TESTING LABORATORY
CERTIFICATE#4323.01

FCC PART 22H, PART 24E

TEST REPORT

For

Shanghai WanWayTech Co., Ltd

23rd Floor, Yibo Mansion, No.1999 Wenchuan Road, Baoshan District, Shanghai, China

FCC ID: 2AUKF-G18

Report Type:	**Product Type:**
Original Report	GPS Tracker

Test Engineer:	Chao Gao
Report Number:	RSHF191217001-00B
Report Date:	2020-02-11
Reviewed By:	Oscar Ye EMC Manager
Prepared By:	Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road, Kunshan, Jiangsu province, China Tel: +86-0512-86175000 Fax: +86-0512-88934268 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	Shanghai WanWayTech Co., Ltd
Tested Model	G18
Series Model	G20, G21, EV18, G18P, G18W
Model Difference	See declaration letter
Product Type	GPS Tracker
Power Supply	DC 9-90V from external power source and DC 3.7V from battery
Dimension	85mm(L)*24 mm(W)*14mm(H)
RF Function	GPRS
Operating Band/Frequency	GPRS 850: 824.2-848.8MHz GPRS 1900: 1850.2-1909.8MHz
Modulation Type	GMSK
Antenna Type	PCB antenna
Antenna Gain	0.0dBi

**All measurement and test data in this report was gathered from production sample serial number: 20191217001. (Assigned by the BACL. The EUT supplied by the applicant was received on 2019-12-17)*

Objective

This type approval report is prepared on behalf of *Shanghai WanWayTech Co., Ltd* in accordance with Part 2, Part 22-Subpart H and Part 24-Subpart E of the Federal Communication Commission's rules.

The objective is to determine the compliance of 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.

Related Submittal(s)/Grant(s)

N/A

Test Methodology

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

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

Applicable Standards: TIA/EIA 603-D.

All radiated and conducted emissions measurements were performed at Bay Area Compliance Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Item		Uncertainty
AC Power Lines Conducted Emissions		3.19dB
RF conducted test with spectrum		0.9dB
RF Output Power with Power meter		0.5dB
Radiated emission	30MHz~1GHz	5.91dB
	1GHz~6GHz	4.68dB
	6GHz~18GHz	4.92dB
	18GHz~40GHz	5.21dB
Occupied Bandwidth		0.5kHz
Temperature		1.0℃
Humidity		6%

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 Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01 and CAB identifier CN0004 under the ISED requirement. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured for testing according to TIA/EIA-603-D.

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

Channel List

Mode	Channel		Frequency (MHz)
GPRS 850	Low	128	824.2
	Middle	190	836.6
	High	251	848.8
GPRS 1900	Low	512	1850.2
	Middle	661	1880.0
	High	810	1909.8

Equipment Modifications

No modifications were made to the EUT.

Support Equipment List and Details

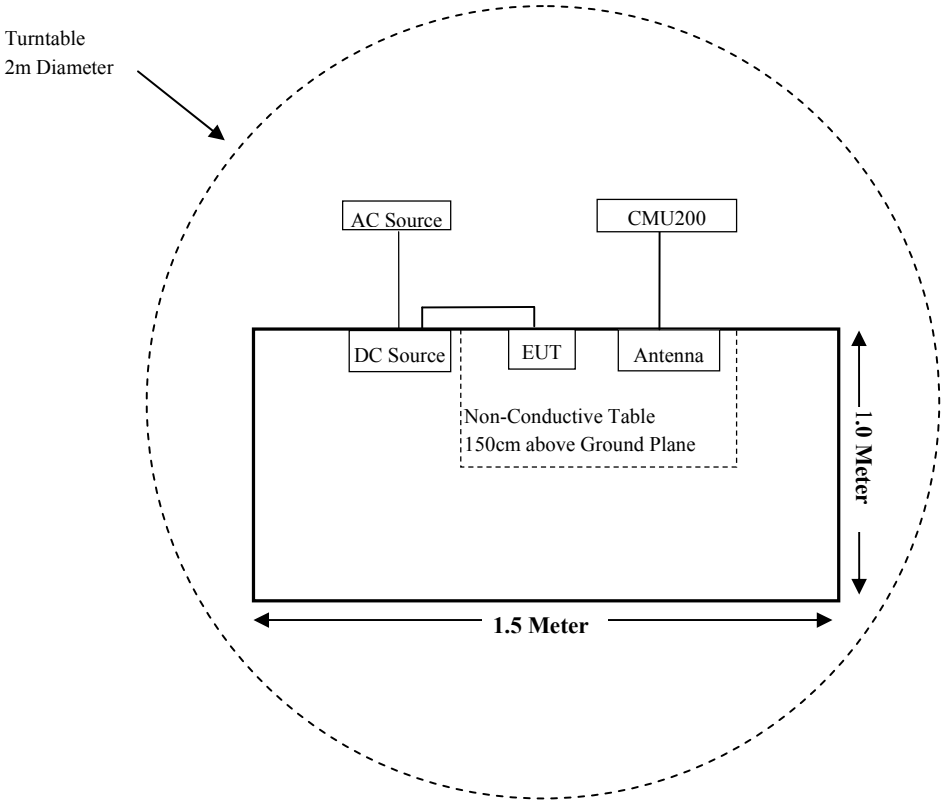
Manufacturer	Description	Model	Serial Number
Waylens Inc.	Antenna	/	/
Rohde & Schwarz	Universal Radio Communication Tester	CMU200	110605

External I/O Cable

Cable Description	Length (m)	From Port	To
/	/	/	/

Block Diagram of Test Setup

For Radiated Emissions (Below &Above 1GHz):



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1310 & §2.1091	Maximum Permissible Exposure(MPE)	Compliant
§2.1046; § 22.913 (a);§ 24.232 (c);	RF Output Power	Compliant
§ 2.1047	Modulation Characteristics	Not Applicable
§ 2.1049; § 22.905; § 22.917; § 24.238;	Occupied Bandwidth	Compliant
§ 2.1051; § 22.917 (a); § 24.238 (a);	Spurious Emissions at Antenna Terminal	Compliant
§ 2.1053; § 22.917 (a); § 24.238 (a);	Spurious Radiated Emissions	Compliant
§ 22.917 (a); § 24.238 (a);	Band Edge	Compliant
§ 2.1055; § 22.355; § 24.235;	Frequency Stability	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test（Chamber 1#）					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2019-11-30	2020-11-29
HP	Signal Generator	HP 8341B	2624A00116	2019-11-30	2020-11-29
Sunol Sciences	Broadband Antenna	JB3	A090413-1	2017-12-26	2020-12-25
Sunol Sciences	Bilog antenna	JB3	A060217	2017-08-04	2020-08-03
Sonoma Instrunent	Pre-amplifier	310N	171205	2019-08-14	2020-08-13
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-8	008	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2019-08-15	2020-08-14
Rohde & Schwarz	Universal Radio Communication Tester	CMU200	110605	2019-11-12	2020-11-11
Radiated Emission Test（Chamber 2#）					
HP	Signal Generator	HP 8341B	2624A00116	2019-11-30	2020-11-29
Rohde & Schwarz	EMI Test Receiver	ESU40	100207	2019-08-27	2020-08-26
ETS-LINDGREN	Horn Antenna	3115	9207-3900	2017-07-15	2020-07-14
ETS-LINDGREN	Horn Antenna	3115	6229	2020-01-10	2023-01-09
ETS-LINDGREN	Horn Antenna	3116	00084159	2017-12-12	2020-12-11
ETS-LINDGREN	Horn Antenna	3116	2516	2020-01-17	2023-01-16
A.H.Systems, inc	Amplifier	2641-1	491	2019-02-20	2020-02-19
EM Electronics Corporation	Amplifier	EM18G40G	060726	2019-03-22	2020-03-21
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-11	011	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-12	012	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-13	013	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-16	016	2019-08-15	2020-08-14
Rohde & Schwarz	Universal Radio Communication Tester	CMU200	110605	2019-11-12	2020-11-11

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2019-11-30	2020-11-29
Rohde & Schwarz	Signal Analyzer	FSV40	101116	2019-07-23	2020-07-22
Narda	Attenuator	6dB	006	2020-01-10	2021-01-09
Rohde & Schwarz	Universal Radio Communication Tester	CMU200	110605	2019-11-12	2020-11-11
Mini-Ciruits	Power splitter	ZFRSC-14-S+	SF019411452	2019-11-10	2020-11-09
BACL	Temperature & Humidity Chamber	BTH-150	30023	2019-10-10	2020-10-09
EAST	Regulated DC Power Supply	MCH-303D-II	14070562	2019-10-10	2020-10-09
Shanghai WanWayTech	RF Cable	Shanghai WanWayTech C01	C01	Each Time	/

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247 (i) and subpart 1.1310, 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f^2)	30
30-300	27.5	0.073	0.2	30
300-1500	/		f/1500	30
1500-100,000	/		1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density

Calculated Formulary:

Predication of MPE limit at a given distance

$S = PG/4 \pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Calculated Data:

Mode	Frequency Range (MHz)	Antenna Gain		Target Output Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
GPRS 850	824.2-848.8	0.0	1.00	26.50	446.68	20	0.0889	0.55
GPRS 1900	1850.2-1909.8	0.0	1.00	23.00	199.53	20	0.0397	1.00

Note:
Antenna Gain (numeric): 0.0dBi (1.0) for GPRS 850 mode.
Antenna Gain (numeric): 0.0 dBi (1.0) for GPRS 1900 mode.
3. GSM 850: Tune-up maximum output power : 1 slot 33.00dBm, 2 slots 32.00dBm, 3 slots 30.50dBm, 4 slots 29.50dBm, so the tune-up time based Ave. power compared to sloted Ave. power is 26.50dBm.
PCS 1900: Tune-up Maximum output power: 1 slot 29.00dBm, 2 slots 28.00dBm, 3 slots 27.00dBm, 4 slots 26.00dBm, so the tune-up time based Ave. power compared to sloted Ave. power is 23.00 dBm.

Number of Time slot	1	2	3	4
Duty Cycle	1:8	1:4	1:2.66	1:2
Time based Ave. power compared to slotted Ave. power	-9 dB	-6 dB	-4.25 dB	-3 dB

Result: The device meet FCC MPE at 20 cm distance.

FCC §2.1047 - MODULATION CHARACTERISTIC

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 Standards

According to FCC §2.1046 and §22.913 (a), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts (38.45dBm).

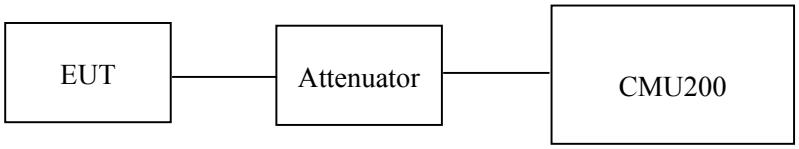
According to FCC §2.1046 and §24.232 (c), mobile and portable stations are limited to 2 watts (33dBm) EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

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 CMU200 through sufficient attenuation.



Radiated Output Power:

The measurements procedures specified in ANSI/TIA-603-D were applied.

a) Connect the equipment as illustrated. Mount the equipment with the manufacturer specified antenna in a vertical orientation on a manufacturer specified mounting surface located on a non-conducting rotating platform of a RF anechoic chamber (preferred) or a standard radiation site.

b) Key the transmitter, then rotate the EUT 360o azimuthally and record spectrum analyzer power level (LVL) measurements at angular increments that are sufficiently small to permit resolution of all peaks. If a standard radiation test site is used, raise and lower the test antenna to obtain a maximum reading at each angular increment. (Note: several batteries may be needed to offset the effect of battery voltage droop, which should not exceed 5% of the manufactured specified battery voltage during transmission).

c) Replace the transmitter under test with a vertically polarized half-wave dipole (or an antenna whose gain is known relative to an ideal half-wave dipole). The center of the antenna should be at the same location as the center of the antenna under test.

d) Connect the antenna to a signal generator with a known output power and record the path loss (in dB) as LOSS. If a standard radiation test site is used,raise and lower the test antenna to obtain a maximum reading.
LOSS = Generator Output Power (dBm) – Analyzer reading (dBm)

e) Determine the effective radiated output power at each angular position from the readings in steps b) and d) using the following equation:
ERP (dBm) = LVL (dBm) + LOSS (dB)

f) The maximum ERP is the maximum value determined in the preceding step.
(Note: Effective Isotropic Radiated Power (EIRP) can be computed using the following:
EIRP (dBm) = ERP (dBm) + 2.15 (dB)

Test Data

Environmental Conditions

Temperature:	23.9 ℃
Relative Humidity:	51 %
ATM Pressure:	101.3 kPa

The testing was performed by Chao Gao on 2020-01-14.

Conducted Power:

GSM 850 Band

Mode	Channel	Frequency (MHz)	Average Output Power (dBm)				Limit (dBm)
			1 slot	2 slot	3 slot	4 slot	
GPRS 850	128	824.2	32.70	31.60	30.46	29.42	38.45
	190	836.6	32.70	31.45	30.28	29.20	38.45
	251	848.8	32.60	31.52	30.35	29.05	38.45

PCS 1900 Band

Mode	Channel	Frequency (MHz)	Average Output Power (dBm)				Limit (dBm)
			1 slot	2 slot	3 slot	4 slot	
GPRS 1900	512	1850.2	28.30	27.00	26.50	25.58	33.00
	661	1880.0	28.60	27.50	26.54	25.55	33.00
	810	1909.8	28.50	27.88	26.53	25.47	33.00

Peak-to-average ratio (PAR):

GSM 850

Mode	Channel	PAR (dB)	Limit (dB)
GPRS 850	Low	2.35	13.00
	Middle	2.41	13.00
	High	2.26	13.00

PCS 1900

Mode	Channel	PAR (dB)	Limit (dB)
GPRS 1900	Low	2.38	13.00
	Middle	2.46	13.00
	High	2.51	13.00

ERP:

GSM 850 Mode

Frequency (MHz)	Receiver Reading (dBµV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)	Submitted Level (dBm)	Cable loss (dB)	Antenna Gain (dBd/dBi)			
Cellular Band (Part 22H), Middle Channel										
836.6	96.26	124	150	H	28.83	0.63	-1.14	27.06	38.45	11.39
836.6	98.07	156	150	V	27.18	0.63	-1.14	25.41	38.45	13.04

EIRP:

PCS1900 Mode

Frequency (MHz)	Receiver Reading (dBµV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)	Submitted Level (dBm)	Cable loss (dB)	Antenna Gain (dBd/dBi)			
PCS Band (Part 24E), Middle Channel										
1880	88.27	228	150	H	15.99	0.85	8.81	23.95	33	9.05
1880	86.43	134	150	V	14.15	0.85	8.81	22.11	33	10.89

FCC §2.1049, §22.917, §22.905 & §24.238; - OCCUPIED BANDWIDTH

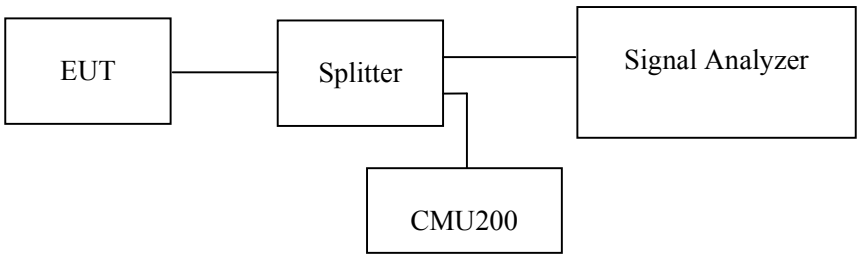
Applicable Standards

FCC 47 §2.1049, §22.917, §22.905 & §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 5 kHz (Cellular /PCS) and the 26 dB & 99% bandwidth was recorded.



Test Data

Environmental Conditions

Temperature:	23.2 ℃
Relative Humidity:	51 %
ATM Pressure:	103.3 kPa

The testing was performed by Chao Gao on 2020-01-18.

EUT operation mode: Transmitting

Test Result: Compliant.

GSM 850

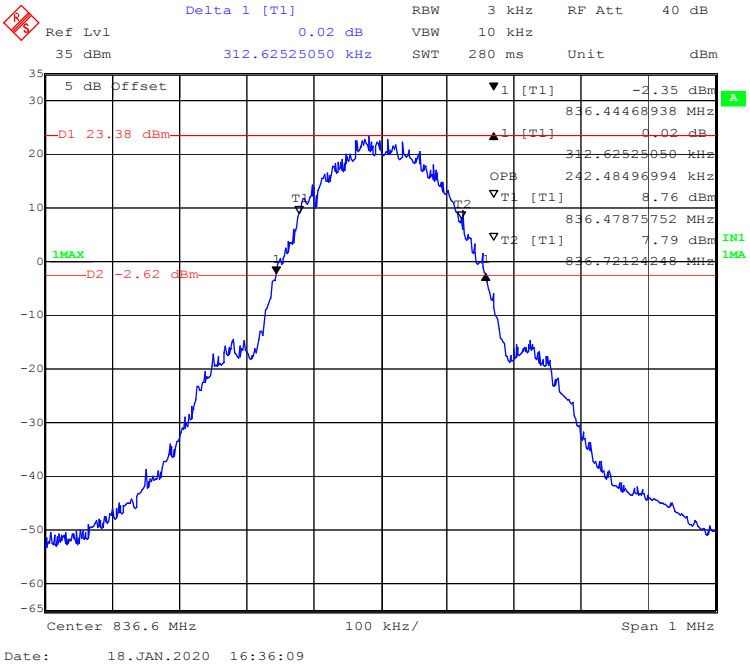
Mode	Frequency (MHz)	26 dB Emission Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
GPRS 850	836.6	0.313	0.242

PCS 1900

Mode	Frequency (MHz)	26 dB Emission Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
GPRS 1900	1880.0	0.319	0.240

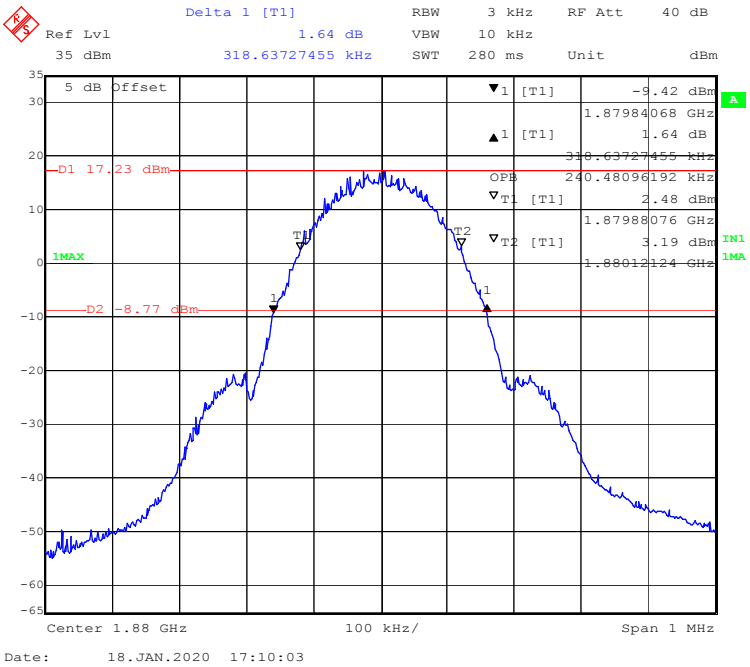
GSM 850

99% Occupied &26 dB Emissions Bandwidth for GPRS 850 Mode



PCS 1900 Band

99% Occupied &26 dB Emissions Bandwidth for GPRS 1900 Mode



FCC § 2.1051; § 22.917 (a); § 24.238 (a); - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

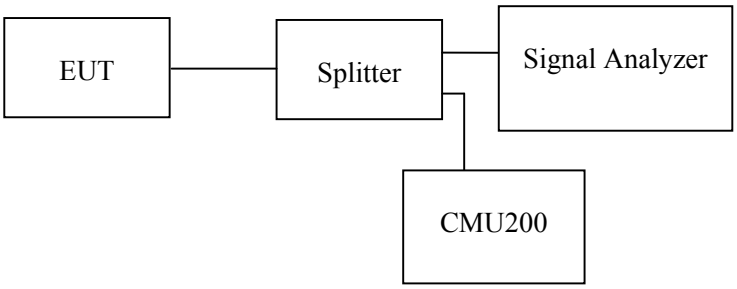
Applicable Standards

FCC §2.1051, §22.917(a) and §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 100 kHz for below 1GHz & 1MHz for above 1GHz. sufficient scans were taken to show any out of band emissions up to 10th harmonic.



Test Data

Environmental Conditions

Temperature:	23.5 ℃
Relative Humidity:	51 %
ATM Pressure:	103.3kPa

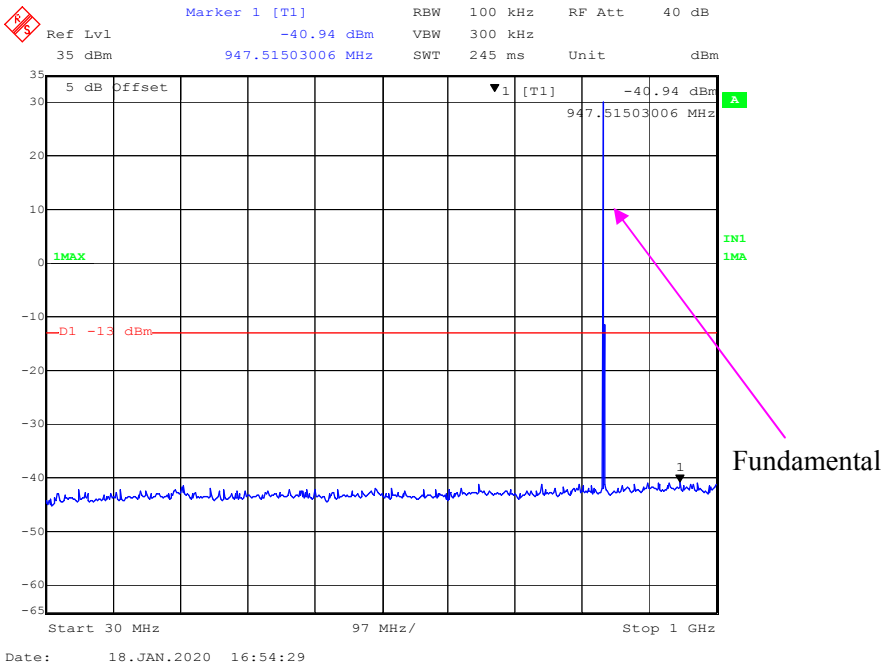
The testing was performed by Chao Gao on 2020-01-18.

EUT operation mode: Transmitting

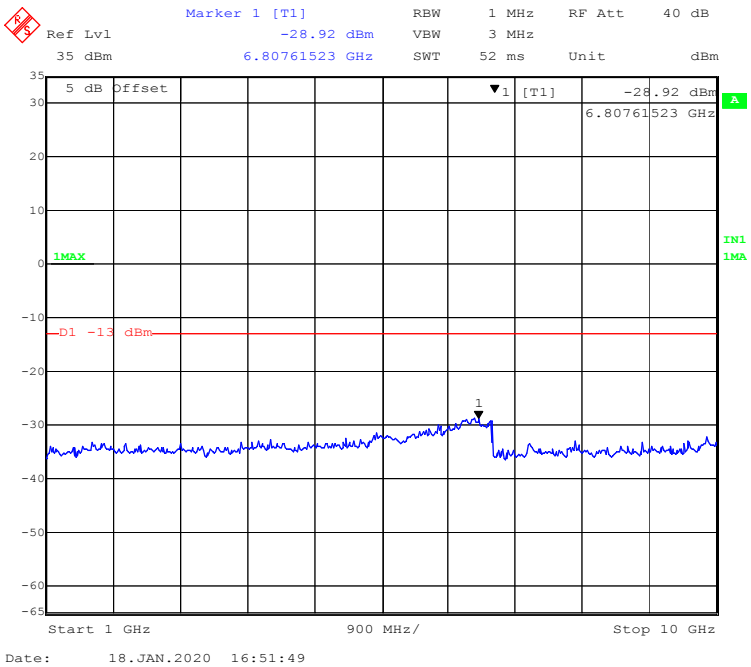
Test Result: Compliant.

GSM 850 Band:

30 MHz – 1GHz(GPRS 850 Mode)

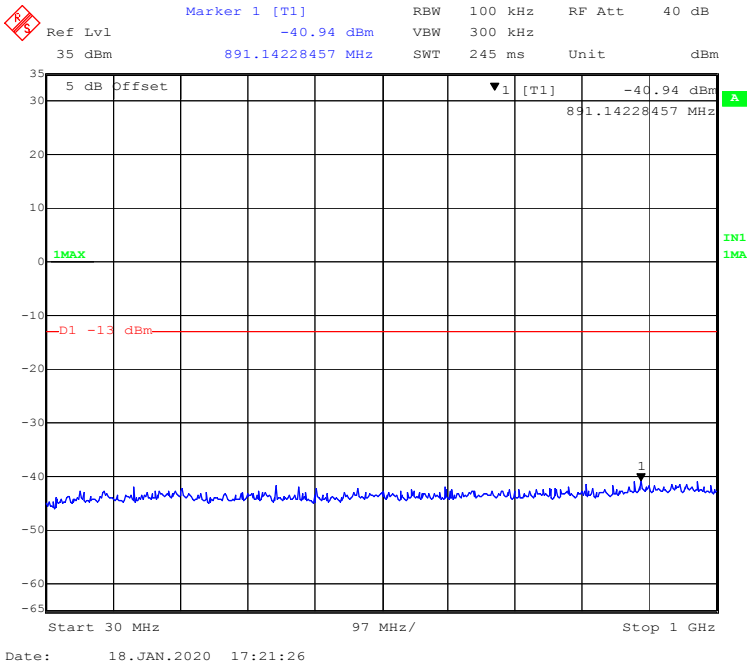


1 GHz – 10 GHz (GPRS 850 Mode)

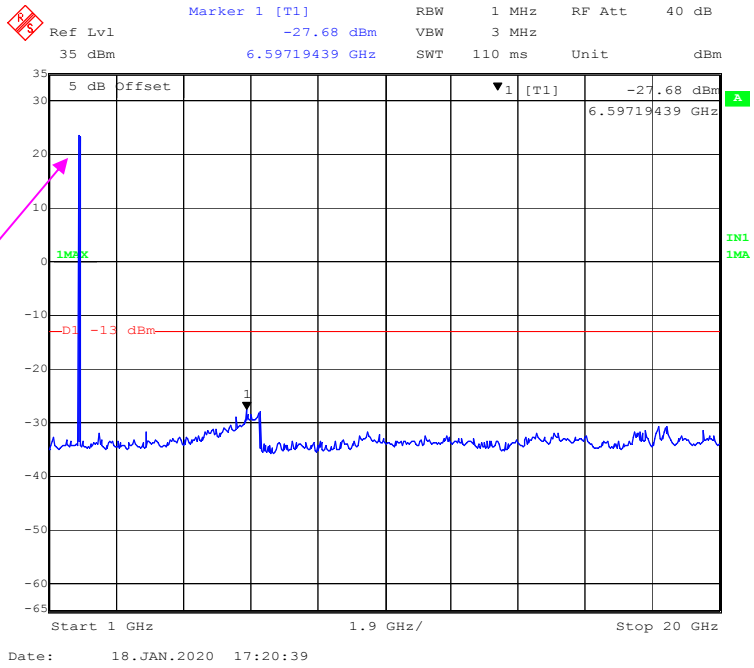


PCS 1900 Band:

30 MHz – 1GHz(GPRS 1900 Mode)



1 GHz – 20 GHz (GPRS 1900 Mode)



Fundamental

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

Applicable Standards

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

22.917 (a) Out of band emissions. 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.

24.238 (a) Out of band emissions. 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.

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 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.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = 10 lg (TX pwr in Watts/0.001) – the absolute level

Spurious attenuation limit in dB = 43 + 10 Log_{10} (power out in Watts)

Test Data

Environmental Conditions

Temperature:	23.2 ℃
Relative Humidity:	51 %
ATM Pressure:	101.3kPa

The testing was performed by Chao Gao on 2020-01-16.

Test mode: Transmitting (Pre-scan with low, middle and high channels, and the worse case data as below)

30 MHz ~ 10 GHz:

GSM 850 Band

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)	Submitted Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
GSM Mode, Middle channel										
150.89	41.67	192	150.0	H	-69.55	0.37	-6.15	-76.07	-13	63.07
150.89	45.50	121	150.0	V	-61.72	0.37	-6.15	-68.24	-13	55.24
1673.20	47.62	134	150.0	H	-57.91	0.84	8.48	-50.27	-13	37.27
1673.20	49.59	156	150.0	V	-55.94	0.84	8.48	-48.30	-13	35.30
2509.80	52.56	173	150.0	H	-49.40	0.89	10.10	-40.19	-13	27.19
2509.80	53.95	334	150.0	V	-48.01	0.89	10.10	-38.80	-13	25.80

30 MHz ~ 20 GHz:

PCS 1900 Band

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)	Submitted Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
GSM Mode, Middle channel										
159.13	38.61	137	150.0	H	-72.17	0.38	-6.17	-78.72	-13	65.72
159.13	42.38	291	150.0	V	-65.25	0.38	-6.17	-71.80	-13	58.80
3760.00	59.29	241	150.0	H	-38.70	0.95	9.74	-29.91	-13	16.91
3760.00	64.74	37	150.0	V	-33.25	0.95	9.74	-24.46	-13	11.46
5640.00	47.62	54	150.0	H	-46.23	1.15	10.47	-36.91	-13	23.91
5640.00	51.04	296	150.0	V	-42.81	1.15	10.47	-33.49	-13	20.49

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

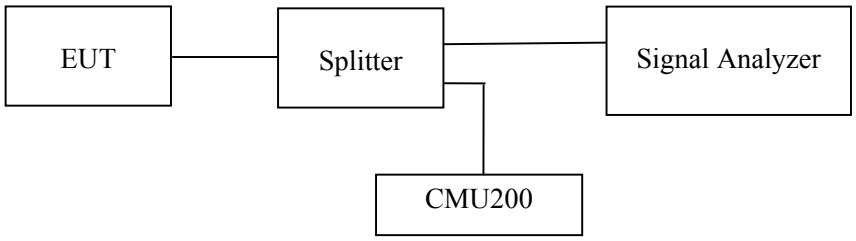
Applicable Standards

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.



Test Data

Environmental Conditions

Temperature:	23.5 ℃
Relative Humidity:	51 %
ATM Pressure:	103.3 kPa

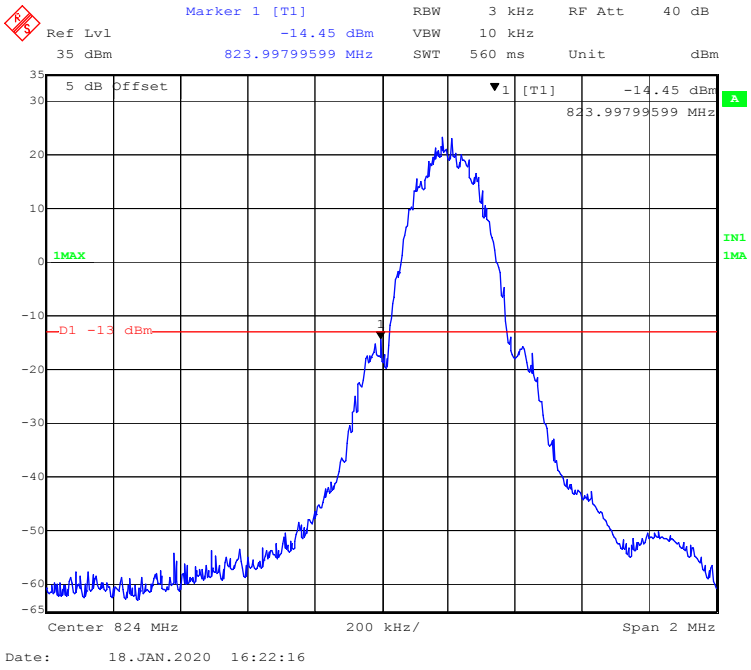
The testing was performed by Chao Gao on 2020-01-18.

EUT operation mode: Transmitting

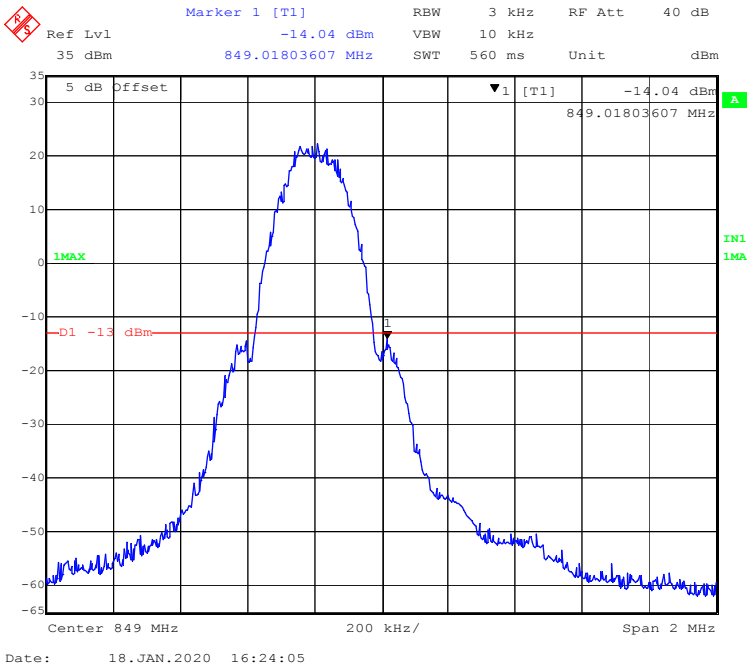
Test Result: Compliant.

GSM 850 Band

GPRS 850 Mode, Left Band Edge

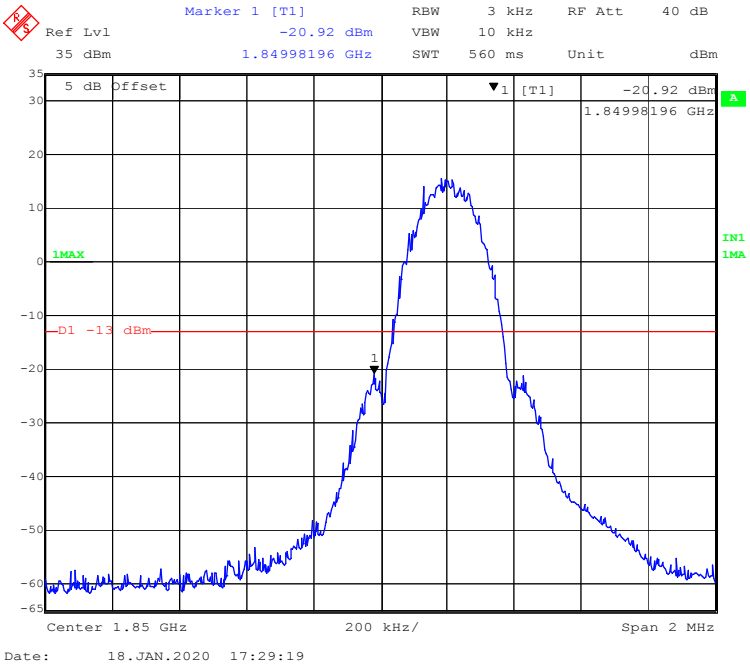


GPRS 850 Mode, Right Band Edge

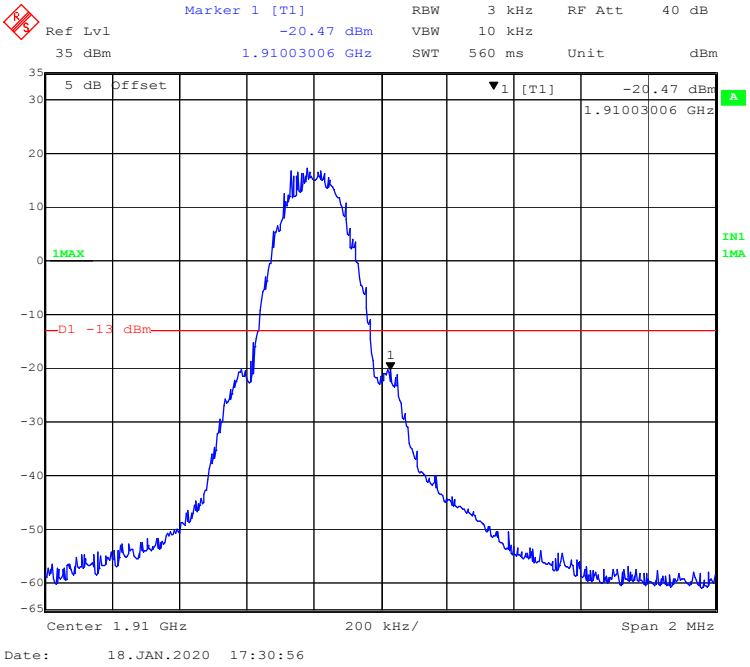


PCS 1900 Band

GPRS 1900 Mode, Left Band Edge



GPRS 1900 Mode, Right Band Edge



FCC § 2.1055; § 22.355; § 24.235; - FREQUENCY STABILITY

Applicable Standards

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

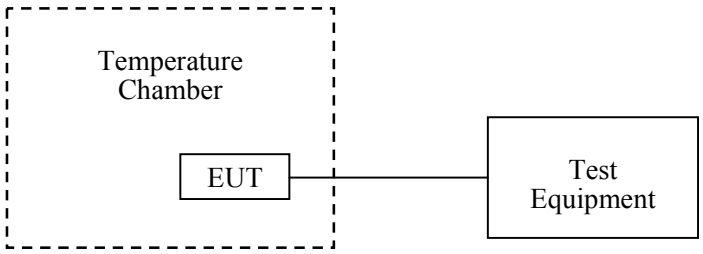
According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC 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 DC 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

Temperature:	23.7 ℃
Relative Humidity:	51 %
ATM Pressure:	101.3kPa

The testing was performed by Chao Gao on 2020-01-17.

EUT operation mode: Transmitting

Test Result: Compliant.

GSM 850 Band

GSM Mode, Middle Channel, f_o =836.6 MHz				
Temperature (℃)	**Power Supplied (V_{DC})**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Limit (ppm)**
-30	12.0	-28	-0.0335	2.5
-20		-35	-0.0418	2.5
-10		-16	-0.0191	2.5
0		-32	-0.0383	2.5
10		-37	-0.0442	2.5
20		-12	-0.0143	2.5
30		-34	-0.0406	2.5
40		-38	-0.0454	2.5
50		-21	-0.0251	2.5
25	V min.= 9	-17	-0.0203	2.5
25	V max.= 90	-24	-0.0287	2.5

PCS 1900 Band

GSM Mode, Middle Channel, f_0 =1880.0 MHz				
Temperature (℃)	**Power Supplied (V_{DC})**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Result**
-30	12.0	-26	-0.0138	pass
-20		-39	-0.0207	pass
-10		-15	-0.0080	pass
0		-46	-0.0245	pass
10		-32	-0.0170	pass
20		-26	-0.0138	pass
30		-30	-0.0160	pass
40		-39	-0.0207	pass
50		-41	-0.0218	pass
25	V min.= 9	-28	-0.0149	pass
25	V max.= 90	-24	-0.0128	pass

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