

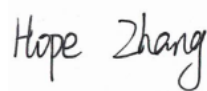

FCC PART 22H, PART 24E  
MEASUREMENT AND TEST REPORT

For

**Queclink Wireless Solutions Co.,Ltd**

3 Floor, Building 2, No.717 Yishan Road, Xuhui District, shanghai, China 200233

**FCC ID: YQD-GV300CAN**

<b>Report Type:</b> Original Report	<b>Product Type:</b> GPS Tracker
<b>Test Engineer:</b> Hope Zhang 	
<b>Report Number:</b> RSHA181120001-00B	
<b>Report Date:</b> 2018-12-17	
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## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

Applicant	Queclink Wireless Solutions Co.,Ltd
Tested Model	GV300CAN
Product Type	GPS Tracker
Dimension	80mm(L)*49mm(W)*26mm(H)
Power Supply	1. DC 3.7V from Battery 2. DC 8~32V(nominal voltage DC12V/24V)

*\*All measurement and test data in this report was gathered from production sample serial number: 20181120001.  
(Assigned by the BACL. The EUT supplied by the applicant was received on 2018-11-20)*

### Objective

This type approval report is prepared on behalf of *Queclink Wireless Solutions 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)

Part 15.247 DTS submissions with FCC ID: YQD-GV300CAN.

### 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	6.11dB
	1GHz~6GHz	4.45dB
	6GHz~18GHz	5.23dB
	18GHz~40GHz	5.65dB
Occupied Bandwidth		0.5kHz
Temperature		1.0°C
Humidity		6%

**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. 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
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

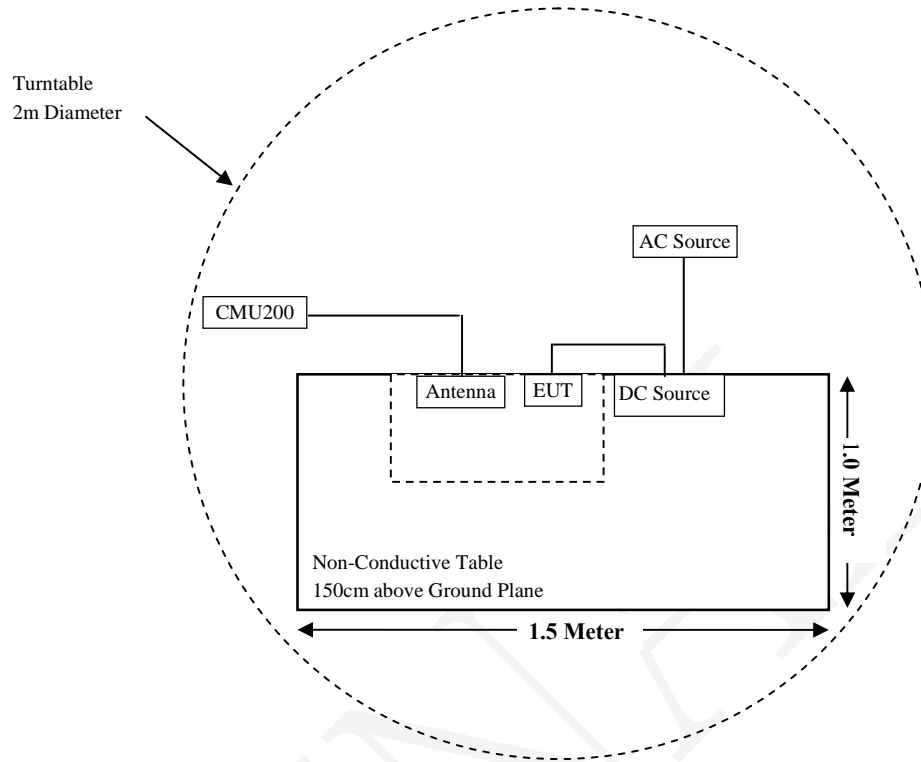
Manufacturer	Description	Model	Serial Number
Rohde & Schwarz	UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	110605
EAST	Regulated DC Power Supply	MCH-303D-II	14070562
Aihuaxin Technology	Antenna	/	/

### External Cable List and Details

Cable Description	Length (m)	From Port	To
Antenna Cable	1.8	Antenna	CMU200
Power Cable	1.2	EUT	DC Source

## Block Diagram of Test Setup

For Radiated Emissions(Below & Above 1GHz)



**SUMMARY OF TEST RESULTS**

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



**TEST EQUIPMENT LIST**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
<b>Radiated Emission Test (Chamber 1#)</b>					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2018-11-12	2019-11-11
HP	Signal Generator	HP 8341B	2624A00116	2018-11-12	2019-11-11
Sunol Sciences	Broadband Antenna	JB3	A090413-1	2016-12-26	2019-12-25
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2016-01-09	2019-01-08
Sonoma Instrunent	Pre-amplifier	310N	171205	2018-08-15	2019-08-14
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-8	008	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2018-08-15	2019-08-14
Rohde & Schwarz	UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	110605	2018-11-12	2019-11-11
EAST	Regulated DC Power Supply	MCH-303D-II	14070562	2018-10-10	2019-10-09
<b>Radiated Emission Test (Chamber 2#)</b>					
HP	Signal Generator	HP 8341B	2624A00116	2018-11-12	2019-11-11
Rohde & Schwarz	EMI Test Receiver	ESU40	100207	2018-08-27	2019-08-26
ETS-LINDGREN	Horn Antenna	3115	9311-4159	2016-01-11	2019-01-10
ETS-LINDGREN	Horn Antenna	3115	6229	2016-01-11	2019-01-10
ETS-LINDGREN	Horn Antenna	3116	00084159	2016-10-18	2019-10-17
ETS-LINDGREN	Horn Antenna	3116	2516	2016-12-12	2019-12-12
A.H.Systems, inc	Amplifier	2641-1	466	2018-09-11	2019-09-10
EM Electronics	Amplifier	EM18G40G	060726	2018-03-22	2019-03-21
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-11	011	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-12	012	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-13	013	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-16	016	2018-08-15	2019-08-14
Rohde & Schwarz	UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	110605	2018-11-12	2019-11-11
EAST	Regulated DC Power Supply	MCH-303D-II	14070562	2018-10-10	2019-10-09

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
<b>RF Conducted Test</b>					
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2018-11-12	2019-11-11
Rohde & Schwarz	UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	110605	2018-11-12	2019-11-11
BACL	Temperature & Humidity Chamber	BTH-150	30023	2018-10-10	2019-10-09
EAST	Regulated DC Power Supply	MCH-303D-II	14070562	2018-10-10	2019-10-09
Narda	Attenuator/6dB	10690812-2	26850-6	2018-01-10	2019-01-09
Queclink	RF Cable	Queclink01	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.

<b>Limits for General Population/Uncontrolled Exposure</b>				
<b>Frequency Range (MHz)</b>	<b>Electric Field Strength (V/m)</b>	<b>Magnetic Field Strength (A/m)</b>	<b>Power Density (mW/cm<sup>2</sup>)</b>	<b>Averaging Time (minutes)</b>
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f <sup>2</sup> )	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<sup>2</sup>);

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);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

**Calculated Data:**

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )	MPE Ratio
		(dBi)	(numeric)	(dBm)	(mW)				
GPRS 850	824~849	2.00	1.58	26.75	473.15	20	0.1492	0.55	0.2712
GPRS 1900	1850~1910	3.01	2.00	25.00	316.23	20	0.1258	1.00	0.1258
BLE	2402-2480	4.56	2.86	7.00	5.01	20	0.0028	1.00	0.0028

Note:

- (1) The target output powers are all declared by the Manufacturer.
- (2) BLE and GPRS can transmit simultaneously; the worst condition was as below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.0028/1.00 + 0.1492/0.55 = 0.0028 + 0.2712 = 0.2740 < 1.0$$

- (3) For GPRS Mode, the time based average power is relevant, the difference in between depends on the duty cycle of the TDMA signal.

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 meets FCC MPE at 20 cm distance.

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

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

FINAL

## **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).

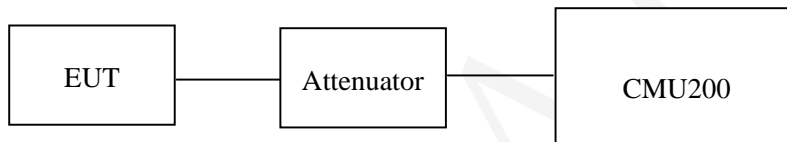
According to FCC §2.1046 and §24.232 (c), mobile and portable stations are limited to 2 watts(33dBm) EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications..

According to FCC §24.232 (d), the peak-to-average ratio (PAR) of the transmission 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.

$$\text{LOSS} = \text{Generator Output Power (dBm)} - \text{Analyzer reading (dBm)}$$

e) Determine the effective radiated output power at each angular position from the readings in steps b) and

d) using the following equation:

$$\text{ERP (dBm)} = \text{LVL (dBm)} + \text{LOSS (dB)}$$

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:

$$\text{EIRP (dBm)} = \text{ERP (dBm)} + 2.15 \text{ (dB.)}$$

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

<b>Temperature:</b>	23.3 °C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	101.2kPa

The testing was performed by Hope Zhang on 2018-12-03.

**Conducted Power:****GPRS 850 Band**

Mode	Channel	Frequency (MHz)	Average Output Power (dBm)				Limit (dBm)
			1 slot	2 slots	3 slots	4 slots	
GPRS	128	824.2	32.22	31.11	30.08	28.77	38.45
	190	836.6	32.41	31.29	30.17	28.82	38.45
	251	848.8	32.53	31.42	30.36	28.93	38.45

**GPRS 1900 Band**

Mode	Channel	Frequency (MHz)	Average Output Power (dBm)				Limit (dBm)
			1 slot	2 slots	3 slots	4 slots	
GPRS	512	1852.2	30.15	29.12	27.95	27.16	33
	661	1880.0	30.47	29.39	28.17	27.87	33
	810	1909.8	30.23	29.27	28.18	27.92	33

**Peak-to-average ratio (PAR):****GPRS 1900 Band**

Mode	Channel	PAR (dB)	Limit (dB)
GPRS	Low	2.37	13
	Middle	2.42	13
	High	2.44	13

**Radiated Power:**

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)			
GPRS 850 Band, Middle Channel(ERP)										
836.60	93.23	57	211	H	29.54	0.63	-1.14	27.77	38.45	10.68
836.60	94.77	245	171	V	27.62	0.63	-1.14	25.85	38.45	12.60
GSM1900 Band, Middle Channel(EIRP)										
1880.00	82.58	228	216	H	16.69	0.85	8.81	24.65	33.00	8.35
1880.00	83.88	134	194	V	17.57	0.85	8.81	25.53	33.00	7.47

**Note:**

All above data were tested with no amplifier.

Absolute Level = Submitted Level - Cable loss + Antenna Gain

Margin = Limit- Absolute Level



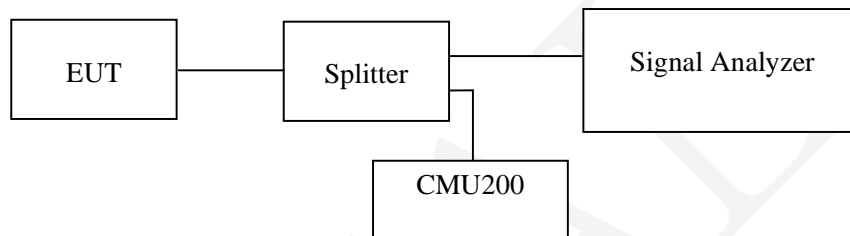
**FCC §2.1049, §22.917, §22.905 & §24.238 - OCCUPIED BANDWIDTH****Applicable Standards**

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) & 100 kHz (WCDMA), and the 26 dB & 99% bandwidth was recorded.

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

Temperature:	23.3 °C
Relative Humidity:	48 %
ATM Pressure:	101.2kPa

*The testing was performed by Hope Zhang on 2018-12-03.*

*EUT operation mode: Transmitting*

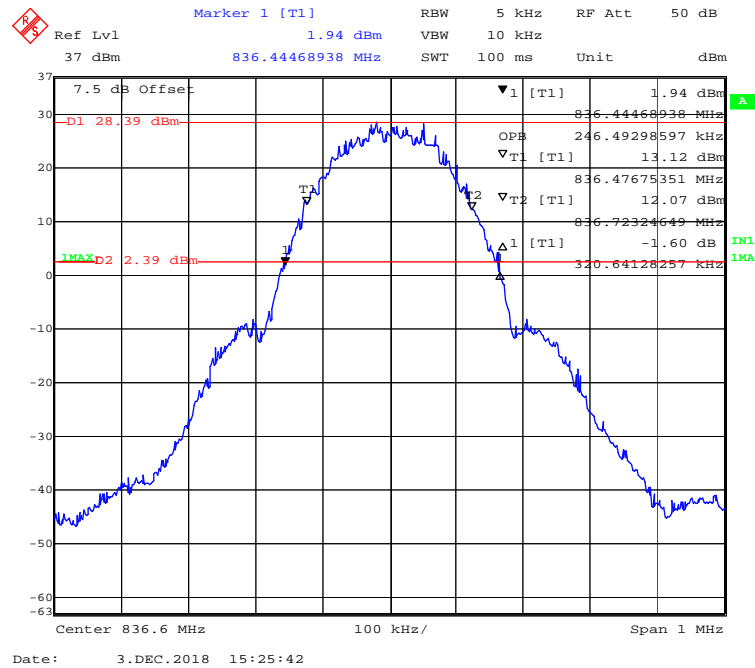
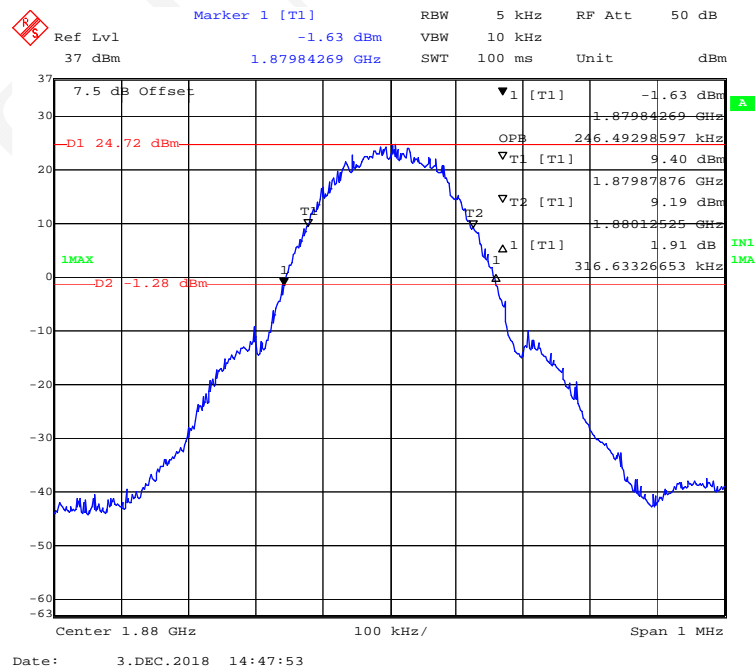
*Test Result: Compliance.*

**GSM 850 Band**

Mode	Frequency (MHz)	26 dB Emission Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
GPRS (GMSK)	836.6	0.321	0.246

**PCS 1900 Band**

Mode	Frequency (MHz)	26 dB Emission Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
GPRS (GMSK)	1880.0	0.317	0.246

**GSM 850 Band****99% Occupied & 26 dB Emissions Bandwidth for GPRS (GMSK) Mode****PCS 1900Band****99% Occupied & 26 dB Emissions Bandwidth for GPRS (GMSK) Mode**

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

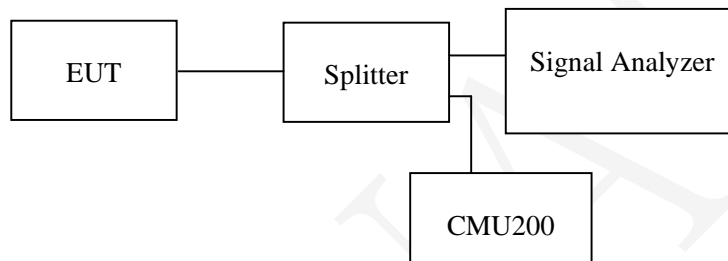
### Applicable Standards

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 100kHz for below 1GHz & 1MHz/3MHz for above 1GHz. Sufficient scans were taken to show any out of band emissions up to 10<sup>th</sup> harmonic.



### Test Data

#### Environmental Conditions

Temperature:	23.3 °C
Relative Humidity:	50 %
ATM Pressure:	101.2kPa

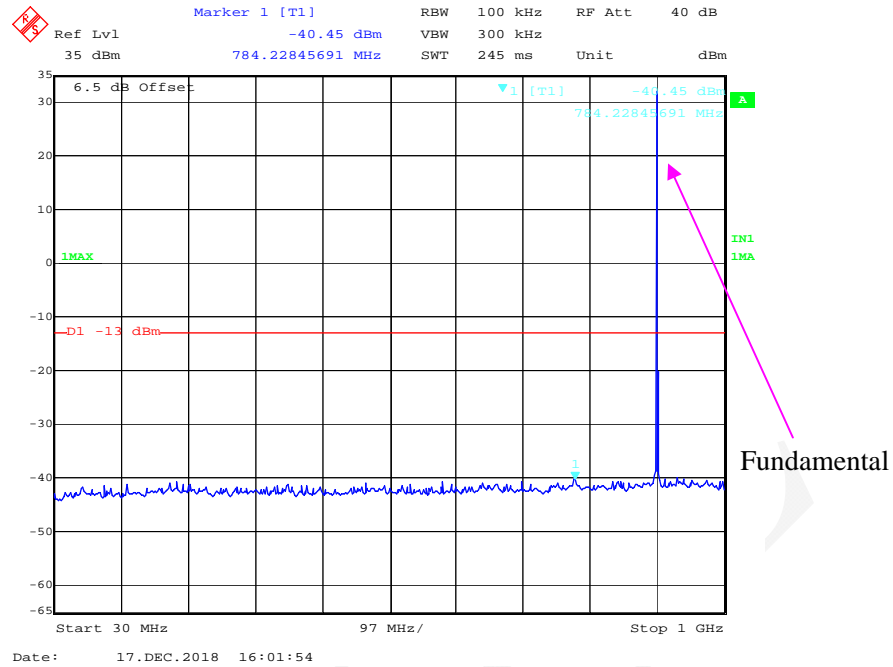
*The testing was performed by Hope Zhang on 2018-12-17.*

*EUT operation mode: Transmitting*

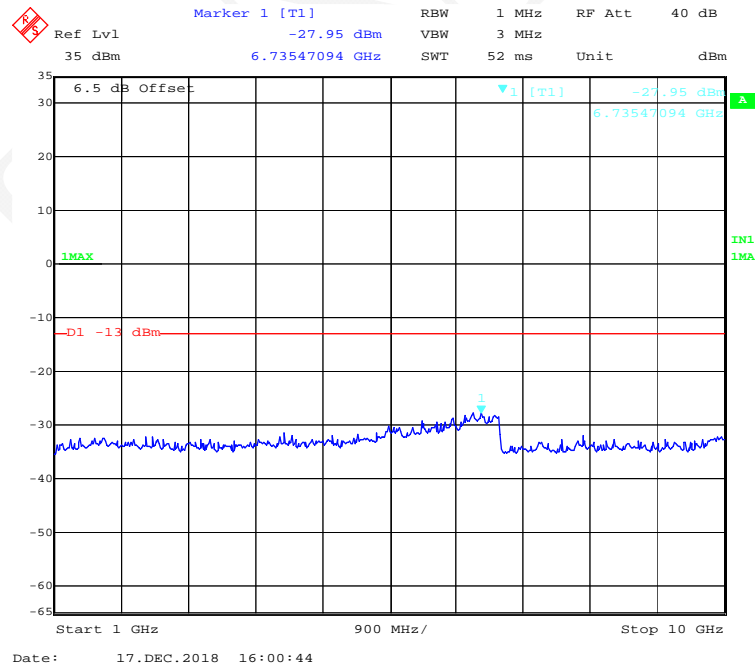
*Test Result: Compliance.*

**GSM 850 Band:**

**30 MHz – 1GHz(GPRS Mode)**

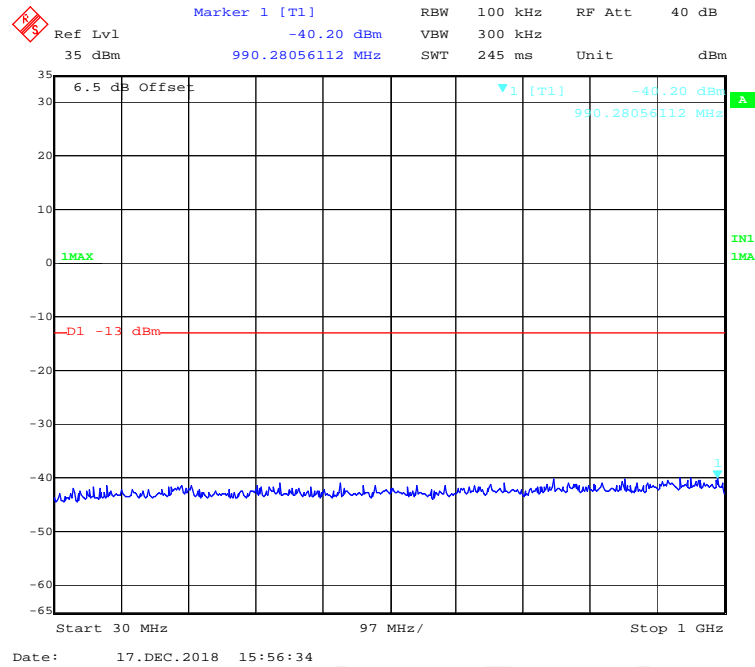


**1 GHz – 10 GHz (GPRS Mode)**

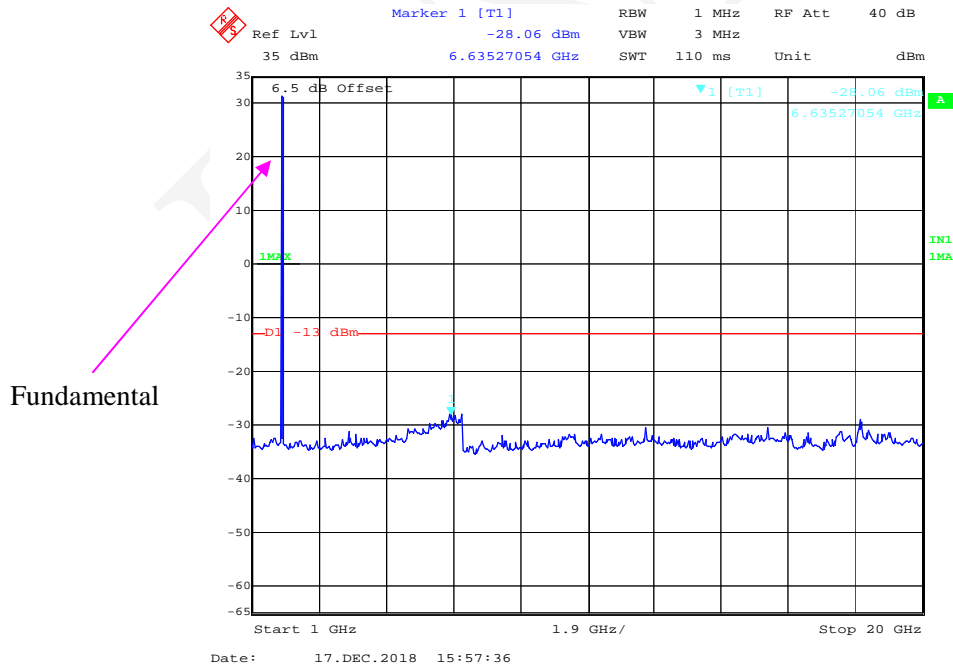


PCS 1900 Band:

30 MHz – 1GHz(GPRS Mode)



1 GHz – 20 GHz (GPRS Mode)



**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 =  $10 \lg (\text{TX pwr in Watts}/0.001)$  – the absolute level

Spurious attenuation limit in dB =  $43 + 10 \log_{10} (\text{power out in Watts})$

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

<b>Temperature:</b>	23.3 °C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	101.2kPa

*The testing was performed by Hope Zhang on 2018-12-04.*

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

**30 MHz ~ 10 GHz:****GPRS 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)			
GPRS Mode, Middle channel										
126.03	42.09	211	198	H	-63.97	0.35	-6.10	-70.42	-13	57.42
126.03	47.41	295	129	V	-52.19	0.35	-6.10	-58.64	-13	45.64
1673.20	57.29	19	168	H	-46.10	0.84	8.48	-38.46	-13	25.46
1673.20	54.86	84	120	V	-49.03	0.84	8.48	-41.39	-13	28.39
2509.80	52.05	14	223	H	-48.89	0.89	10.09	-39.69	-13	26.69
2509.80	49.81	163	161	V	-51.14	0.89	10.09	-41.94	-13	28.94

**30 MHz ~ 20 GHz:****GPRS 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)			
GPRS Mode, Middle channel										
126.05	42.15	83	165	H	-63.91	0.35	-6.10	-70.36	-13	57.36
126.05	48.09	136	132	V	-51.51	0.35	-6.10	-57.96	-13	44.96
3760.00	41.47	81	105	H	-55.24	0.95	9.74	-46.45	-13	33.45
3760.00	43.55	330	176	V	-53.75	0.95	9.74	-44.96	-13	31.96
5640.00	42.15	152	244	H	-51.78	1.15	10.47	-42.46	-13	29.46
5640.00	40.92	240	162	V	-53.04	1.15	10.47	-43.72	-13	30.72

**Note:**

- 1) Absolute Level = Submitted Level - Cable loss + Antenna Gain
- 2) Margin = Limit- Absolute Level



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

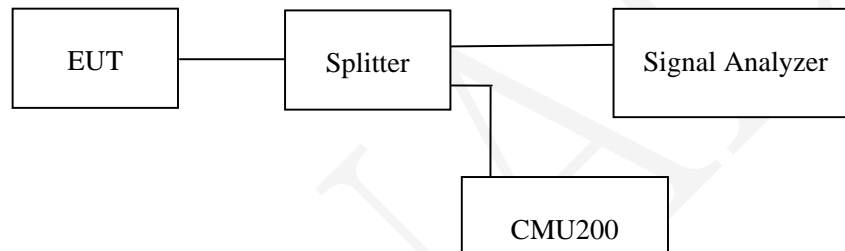
According to § 22.917(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

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:	23.3 °C
Relative Humidity:	50 %
ATM Pressure:	101.2kPa

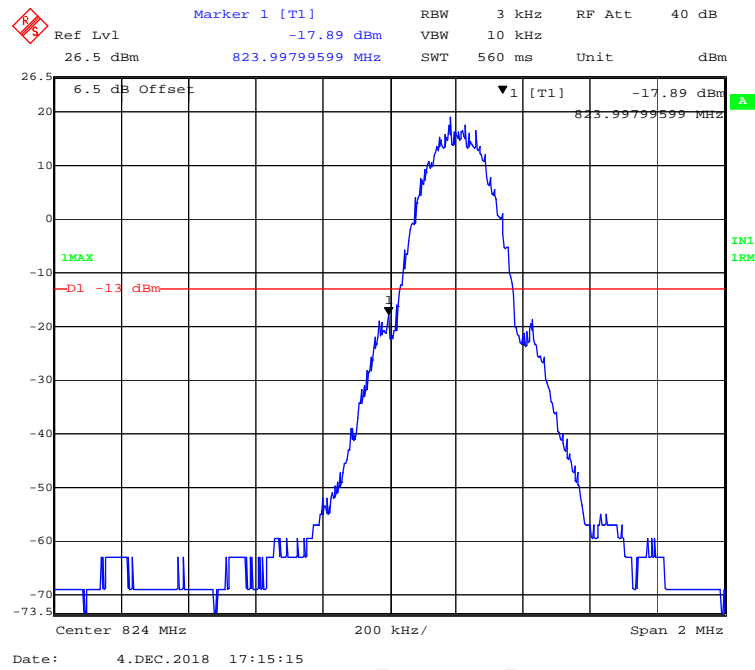
*The testing was performed by Hope Zhang on 2018-12-04.*

*EUT operation mode: Transmitting*

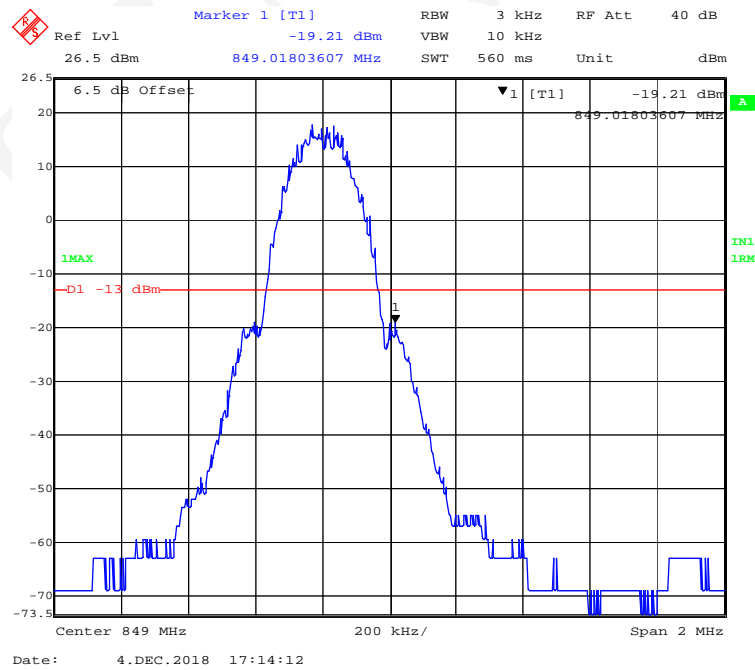
*Test Result: Compliance.*

# GSM 850 Band:

## GPRS Mode, Left Band Edge

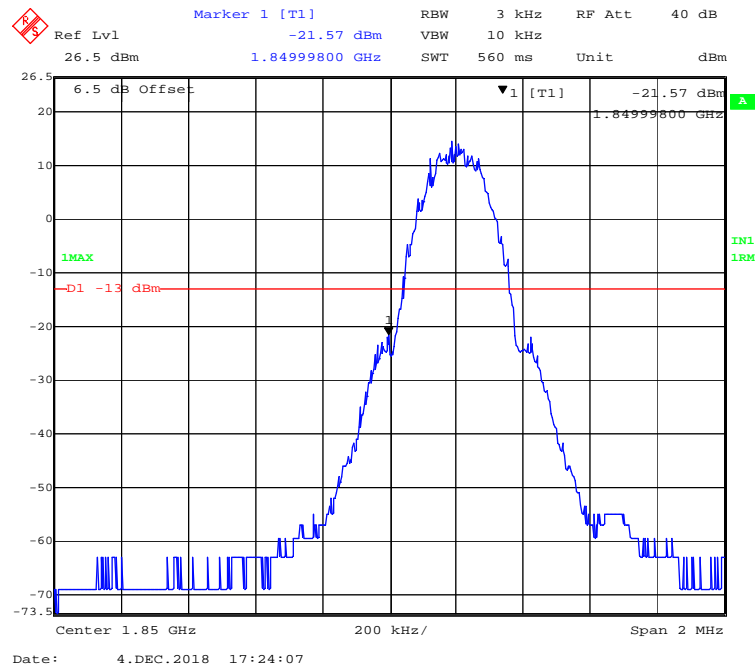


## GPRS Mode, Right Band Edge

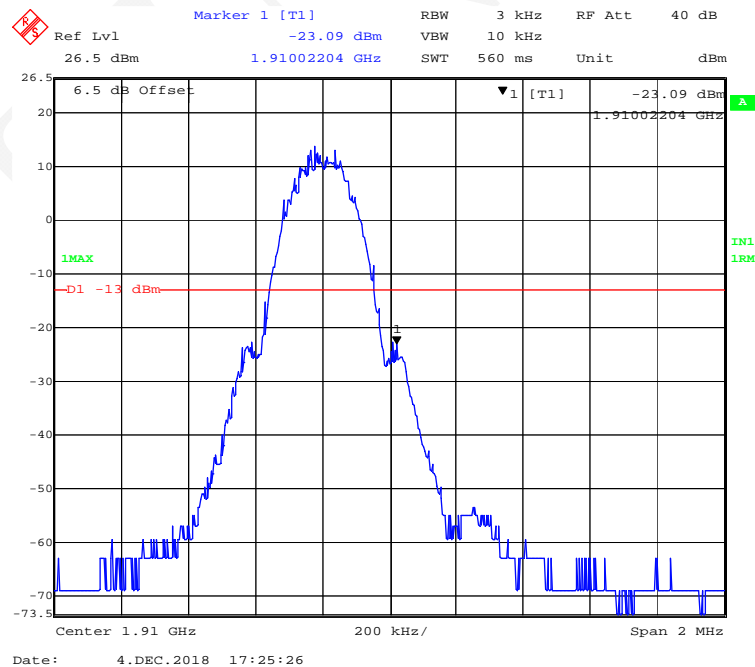


**PCS 1900 Band:**

**GPRS Mode, Left Band Edge**



**GPRS 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

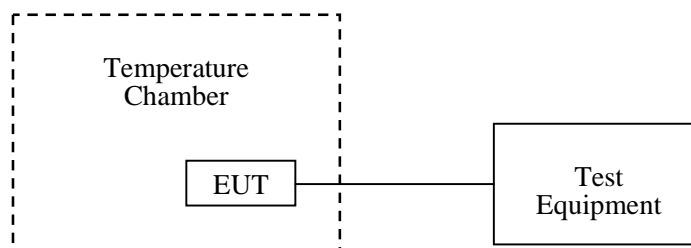
According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

**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**

<b>Temperature:</b>	23.3 °C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	101.2kPa

The testing was performed by Hope Zhang on 2018-12-04.

EUT operation mode: Transmitting

Test Result: Compliance.

**GSM 850 Band:**

GPRS Mode, Middle Channel, $f_o = 836.6$ MHz				
Temperature (°C)	Power Supplied (V <sub>DC</sub> )	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-30	3.7	2	0.0024	2.5
-20		9	0.0108	2.5
-10		2	0.0024	2.5
0		2	0.0024	2.5
10		1	0.0012	2.5
20		7	0.0084	2.5
30		5	0.0060	2.5
40		6	0.0072	2.5
50		2	0.0024	2.5
25	V min.= 3.1	5	0.0060	2.5
25	V max.= 4.3	2	0.0024	2.5

GPRS Mode, Middle Channel, $f_0=836.6$ MHz				
Temperature (°C)	Power Supplied ( $V_{DC}$ )	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
-30	12	2	0.0024	2.5
-20		6	0.0072	2.5
-10		5	0.0060	2.5
0		-1	-0.0012	2.5
10		0	0.0000	2.5
20		3	0.0036	2.5
30		4	0.0048	2.5
40		2	0.0024	2.5
50		5	0.0060	2.5
25	V min.= 10.2	4	0.0048	2.5
25	V max.= 13.8	1	0.0012	2.5
-30	24	4	0.0048	2.5
-20		2	0.0024	2.5
-10		6	0.0072	2.5
0		3	0.0036	2.5
10		2	0.0024	2.5
20		4	0.0048	2.5
30		6	0.0072	2.5
40		5	0.0060	2.5
50		1	0.0012	2.5
25	V min.= 20.4	5	0.0060	2.5
25	V max.= 27.6	-1	-0.0012	2.5

**PCS 1900 Band:**

GPRS Mode, Middle Channel, $f_0=1880.0$ MHz				
Temperature (°C)	Power Supplied ( $V_{dc}$ )	Frequency Error (Hz)	Frequency Error (ppm)	Result
-30	3.7	3	0.0016	pass
-20		12	0.0064	pass
-10		10	0.0053	pass
0		18	0.0096	pass
10		18	0.0096	pass
20		6	0.0032	pass
30		6	0.0032	pass
40		18	0.0096	pass
50		15	0.0080	pass
25	V min.= 3.1	12	0.0064	pass
25	V max.= 4.3	12	0.0064	pass

GPRS Mode, Middle Channel, $f_o=1880.0$ MHz				
Temperature (°C)	Power Supplied ( $V_{DC}$ )	Frequency Error (Hz)	Frequency Error (ppm)	Result
-30	12	5	0.0027	Pass
-20		10	0.0053	Pass
-10		6	0.0032	Pass
0		9	0.0048	Pass
10		4	0.0021	Pass
20		5	0.0027	Pass
30		8	0.0043	Pass
40		11	0.0059	Pass
50		7	0.0037	Pass
25	V min.= 10.2	6	0.0032	Pass
25	V max.= 13.8	9	0.0048	Pass
-30	24	6	0.0032	Pass
-20		9	0.0048	Pass
-10		11	0.0059	Pass
0		8	0.0043	Pass
10		7	0.0037	Pass
20		6	0.0032	Pass
30		3	0.0016	Pass
40		9	0.0048	Pass
50		10	0.0053	Pass
25	V min.= 20.4	8	0.0043	Pass
25	V max.= 27.6	5	0.0027	Pass

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