § 27.53(h) (1), RSS-139 6.6

Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log10 (P)$ dB.

FCC § 27.53(m) (4), RSS-139 6.6

For mobile digital stations (BRS and EBS stations), the attenuation factor shall be not less than:

- $40+10\log P$ dB (-10 dBm, 100 nW) on all frequencies between the channel edge and 5 MHz from the channel edge.
- $43+10\log P$ dB (-13 dBm, 50 nW) on all frequencies between 5 MHz and X MHz from the channel edge,
- $55+10\log P$ dB (-25 dBm, 3 nW) on all frequencies more than X MHz from the channel edge, where X is the greater of 6 MHz or the actual emission bandwidth (26 dB).

In addition, the attenuation factor shall not be less than $43 + 10 \log (P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10 \log (P)$ dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

FCC § 90.691

- (a) Out-of-band emission requirement shall apply only to the "outer" channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:
 - (1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116

Log10(f/6.1) decibels or 50 + 10 Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

(b) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

FCC § 90.543

(e) For operations in the 758–768 MHz and the 788–798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

- (1) On all frequencies between 769–775 MHz and 799–805 MHz, by a factor not less than $76 + 10 \log (P)$ dB in a 6.25 kHz band segment, for base and fixed stations.
- (2) On all frequencies between 769–775 MHz and 799–805 MHz, by a factor not less than $65 + 10 \log (P)$ dB in a 6.25 kHz band segment, for mobile and portable stations.
- (3) On any frequency between 775–788 MHz, above 805 MHz, and below 758 MHz, by at least $43 + 10 \log (P)$ dB.
- (4) Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

RSS199 4.5

(a) for base station and fixed subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least $43 + 10 \log 10 p$.

(b) for mobile subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least:

- (i) $40 + 10 \log 10 p$ from the channel edges to 5 MHz away
- (ii) $43 + 10 \log 10 p$ between 5 MHz and X MHz from the channel edges, and
- (iii) $55 + 10 \log 10 p$ at X MHz and beyond from the channel edges

In addition, the attenuation shall not be less than $43 + 10 \log 10 p$ on all frequencies between 2490.5 MHz and 2496 MHz, and $55 + 10 \log 10 p$ at or below 2490.5 MHz.

In (a) and (b), p is the transmitter power measured in watts and X is 6 MHz or the equipment occupied bandwidth, whichever is greater.

5.6.2 Test Setup

The section 4.5 test setup 5 description is used for conducted test, and the test setup description is used for radiated test. The photo of test setup please refer to Appendix I Test Setup Photos

5.6.3 Test Procedure

The EUT, which is powered by the Battery, is coupled to the Spectrum Analyzer (SA) and the System Simulator (SS) with attenuators through the Power Splitter; the RF load attached to the EUT antenna terminal is 50 Ohm; the path loss as the factor is calibrated to correct the reading.

1. The EUT is coupled to the system simulator and spectrum analyzer; the RF load attached to EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.
2. CMW500 is used to establish communication with the EUT, and its parameters are set to force the EUT transmitting at maximum output power.
3. The RF output of the transmitter is connected to the input of the spectrum analyzer through sufficient attenuation.
4. The center of the spectrum analyzer was set to block edge frequency.
5. Band edge are tested with 1%*cBW (RBW), and sweep point number referred to following formula.
Sweep point number = 2*Span/RBW VBW=3RBW
6. Record the frequencies and levels of spurious emissions.

For mobile and portable stations, on all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than $65 + 10 \log (P)$ dB in a 6.25 kHz band segment. Since it was not possible to set the resolution bandwidth to 6.25 kHz with the available equipment, a bandwidth of 10 kHz was used instead to show compliance. By using a 10 kHz bandwidth on the spectrum analyzer.

$$10 \log(10 \text{ kHz} / 6.25 \text{ kHz}) = 2.04 \text{ dB}$$

Limit Line = -35 dBm + 2.04 dB = -32.96dBm

5.6.4 Test Result

Please refer to the appendix report

5.7 Field Strength of Spurious Radiation

5.7.1 Limit

FCC § 2.1053 & 22.917(a) & 24.238(a) & 27.53(a) & 27.53(c) & 27.53(f) & 27.53(g) & 27.53(h) & 27.53(m) & 90.691 & 90.543 ; RSS-130 4.7, RSS-132 5.5, RSS-133 6.5, RSS-139 6.6, RSS199 4.5

FCC § 22.917(a) & 24.238(a)

The power of any emission 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. This is calculated to be -13 dBm.

FCC § 27.53(a) (4), RSS-139 6.6

For mobile and portable stations operating in the 2305-2315MHz and 2350-2360MHz bands:

(1) By a factor of not less than: $43 + 10 \log(P)$ dB on all frequencies between 2305 and 2320MHz and on all frequencies between 2345 and 2360MHz that are outside the licensed band(s) of operation, not less than $55 + 10 \log(P)$ dB on all frequencies between 2320 and 2324MHz and on all frequencies between 2341 and 2345MHz, not less than $61 + 10 \log(P)$ dB on all frequencies between 2324 and 2328MHz and on all frequencies between 2337 and 2341MHz, and not less than $67 + 10 \log(P)$ dB on all frequencies between 2328 and 2337MHz.

(2) By a factor of not less than $43 + 10 \log(P)$ dB on all frequencies between 2300 and 2305MHz, $55 + 10 \log(P)$ dB on all frequencies between 2296 and 2300MHz, $61 + 10 \log(P)$ dB on all frequencies between 2292 and 2296MHz, $67 + 10 \log(P)$ dB on all frequencies between 2288 and 2292MHz, and $70 + 10 \log(P)$ dB below 2288MHz.

(3) By a factor of not less than $43 + 10 \log(P)$ dB on all frequencies between 2360 and 2365MHz, and not less than $70 + 10 \log(P)$ dB above 2365MHz.

FCC § 27.53(c), RSS-139 6.6

For operations in the 746–758 MHz band and the 776–788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

- (1) On any frequency outside the 746–758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log(P)$ dB;
- (2) On any frequency outside the 776–788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log(P)$ dB;
- (3) On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than $76 + 10 \log(P)$ dB in a

6.25 kHz band segment, for base and fixed stations;

- (4) On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than $65 + 10 \log(P)$ dB in a

6.25 kHz band segment, for mobile and portable stations;

- (5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater.

However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

- (6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) of this section is based on the use of

measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

FCC § 27.53(f), RSS-139 6.6

For operations in the 746–758 MHz, 775–788 MHz, and 805–806 MHz bands, emissions in the band 1559–1610 MHz shall be limited to - 70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and

-80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

FCC § 27.53(g), RSS-139 6.6

For operations in the 600MHz band and the 698-746MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43+10\log(P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

FCC § 27.53(h) (1), RSS-139 6.6

Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands,

the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power

(P) in watts by at least $43 + 10 \log_{10} (P)$ dB. FCC § 27.53(m) (4)

For mobile digital stations (BRS and EBS stations), the attenuation factor shall be not less than:

- $40+10\log P$ dB (-10 dBm, 100 nW) on all frequencies between the channel edge and 5 MHz from the channel edge.
- $43+10\log P$ dB (-13 dBm, 50 nW) on all frequencies between 5 MHz and X MHz from the channel edge,
- $55+10\log P$ dB (-25 dBm, 3 nW) on all frequencies more than X MHz from the channel edge, where X is the greater of 6 MHz or the actual emission bandwidth (26 dB).

In addition, the attenuation factor shall not be less than $43 + 10 \log (P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10 \log (P)$ dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

FCC § 90.691

(a) Out-of-band emission requirement shall apply only to the "outer" channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $116 \log_{10}(f/6.1)$ decibels or $50 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation,

where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10\log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

(b) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

FCC § 90.543

(e) For operations in the 758–768 MHz and the 788–798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(1) On all frequencies between 769–775 MHz and 799–805 MHz, by a factor not less than $76 + 10 \log (P)$ dB in a 6.25 kHz band segment, for base and fixed stations.

(2) On all frequencies between 769–775 MHz and 799–805 MHz, by a factor not less than $65 + 10 \log (P)$ dB in a 6.25 kHz band segment, for mobile and portable stations.

(3) On any frequency between 775–788 MHz, above 805 MHz, and below 758 MHz, by at least $43 + 10 \log (P)$ dB.

(4) Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

RSS199 4.5

(a) for base station and fixed subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least $43 + 10 \log_{10} p$.

(b) for mobile subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least:

(i) $40 + 10 \log_{10} p$ from the channel edges to 5 MHz away

(ii) $43 + 10 \log_{10} p$ between 5 MHz and X MHz from the channel edges, and

(iii) $55 + 10 \log_{10} p$ at X MHz and beyond from the channel edges

In addition, the attenuation shall not be less than $43 + 10 \log_{10} p$ on all frequencies between 2490.5 MHz and 2496 MHz, and $55 + 10 \log_{10} p$ at or below 2490.5 MHz.

In (a) and (b), p is the transmitter power measured in watts and X is 6 MHz or the equipment occupied bandwidth, whichever is greater.

5.7.2 Test Setup

The section 4.5 test setup 4 description is used for conducted test, and the test setup description is used for radiated test. The photo of test setup please refer to Appendix I Test Setup Photos

5.7.3 Test Procedure

1. On a test site, the EUT shall be placed at 80cm height on a turn table, and in the position close to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to correspond to the fundamental frequency of the transmitter.

3. The output of the test antenna shall be connected to the measuring receiver and the peak detector is used for the measurement.
4. During the measurement of the EUT, the resolution bandwidth was to 1 MHz and the average bandwidth was set to 1 MHz.
5. The transmitter shall be switched on; the measuring receiver shall be tuned to the frequency of the transmitter under test.
6. The test antenna shall be raised and lowered through the specified range of height until the maximum signal level is detected by the measuring receiver.
7. The transmitter shall be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
8. The test antenna shall be raised and lowered again through the specified range of height until the maximum signal level is detected by the measuring receiver.
9. The maximum signal level detected by the measuring receiver shall be noted.
10. The EUT was replaced by half-wave dipole (824 ~ 849 MHz) or horn antenna (1 850 ~ 1 910 MHz) connected to a signal generator.
11. In necessary, the input attenuator setting on the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
12. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
13. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring received, which is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
14. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
15. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.

Final measurement calculation as below:

The relevant equation for determining the ERP/EIRP from the radiated RF output power is: ERP/EIRP (dBm) = SA Read Value (dBm) + Correction Factor (dB)

where:

ERP/EIRP = effective or equivalent radiated power, in dBm;

SA Read Value = measured transmitter power received by EMI receiver or spectrum analyzer, in dBm;

Correction Factor = total correction factor including cable loss, in dB;

During the test, the data of Correction Factor (dB) is added in the EMI receiver or spectrum analyzer, so SA Read Value (dBm) is the final values which contains the data of Correction Factor (dB).

For example:

In the ERP test, when SA read value for GSM850 is 21dBm, and correction factor is 8dB, then final ERP value for GSM850 is:

$$\text{ERP (dBm)} = 21\text{dBm} + 8\text{dB} = 29\text{dBm}$$

5.7.4 Test Result

Note1: It was found that the emission value below 1GHz and above 18GHz was below the limit of 20dB, so it was recorded in the report.

Note2: For all bandwidths of LTE frequency band, modulation types and RB configurations were pretested, and it was found that minimum bandwidths, QPSK modulation and 1RB0 were the worst modes, and only the worst modes were reflected in the report.

Temperature	22.5°C	Humidity	56%
Test voltage	DC5V	Test Engineer	Sean He

LTE Band 2, 1.4MHz Bandwidth						
Lowest channel						
Frequency (MHz)	Reading Level (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Polarization
3720.00	-19.03	-37.12	-56.15	-13.00	-43.15	Horizontal
5580.00	-16.14	-34.19	-50.33	-13.00	-37.33	Horizontal
7440.00	-13.60	-36.24	-49.84	-13.00	-36.84	Horizontal
3720.00	-19.66	-37.12	-56.78	-13.00	-43.78	Vertical
5580.00	-17.14	-34.19	-51.33	-13.00	-38.33	Vertical
7440.00	-14.36	-36.24	-50.60	-13.00	-37.60	Vertical
Middle channel						
3760.00	-19.89	-37.01	-56.90	-13.00	-43.90	Horizontal
5640.00	-17.00	-34.08	-51.08	-13.00	-38.08	Horizontal
7520.00	-14.46	-36.13	-50.59	-13.00	-37.59	Horizontal
3760.00	-19.24	-37.01	-56.25	-13.00	-43.25	Vertical
5640.00	-16.72	-34.08	-50.80	-13.00	-37.80	Vertical
7520.00	-13.94	-36.13	-50.07	-13.00	-37.07	Vertical
Highest channel						
3800.00	-20.54	-36.90	-57.44	-13.00	-44.44	Horizontal
5700.00	-17.65	-33.97	-51.62	-13.00	-38.62	Horizontal
7600.00	-15.11	-36.02	-51.13	-13.00	-38.13	Horizontal
3800.00	-18.56	-36.90	-55.46	-13.00	-42.46	Vertical
5700.00	-16.04	-33.97	-50.01	-13.00	-37.01	Vertical
7600.00	-13.26	-36.02	-49.28	-13.00	-36.28	Vertical

Remark:

1. The emission levels of below 1 GHz are lower than the limit 10dB, so not show in test report.
2. Margin=Level-Limit=Reading Level+Factor-Limit

LTE Band 4, 1.4MHz Bandwidth						
Lowest channel						
Frequency (MHz)	Reading Level (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Polarization
3440.00	-21.67	-37.30	-58.97	-13.00	-45.97	Horizontal
5160.00	-16.92	-35.01	-51.93	-13.00	-38.93	Horizontal
6880.00	-13.64	-36.13	-49.77	-13.00	-36.77	Horizontal
3440.00	-22.30	-37.30	-59.60	-13.00	-46.60	Vertical
5160.00	-17.92	-35.01	-52.93	-13.00	-39.93	Vertical
6880.00	-14.40	-36.13	-50.53	-13.00	-37.53	Vertical
Middle channel						
3465.00	-22.53	-37.19	-59.72	-13.00	-46.72	Horizontal
5197.50	-17.78	-34.90	-52.68	-13.00	-39.68	Horizontal
6930.00	-14.50	-36.02	-50.52	-13.00	-37.52	Horizontal
3465.00	-21.88	-37.19	-59.07	-13.00	-46.07	Vertical
5197.50	-17.50	-34.90	-52.40	-13.00	-39.40	Vertical
6930.00	-13.98	-36.02	-50.00	-13.00	-37.00	Vertical
Highest channel						
3490.00	-23.18	-37.08	-60.26	-13.00	-47.26	Horizontal
5235.00	-18.43	-34.79	-53.22	-13.00	-40.22	Horizontal
6980.00	-15.15	-35.91	-51.06	-13.00	-38.06	Horizontal
3490.00	-21.20	-37.08	-58.28	-13.00	-45.28	Vertical
5235.00	-16.82	-34.79	-51.61	-13.00	-38.61	Vertical
6980.00	-13.30	-35.91	-49.21	-13.00	-36.21	Vertical

Remark:

1. The emission levels of below 1 GHz are lower than the limit 10dB, so not show in test report.
2. Margin=Level-Limit=Reading Level+Factor-Limit

LTE Band 12, 1.4MHz Bandwidth						
Lowest channel						
Frequency (MHz)	Reading Level (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Polarization
1408.00	-17.51	-37.79	-55.30	-13.00	-42.30	Horizontal
2112.00	-20.92	-37.11	-58.03	-13.00	-45.03	Horizontal
2816.00	-22.53	-36.57	-59.10	-13.00	-46.10	Horizontal
1408.00	-18.14	-37.79	-55.93	-13.00	-42.93	Vertical
2112.00	-21.92	-37.11	-59.03	-13.00	-46.03	Vertical
2816.00	-23.29	-36.57	-59.86	-13.00	-46.86	Vertical
Middle channel						
1415.00	-18.37	-37.68	-56.05	-13.00	-43.05	Horizontal
2122.50	-21.78	-37.00	-58.78	-13.00	-45.78	Horizontal
2830.00	-23.39	-36.46	-59.85	-13.00	-46.85	Horizontal
1415.00	-17.72	-37.68	-55.40	-13.00	-42.40	Vertical
2122.50	-21.50	-37.00	-58.50	-13.00	-45.50	Vertical
2830.00	-22.87	-36.46	-59.33	-13.00	-46.33	Vertical
Highest channel						
1422.00	-19.02	-37.57	-56.59	-13.00	-43.59	Horizontal
2133.00	-22.43	-36.89	-59.32	-13.00	-46.32	Horizontal
2844.00	-24.04	-36.35	-60.39	-13.00	-47.39	Horizontal
1422.00	-17.04	-37.57	-54.61	-13.00	-41.61	Vertical
2133.00	-20.82	-36.89	-57.71	-13.00	-44.71	Vertical
2844.00	-22.19	-36.35	-58.54	-13.00	-45.54	Vertical

Remark:

1. The emission levels of below 1 GHz are lower than the limit 10dB, so not show in test report.
2. Margin=Level-Limit=Reading Level+Factor-Limit

6 Test Setup Photos

Please refer to the Appendix I Test Setup Photos

7 EUT Constructional Details (EUT Photos)

Please refer to the Appendix II External Photos & Appendix III External Photos



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