MRT Technology (Taiwan) Co., Ltd
Phone: +886-3-3288388
Fax: +886-3-3288918
Web: www.mrt-cert.com

Report No.: 2310TW8705-U7
Report Version: 1.0
Issue Date: 2024-01-15

MEASUREMENT REPORT (C2PC for FCC)

FCC ID	:	WIYSLM500QA
Applicant	:	CASTLES TECHNOLOGY CO., LTD.
Application Type	:	Certification
Product	:	Smart module
Model No.	:	SLM500
Brand Name	:	CASTLES TECHNOLOGY
FCC Classification	:	PCS Licensed Transmitter (PCB)
FCC Rule Part(s)	:	Part2, Part22 Subpart H, Part24 Subpart E
Test Procedure(s)	:	ANSI C63.10-2013
Received Date	:	October 24, 2023
Test Date	:	November 08~24, 2023

Tested By : (Wen Lee)

Reviewed By : (Paddy Chen)

Approved By : (Chenz Ker)

Testing Laboratory 3261

The test results only relate to the tested sample.
This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

Revision History

Report No.	Version	Description	Issue Date	Note
2310TW8705-U7	1.0	Original Report	2024-01-15	

Note:

1. This time, add Host ((Product Name: POS Terminal, Model No.: S1L2) and new antennas have been added, which have a higher gain compared to the original antennas., so the FCC C2PC (Conducted Output Power, Spurious Emission) is executed.
2. FCC Original Report Grant Date: 02/15/2022, FCC ID: WIYSLM500QA.

CONTENTS

Description Page

§2.1033 General Information

Applicant	CASTLES TECHNOLOGY CO., LTD.
Applicant Address	6F, NO. 207-5, SEC. 3, BEIXIN RD., XINDIAN DISTRICT, NEW TAIPEI CITY 231632, TAIWAN (R. O. C.)
Manufacturer	CASTLES TECHNOLOGY CO., LTD.
Manufacturer Address	6F, NO. 207-5, SEC. 3, BEIXIN RD., XINDIAN DISTRICT, NEW TAIPEI CITY 231632, TAIWAN (R. O. C.)
Test Site	MRT Technology (Taiwan) Co., Ltd
Test Site Address	No. 38, Fuxing Second Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C)
MRT FCC Registration No.	291082
Test Device Serial No.	#1-1 ☐ Production ☒ Pre-Production ☐ Engineering

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Fuxing Rd., Taoyuan, Taiwan (R.O.C)

- **MRT facility is a FCC registered (Reg. No. 291082) test facility with the site description report on file and is designated by the FCC as an Accredited Test Firm.**
- **MRT facility is an IC registered (MRT Reg. No. 21723) test laboratory with the site description on file at Industry Canada.**
- **MRT Lab is accredited to ISO 17025 by the Taiwan Accreditation Foundation (TAF Cert. No. 3261) in EMC, Telecommunications and Radio testing for FCC (Designation Number: TW3261), Industry Canada, EU and TELEC Rules.**

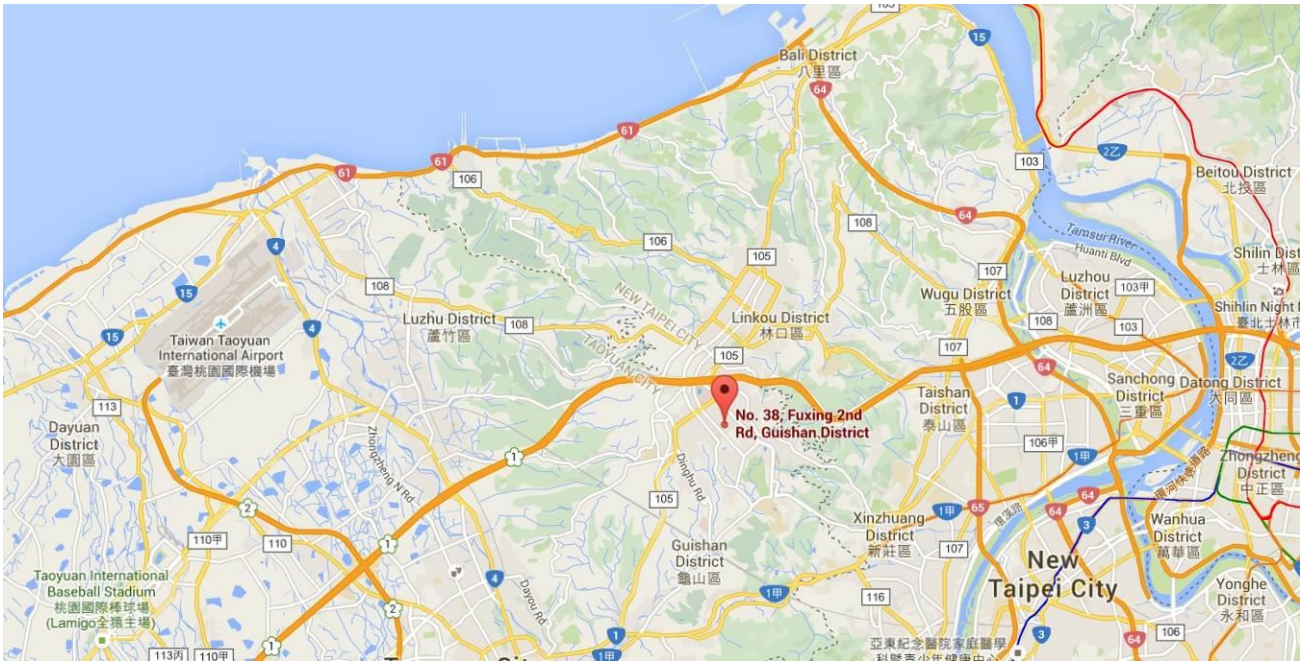
1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taoyuan City. These measurement tests were conducted at the MRT Technology (Taiwan) Co., Ltd. Facility located at No.38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 33377, Taiwan (R.O.C).



2. PRODUCT INFORMATION

2.1. Feature of Equipment under Test

Product Name	Smart module
Model No.	SLM500
Brand Name	CASTLES TECHNOLOGY
Supports Radios Spec.	**WLAN:** 2.4G: 802.11b/g/n-20/n-40 5G: 802.11a/n-20/n-40, Band 1,2,3,4 **WPAN:** Bluetooth Dual Mode: V4.2 NFC 13.56MHz **WWAN:** 2G: GPRS 850 / EGPRS 850 / GPRS 1900 / EGPRS 1900 3G: Band 2, 4, 5 4G: Band 2, 4, 5, 7, 12, 13, 17, 25, 26, 66
2G Operation Band (s)	GPRS / EGPRS 850, GPRS / EGPRS 1900
Frequency Range	GPRS / EGPRS 850: 824~849MHz GPRS / EGPRS 1900: 1850~1910MHz
Accessory	
Power Adapter	MFR: Shenzhen ABP Technology Co.,Ltd. Model No: AD0181-1201000UC Input: AC 100-240V~50-60Hz,0.5A Max Output: DC 12.0V, 1.0A 12.0w Cable Out: Non-shielding, 1.5m

2.2. Equipment Description

Antenna Type	PIFA
Antenna M/N	RFA-LTE-JP782-70B-95, RFA-LTE-AP781-70-53
Antenna Gain	824~849: -0.58dBi ;1850~1910:2.92 dBi
Type of Modulation	GMSK/8PSK

Note: The test report has showed the worst test mode.

2.3. Device Capabilities

This device contains the following capabilities:
GPRS / EGPRS 850, GPRS / EGPRS 1900

2.4. Test Configuration

The **Smart module** was tested per the guidance of ANSI/TIA-603-E-2016 and KDB 971168 D01v02r02. See section 3.0 of this report for a description of the radiated and antenna port conducted emissions tests.

2.5. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

3. DESCRIPTION OF TEST

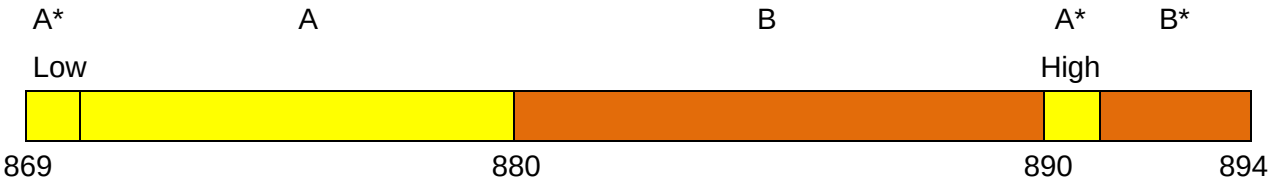
3.1. Evaluation Procedure

The measurement procedures described in the “Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards” (ANSI/TIA-603-E-2016) and “Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems” (KDB 971168) were used in the measurement of the **Smart module**

Deviation from measurement procedure…….....None

3.2. Cellular – Base Frequency Blocks

§22.905



Block 1: 869 – 880 MHz (A* Low + A)

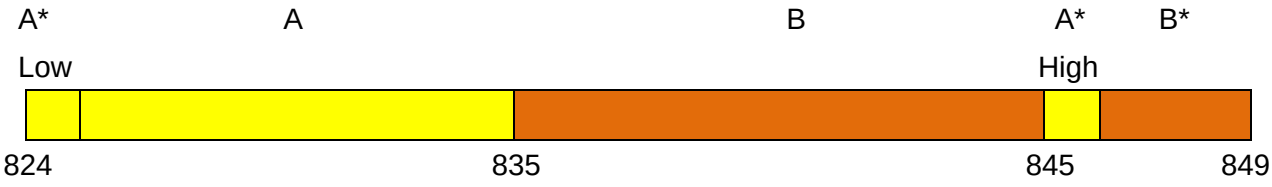
Block 2: 880 – 890 MHz (B)

Block 3: 890 – 891.5 MHz (A* High)

Block 4: 891.5 – 894 MHz (B*)

3.3. Cellular – Mobile Frequency Blocks

§22.905



Block 1: 824 – 835 MHz (A* Low + A)

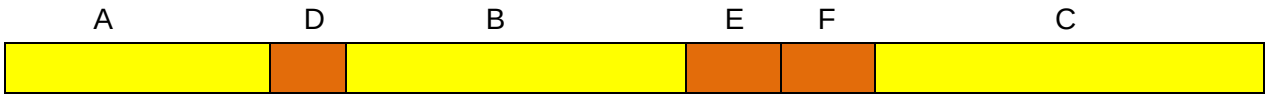
Block 2: 835 – 845 MHz (B)

Block 3: 845 – 846.5 MHz (A* High)

Block 4: 846.5 – 849 MHz (B*)

3.4. PCS – Base Frequency Blocks

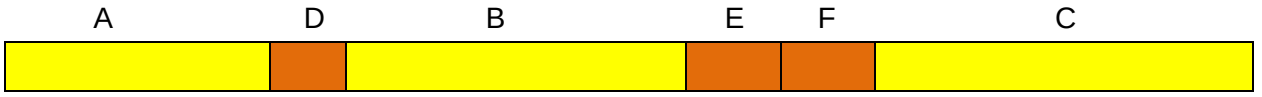
§24.229



Block 1: 1930 – 1945 MHz (A)
Block 2: 1945 – 1950 MHz (D)
Block 3: 1950 – 1965 MHz (B)
Block 4: 1965 – 1970 MHz (E)
Block 5: 1970 – 1975 MHz (F)
Block 6: 1975 – 1990 MHz (C)

3.5. PCS – Mobile Frequency Blocks

§24.229



Block 1: 1850 – 1865 MHz (A)
Block 2: 1865 – 1870 MHz (D)
Block 3: 1870 – 1885 MHz (B)
Block 4: 1885 – 1890 MHz (E)
Block 5: 1890 – 1895 MHz (F)
Block 6: 1895 – 1910 MHz (C)

3.6. Occupied Bandwidth

§2.1049

The occupied bandwidth, that 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 shall be measured. The spectrum analyzers' "occupied bandwidth" measurement function was used to record the occupied bandwidth in accordance with KDB 971168.

3.7. Spurious and Harmonic Emissions at Antenna Terminal

§2.1051 §22.917(a) §24.238(a)

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 10^{th} 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 100 kHz or greater for Part 22. However, 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 emission are attenuated at least 26 dB below the transmitter power.

3.8. Power and Radiated Spurious Emissions

§2.1053 §22.913(a.2) §22.917(a) §24.232(c) §24.238(a)

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurement and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. A MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. A 80cm high PVC support structure is placed on top of the turntable.

The equipment under test was transmitting while connected to its integral antenna and is placed on a wooden turntable 80cm above the ground plane and 3 meters from the receive antenna. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer. Radiated power levels are also investigated with the receive antenna horizontally and vertically polarized. The maximized power level is recorded using the spectrum analyzer “Channel Power” function with the integration band set to the emissions’ occupied bandwidth, a RMS detector, RBW = 100kHz, VBW = 300kHz, and a 1 second sweep time over a minimum of 10 sweeps, per the guidelines of KDB 971168.

Per the guidance of ANSI/TIA-603-E-2016, a half-wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer level previously recorded from the spurious emission from the EUT. The power of the emission is calculated using the following formula:

$$Pd\ [dBm] = Pg\ [dBm] - \text{cable loss}\ [dB] + \text{antenna gain}\ [dBd/dBi]$$

Where, Pd is the dipole equivalent power, Pg is the generator output into the substitution antenna, and the antenna gain is the gain of the substitute antenna used relative to either a half-wave dipole (dBd) or an isotropic source (dBi). The substitute level is equal to Pg [dBm] – cable loss [dB].

The calculated Pd levels are then compared to the absolute spurious emission limit of -13dBm which is equivalent to the required minimum attenuation of 43 + 10*log10(Power [Watts]) specified in 22.917(a).

3.9. Peak-Average Ratio

§24.232(d)

A peak to average ratio measurement is performed at the conducted port of the EUT. The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level.

For pulsed signals, the spectrum analyzer is set to use an internal “RF Burst” trigger that is synced with an incoming pulse and the measurement interval is set to less than the duration of the “on time” of one burst to ensure that energy is only captured during a time in which the transmitter is operating at maximum power. For continuous signals, the trigger is set to “free run” in the CCDF measurement mode.

3.10. Frequency Stability / Temperature Variation

§2.1055 §22.355 §22.863 §22.905 §24.229 §24.235

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-E-2016.
The frequency stability of the transmitter is measured by:
a.) Temperature: The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.
b.) Primary Supply Voltage: The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.
Specification – For Part 22, the frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5 ppm) of the center frequency.

Time Period and Procedure:
1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a “standby” condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

4. TEST EQUIPMENT CALIBRATION DATE

Radiated Emissions – AC2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Acitve Loop Antenna	SCHWARZBECK	FMZB 1519B	MRTTWA00002	1 year	2024/5/22
Broadband TRILOG Antenna	SCHWARZBECK	VULB 9162	MRTTWA00001	1 year	2024/10/31
Broadband Hornantenna	RFSPIN	DRH18-E	MRTTWA00087	1 year	2024/5/17
Broadband Preamplifier	EMC Instruments corporation	EMC118A45SE	MRTTWA00088	1 year	2024/5/17
Breitband Hornantenna	SCHWARZBECK	BBHA 9170	MRTTWA00004	1 year	2024/3/20
Broadband Amplifier	SCHWARZBECK	BBV 9721	MRTTWA00006	1 year	2024/3/27
EMI Test Receiver	R&S	ESR3	MRTTWA00009	1 year	2024/3/8
Signal Analyzer	R&S	FSVA3044	MRTTWA00092	1 year	2024/6/29
Antenna Cable	HUBERSUHNER	SF106	MRTTWE00034	1 year	2024/6/26
Cable	HUBERSUHNER	EMC105-NM-NM -3000	MRTTWE00035	1 year	2024/6/26

Conducted Test Equipment – SR6

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	KEYSIGHT	N9010A	MRTTWA00012	1 year	2024/10/17
USB Wideband Power Sensor	KEYSIGHT	U2021XA	MRTTWA00015	1 year	2024/3/16
Wideband Radio Communication Taster	R&S	CMW 500	MRTTWA00084	1 year	2024/10/18

Test Software

Software	Version	Function
e3	9.160520a	EMI Test Software
EMI	V3	EMI Test Software

5. SAMPLE CALCULATIONS

GSM Emission Designator

Emission Designator = 250KGXW

GSM BW = 250 kHz

G = Phase Modulation

X = Cases not otherwise covered

W = Combination (Audio/Data)

EGPRS Emission Designator

Emission Designator = 250KG7W

GSM BW = 250 kHz

G = Phase Modulation

7 = Quantized/Digital Info

W = Combination (Audio/Data)

WCDMA / CDMA Emission Designator

Emission Designator = 1M25F9W

WCDMA BW = 1.25 MHz

F = Frequency Modulation

9 = Composite Digital Info

W = Combination (Audio/Data)

LTE Emission Designator

Emission Designator = QPSK 5M00G7D / 16QAM 5M00W7D

LTE BW = 1.4/3/5/10/15/20 MHz

QPSK G = Phase Modulation /

16QAM W= in a combination of two or more of the following modes: amplitude, angle, pulse

7 = Quantized/Digital Info

D = Data transmission, telemetry, telecommand

Spurious Radiated Emission

Example: Spurious emission at 1688.10 MHz

The receive spectrum analyzer reading at 3 meters with the EUT on the turntable was –65.0dBm. The gain of the substituted antenna is 6.5dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of –65.0dBm on the spectrum analyzer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 4.5 dB at 1688.1MHz. So 2 dB is added to the signal generator reading of –25dBm yielding –23dBm. The fundamental EIRP was 24.0dBm so this harmonic was 24.0dBm – (-23) = 47dBc.

6. MEASUREMENT UNCERTAINTY

Where relevant, the following test 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.

Conducted Power Measurement
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ± 0.84dB
Radiated Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ± 4.22dB

7. TEST RESULT

7.1. Summary

Product Name: **POS Terminal**

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1049 22.917(b) 24.238(b)	Occupied bandwidth	N/A	Conducted	N/A	Section 7.2
2.1051 22.917(a) 24.238(a)	Conducted Spurious Emissions	> 43 + log10 (P[Watts]) at for all out-of-band emissions		N/A	Section 7.3
2.1051 22.917(a) 24.238(a)	Band Edge	> 43 + log10 (P[Watts]) at for all out-of-band emissions		N/A	Section 7.4
2.1046	Conducted Output Power	N/A		Pass	Section 7.5
22.913(a.2)	Output Power	< 7 Watts max. ERP		Pass	
24.232(c)	Output Power	< 2 Watts max. ERP		Pass	
2.1053 22.917(a) 24.238(a)	Radiated Spurious Emissions	> 43 + log10 (P[Watts]) for all out-of-band emissions	Radiated	Pass	Section 7.5
24.232(d)	Peak-Average Ratio	< 13 dB	Conducted	N/A	Section 7.6
2.1055 22.355 24.235	Frequency Stability	< 2.5 ppm		N/A	Section 7.7

Notes:

1) Determining compliance is based on the test results met the regulation limits or requirements declared by clients, and the test results don't take into account the value of measurement uncertainty.
2) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.

7.2. Occupied Bandwidth

7.2.1. Test Limit

N/A

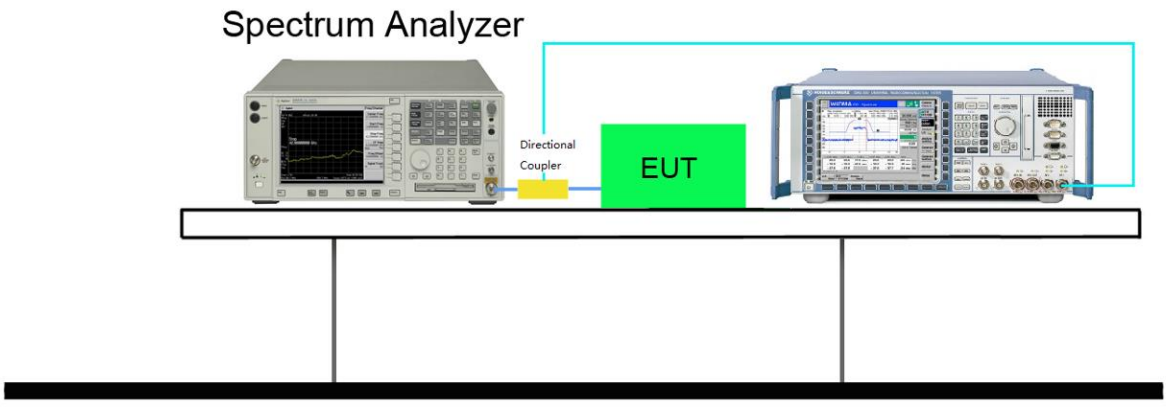
7.2.2. Test Procedure used

KDB 971168 D01v02r02 – Section 4.2 & ANSI/TIA-603-E-2016

7.2.3. Test Setting

1. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be between two and five times the anticipated OBW.
2. The nominal resolution bandwidth (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. (RBW = approximately 1% of the emission bandwidth).
3. Set the detection mode to peak, and the trace mode to max hold.
4. Use the 99 % power bandwidth function of the spectrum analyzer (if available) and report the measured bandwidth.

7.2.4. Test Setup



7.2.5. Test Result

Note: Reference Original Report Grant Date: 02/15/2022, FCC ID: WIYSLM500QA.

7.3. Conducted Spurious Emissions

7.3.1. Test Limit

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 + 10log(P) dB.

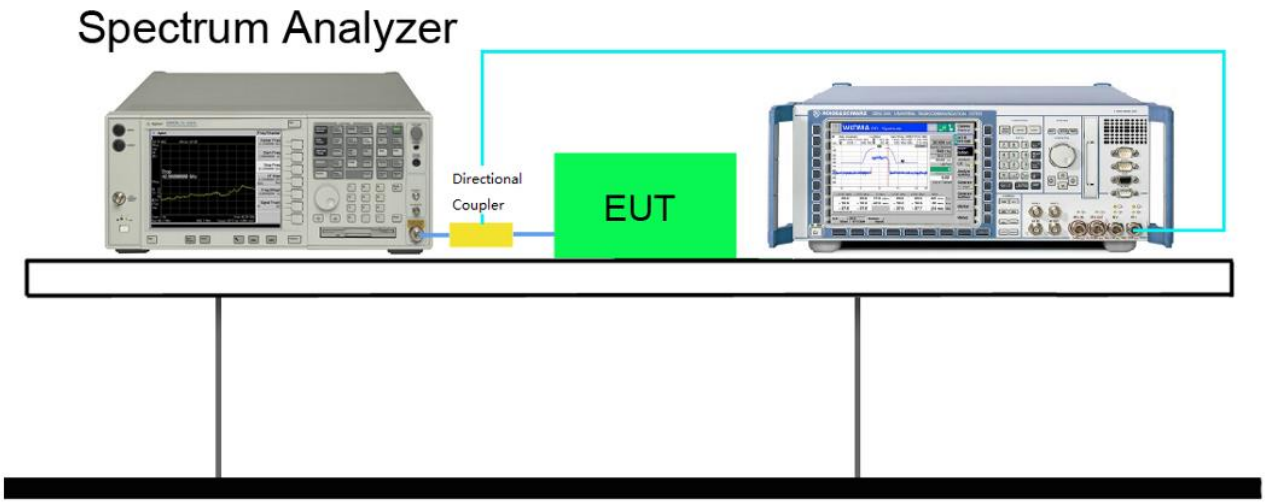
7.3.2. Test Procedure Used

KDB 971168 D01v02r02 – Section 6.0 & ANSI/TIA-603-E-2016

7.3.3. Test Setting

Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz is at or below 1GHz and 1MHz is above 1GHz, If any, up to 10th harmonic.

7.3.4. Test Setup



7.3.5. Test Result

Note: Reference Original Report Grant Date: 02/15/2022, FCC ID: WIYSLM500QA.

7.4. Band Edge at Antenna Terminal

7.4.1. Test Limit

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 + 10log(P) dB.

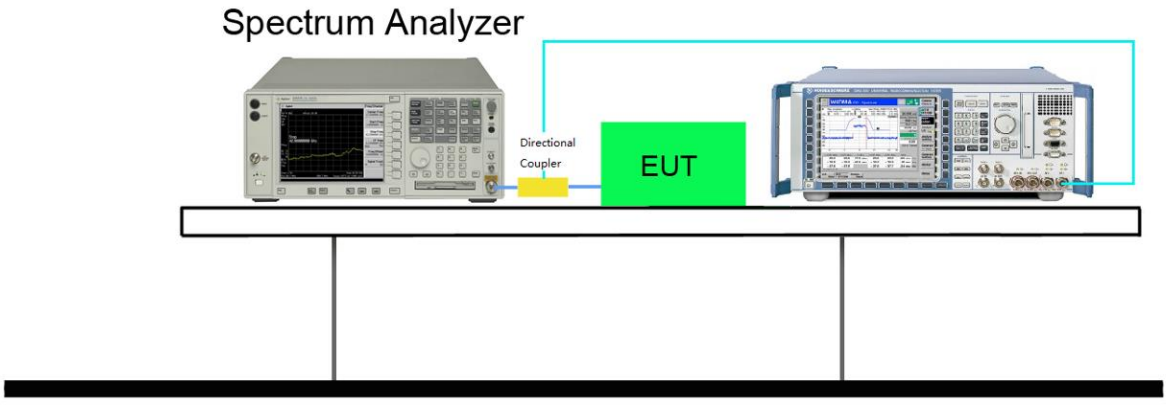
7.4.2. Test Procedure Used

KDB 971168 D01v02r02 – Section 6.0 & ANSI/TIA-603-E-2016

7.4.3. Test Setting

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. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). 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.

7.4.4. Test Setup



7.4.5. Test Result

Note: Reference Original Report Grant Date: 02/15/2022, FCC ID: WIYSLM500QA.

7.5. Power and Radiated Spurious Emissions

7.5.1 Test Limit

Radiated Power

For FCC Part 22.913(a)(2):

The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

For FCC Part 24.232(b):

The EIRP of mobile transmitters and auxiliary test transmitters must not exceed 2 Watts.

Radiated Spurious 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 + 10log(P) dB.

7.5.2 Test Procedure Used

KDB 971168 D01v02r02 - Section 7.0 & ANSI/TIA-603-E-2016

7.5.3 Test Setting

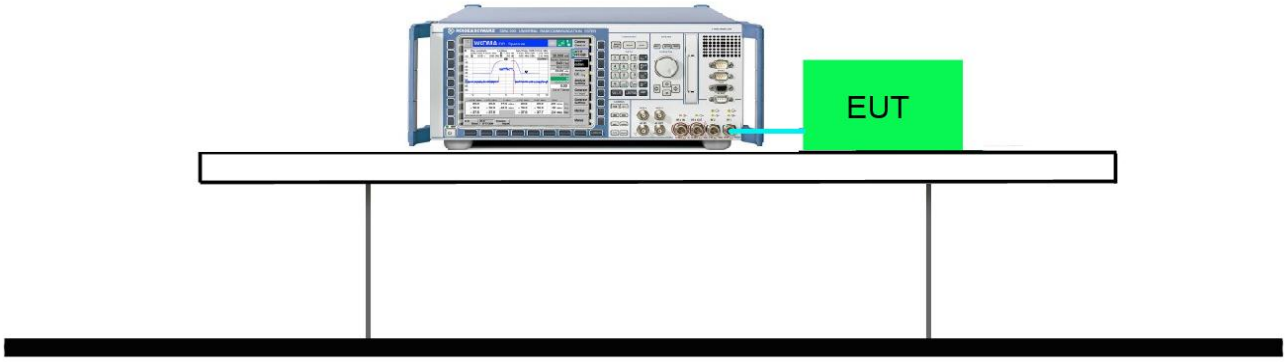
1. The EUT shall be placed at the specified height on a support, and in the position closest to normal use as declared by provider.
2. The test antenna shall be oriented initially for vertical polarization and shall be chosen to correspond to the frequency of the transmitter
3. The output of the test antenna shall be connected to the measuring receiver.
4. The transmitter shall be switched on and the measuring receiver shall be tuned to the frequency of the transmitter under test.
5. The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
6. The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
7. The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
8. The maximum signal level detected by the measuring receiver shall be noted.
9. The transmitter shall be replaced by a substitution antenna.
10. The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
11. The substitution antenna shall be connected to a calibrated signal generator.
12. If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
13. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
14. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that 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.

15. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.
16. The measure of the effective radiated power is the larger of the two levels recorded at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.
17. Test site anechoic chamber refer to ANSI C63.4: 2014.

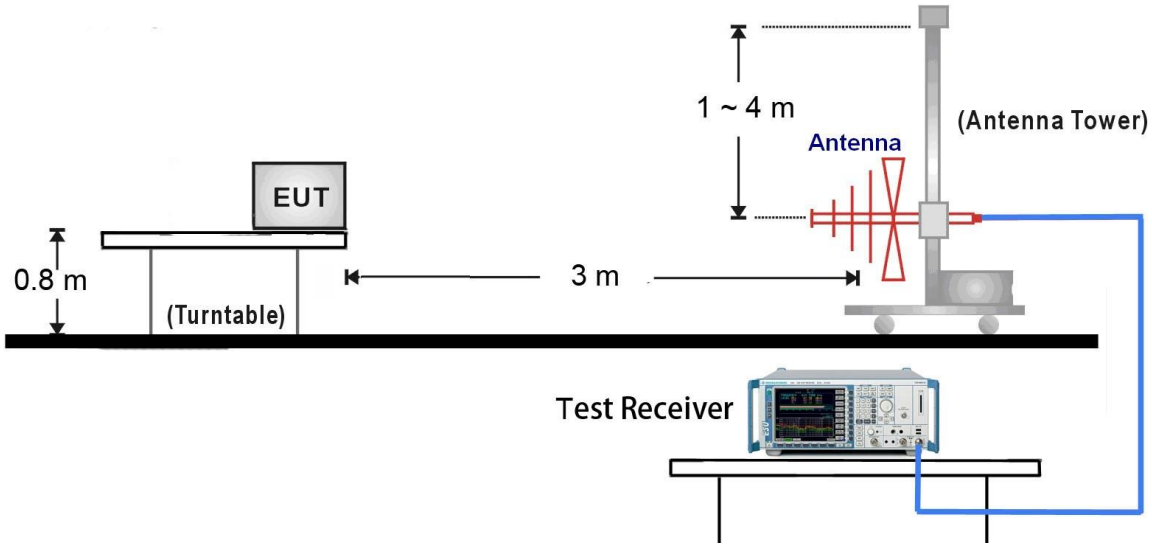
7.5.4 Test Setup

Conducted Power

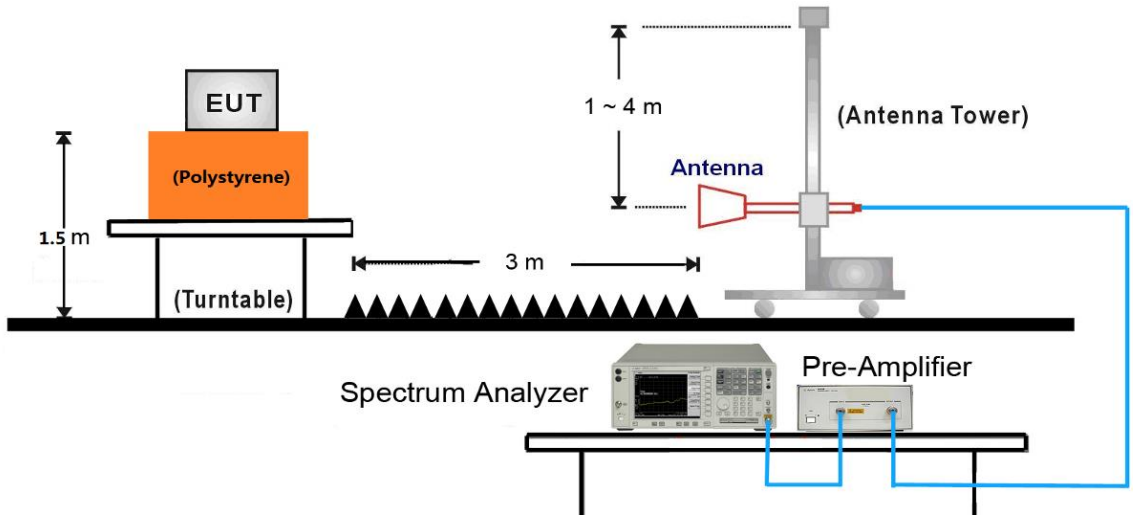


Radiated Power & Radiated Spurious Emissions

30MHz ~ 1GHz Test Setup:



1GHz ~ 10GHz Test Setup:



7.5.5 Test Result

Conducted Power

2G-GSM Mode	Channel No.	Frequency (MHz)	Conducted Power			ERP		
			Peak Power (dBm)	Duty Cycle Factor (dB)	Average Power (dBm)	Antenna Gain (dBi)	ERP (dBm)	Limit (dBm)
GPRS 850 (1 Slot)	128	824.2	31.22	-9.03	22.19	-0.58	28.49	≦ 38.45
	190	836.6	31.63	-9.03	22.60	-0.58	28.90	≦ 38.45
	251	848.8	31.29	-9.03	22.26	-0.58	28.56	≦ 38.45
GPRS 850 (2 Slot)	128	824.2	29.29	-6.02	23.27	-0.58	26.56	≦ 38.45
	190	836.6	29.70	-6.02	23.68	-0.58	26.97	≦ 38.45
	251	848.8	29.82	-6.02	23.80	-0.58	27.09	≦ 38.45
GPRS 850 (3 Slot)	128	824.2	26.53	-4.26	22.27	-0.58	23.80	≦ 38.45
	190	836.6	26.88	-4.26	22.62	-0.58	24.15	≦ 38.45
	251	848.8	27.04	-4.26	22.78	-0.58	24.31	≦ 38.45
GPRS 850 (4 Slot)	128	824.2	25.97	-3.01	22.96	-0.58	23.24	≦ 38.45
	190	836.6	26.35	-3.01	23.34	-0.58	23.62	≦ 38.45
	251	848.8	26.47	-3.01	23.46	-0.58	23.74	≦ 38.45
EGPRS 850 (1 Slot)	128	824.2	25.22	-9.03	16.19	-0.58	22.49	≦ 38.45
	190	836.6	25.41	-9.03	16.38	-0.58	22.68	≦ 38.45
	251	848.8	25.50	-9.03	16.47	-0.58	22.77	≦ 38.45
EGPRS 850 (2 Slot)	128	824.2	24.50	-6.02	18.48	-0.58	21.77	≦ 38.45
	190	836.6	24.69	-6.02	18.67	-0.58	21.96	≦ 38.45
	251	848.8	24.82	-6.02	18.80	-0.58	22.09	≦ 38.45
EGPRS 850 (3 Slot)	128	824.2	21.79	-4.26	17.53	-0.58	19.06	≦ 38.45
	190	836.6	22.11	-4.26	17.85	-0.58	19.38	≦ 38.45
	251	848.8	22.26	-4.26	18.00	-0.58	19.53	≦ 38.45
EGPRS 850 (4 Slot)	128	824.2	21.07	-3.01	18.06	-0.58	18.34	≦ 38.45
	190	836.6	21.40	-3.01	18.39	-0.58	18.67	≦ 38.45
	251	848.8	21.31	-3.01	18.30	-0.58	18.58	≦ 38.45
Note: ERP = Conducted Power + Antenna Gain – 2.15.								

2G-GSM Mode	Channel No.	Frequency (MHz)	Conducted Power			EIRP		
			Peak Power (dBm)	Duty Cycle Factor (dB)	Average Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)
GPRS 1900 (1 Slot)	512	1850.2	28.13	-9.03	19.10	2.92	31.05	≦ 33.01
	661	1880	28.23	-9.03	19.20	2.92	31.15	≦ 33.01
	810	1909.8	28.02	-9.03	18.99	2.92	30.94	≦ 33.01
GPRS 1900 (2 Slot)	512	1850.2	26.24	-6.02	20.22	2.92	29.16	≦ 33.01
	661	1880	26.43	-6.02	20.41	2.92	29.35	≦ 33.01
	810	1909.8	26.11	-6.02	20.09	2.92	29.03	≦ 33.01
GPRS 1900 (3 Slot)	512	1850.2	25.77	-4.26	21.51	2.92	28.69	≦ 33.01
	661	1880	25.42	-4.26	21.16	2.92	28.34	≦ 33.01
	810	1909.8	24.96	-4.26	20.70	2.92	27.88	≦ 33.01
GPRS 1900 (4 Slot)	512	1850.2	24.70	-3.01	21.69	2.92	27.62	≦ 33.01
	661	1880	24.17	-3.01	21.16	2.92	27.09	≦ 33.01
	810	1909.8	23.64	-3.01	20.63	2.92	26.56	≦ 33.01
EGPRS 1900 (1 Slot)	512	1850.2	24.92	-9.03	15.89	2.92	27.84	≦ 33.01
	661	1880	24.56	-9.03	15.53	2.92	27.48	≦ 33.01
	810	1909.8	24.44	-9.03	15.41	2.92	27.36	≦ 33.01
EGPRS 1900 (2 Slot)	512	1850.2	24.82	-9.03	15.79	2.92	27.74	≦ 33.01
	661	1880	24.47	-9.03	15.44	2.92	27.39	≦ 33.01
	810	1909.8	24.32	-9.03	15.29	2.92	27.24	≦ 33.01
EGPRS 1900 (3 Slot)	512	1850.2	22.46	-6.02	16.44	2.92	25.38	≦ 33.01
	661	1880	21.98	-6.02	15.96	2.92	24.90	≦ 33.01
	810	1909.8	21.74	-6.02	15.72	2.92	24.66	≦ 33.01
EGPRS 1900 (4 Slot)	512	1850.2	20.32	-4.26	16.06	2.92	23.24	≦ 33.01
	661	1880	19.72	-4.26	15.46	2.92	22.64	≦ 33.01
	810	1909.8	19.72	-4.26	15.46	2.92	22.64	≦ 33.01
Note: EIRP = Conducted Power + Antenna Gain.								

Radiated Spurious Emission

GSM(GPRS) 850

Frequency (MHz)	Ant. Pol. (H/V)	SA Reading (dBm)	Cable Loss (dB)	Substitute Antenna Gain (dBi)	ERP (dBm)	Limit (dBm)	Margin (dB)
Low Channel 128 (824.2MHz)							
1648.40	H	-44.14	1.91	10.75	-35.30	-13.00	-22.30
2472.60	H	-47.75	3.30	12.45	-38.60	-13.00	-25.60
3296.80	H	-64.82	4.12	13.00	-55.94	-13.00	-42.94
1648.40	V	-49.37	1.91	10.75	-40.53	-13.00	-27.53
2472.60	V	-53.45	3.30	12.45	-44.30	-13.00	-31.30
3296.80	V	-67.00	4.12	13.00	-58.12	-13.00	-45.12
Middle Channel 190 (836.6MHz)							
1673.20	H	-45.62	1.91	10.75	-36.78	-13.00	-23.78
2509.80	H	-47.40	3.30	12.45	-38.25	-13.00	-25.25
3346.40	H	-62.58	4.12	13.00	-53.70	-13.00	-40.70
1673.20	V	-49.59	1.91	10.75	-40.75	-13.00	-27.75
2509.80	V	-53.03	3.30	12.45	-43.88	-13.00	-30.88
3346.40	V	-66.38	4.12	13.00	-57.50	-13.00	-44.50
High Channel 251 (848.8MHz)							
1697.60	H	-45.32	1.91	10.75	-36.48	-13.00	-23.48
2546.40	H	-42.37	3.30	12.45	-33.22	-13.00	-20.22
3395.20	H	-62.94	4.12	13.00	-54.06	-13.00	-41.06
1697.60	V	-48.99	1.91	10.75	-40.15	-13.00	-27.15
2546.40	V	-50.32	3.30	12.45	-41.17	-13.00	-28.17
3395.20	V	-66.13	4.12	13.00	-57.25	-13.00	-44.25

Note:

1. Spurious emissions within 30-1000MHz & Other harmonic were found more than 20dB below limit line.
2. EIRP or ERP (dBm) = SG Reading (dBm) - Cable Loss (dB) + Substitute Antenna Gain (dBi)

GSM(GPRS) 1900

Frequency (MHz)	Ant. Pol. (H/V)	SA Reading (dBm)	Cable Loss (dB)	Substitute Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)
Low Channel 512 (1850.2MHz)							
3700.40	H	-58.90	1.91	10.75	-50.06	-13.00	-37.06
5550.60	H	-46.34	3.30	12.45	-37.19	-13.00	-24.19
7400.80	H	-57.63	4.12	13.00	-48.75	-13.00	-35.75
3700.40	V	-53.44	1.91	10.75	-44.60	-13.00	-31.60
5550.60	V	-47.73	3.30	12.45	-38.58	-13.00	-25.58
7400.80	V	-58.78	4.12	13.00	-49.90	-13.00	-36.90
Middle Channel 661 (1880MHz)							
3760.00	H	-60.53	1.91	10.75	-51.69	-13.00	-38.69
5640.00	H	-49.96	3.30	12.45	-40.81	-13.00	-27.81
7520.00	H	-56.39	4.12	13.00	-47.51	-13.00	-34.51
3760.00	V	-56.37	1.91	10.75	-47.53	-13.00	-34.53
5640.00	V	-51.04	3.30	12.45	-41.89	-13.00	-28.89
7520.00	V	-57.12	4.12	13.00	-48.24	-13.00	-35.24
High Channel 810 (1909.8MHz)							
3819.60	H	-63.03	1.91	10.75	-54.19	-13.00	-41.19
5729.40	H	-55.71	3.30	12.45	-46.56	-13.00	-33.56
7639.20	H	-56.49	4.12	13.00	-47.61	-13.00	-34.61
3819.60	V	-59.05	1.91	10.75	-50.21	-13.00	-37.21
5729.40	V	-61.22	3.30	12.45	-52.07	-13.00	-39.07
7639.20	V	-56.83	4.12	13.00	-47.95	-13.00	-34.95

Note:

1. Spurious emissions within 30-1000MHz & Other harmonic were found more than 20dB below limit line.
2. EIRP or ERP (dBm) = SG Reading (dBm) - Cable Loss (dB) + Substitute Antenna Gain (dBi)

EGPRS 850

Frequency (MHz)	Ant. Pol. (H/V)	SA Reading (dBm)	Cable Loss (dB)	Substitute Antenna Gain (dBi)	ERP (dBm)	Limit (dBm)	Margin (dB)
Low Channel 128 (824.2MHz)							
1648.40	H	-45.16	1.91	10.75	-36.32	-13.00	-23.32
2472.60	H	-44.12	3.30	12.45	-34.97	-13.00	-21.97
3296.80	H	-65.23	4.12	13.00	-56.35	-13.00	-43.35
1648.40	V	-46.24	1.91	10.75	-37.40	-13.00	-24.40
2472.60	V	-49.93	3.30	12.45	-40.78	-13.00	-27.78
3296.80	V	-67.35	4.12	13.00	-58.47	-13.00	-45.47
Middle Channel 190 (836.6MHz)							
1673.20	H	-42.76	1.91	10.75	-33.92	-13.00	-20.92
2509.80	H	-45.05	3.30	12.45	-35.90	-13.00	-22.90
3346.40	H	-64.09	4.12	13.00	-55.21	-13.00	-42.21
1673.20	V	-46.13	1.91	10.75	-37.29	-13.00	-24.29
2509.80	V	-49.14	3.30	12.45	-39.99	-13.00	-26.99
3346.40	V	-66.03	4.12	13.00	-57.15	-13.00	-44.15
High Channel 251 (848.8MHz)							
1697.60	H	-44.04	1.91	10.75	-35.20	-13.00	-22.20
2546.40	H	-41.72	3.30	12.45	-32.57	-13.00	-19.57
3395.20	H	-61.53	4.12	13.00	-52.65	-13.00	-39.65
1697.60	V	-49.18	1.91	10.75	-40.34	-13.00	-27.34
2546.40	V	-49.47	3.30	12.45	-40.32	-13.00	-27.32
3395.20	V	-65.78	4.12	13.00	-56.90	-13.00	-43.90

Note:

1. Spurious emissions within 30-1000MHz & Other harmonic were found more than 20dB below limit line.
2. EIRP or ERP (dBm) = SG Reading (dBm) - Cable Loss (dB) + Substitute Antenna Gain (dBi)

EGPRS 1900

Frequency (MHz)	Ant. Pol. (H/V)	SA Reading (dBm)	Cable Loss (dB)	Substitute Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)
Low Channel 512 (1850.2MHz)							
3700.40	H	-59.13	1.91	10.75	-50.29	-13.00	-37.29
5550.60	H	-49.11	3.30	12.45	-39.96	-13.00	-26.96
7400.80	H	-57.30	4.12	13.00	-48.42	-13.00	-35.42
3700.40	V	-53.05	1.91	10.75	-44.21	-13.00	-31.21
5550.60	V	-56.79	3.30	12.45	-47.64	-13.00	-34.64
7400.80	V	-57.48	4.12	13.00	-48.60	-13.00	-35.60
Middle Channel 661 (1880MHz)							
3760.00	H	-60.67	1.91	10.75	-51.83	-13.00	-38.83
5640.00	H	-50.18	3.30	12.45	-41.03	-13.00	-28.03
7520.00	H	-56.52	4.12	13.00	-47.64	-13.00	-34.64
3760.00	V	-56.36	1.91	10.75	-47.52	-13.00	-34.52
5640.00	V	-57.59	3.30	12.45	-48.44	-13.00	-35.44
7520.00	V	-57.06	4.12	13.00	-48.18	-13.00	-35.18
High Channel 810 (1909.8MHz)							
3819.60	H	-60.59	1.91	10.75	-51.75	-13.00	-38.75
5729.40	H	-48.73	3.30	12.45	-39.58	-13.00	-26.58
7639.20	H	-56.67	4.12	13.00	-47.79	-13.00	-34.79
3819.60	V	-62.88	1.91	10.75	-54.04	-13.00	-41.04
5729.40	V	-55.97	3.30	12.45	-46.82	-13.00	-33.82
7639.20	V	-57.88	4.12	13.00	-49.00	-13.00	-36.00

Note:

1. Spurious emissions within 30-1000MHz & Other harmonic were found more than 20dB below limit line.
2. EIRP or ERP (dBm) = SG Reading (dBm) - Cable Loss (dB) + Substitute Antenna Gain (dBi)

7.6. Peak-Average Ratio

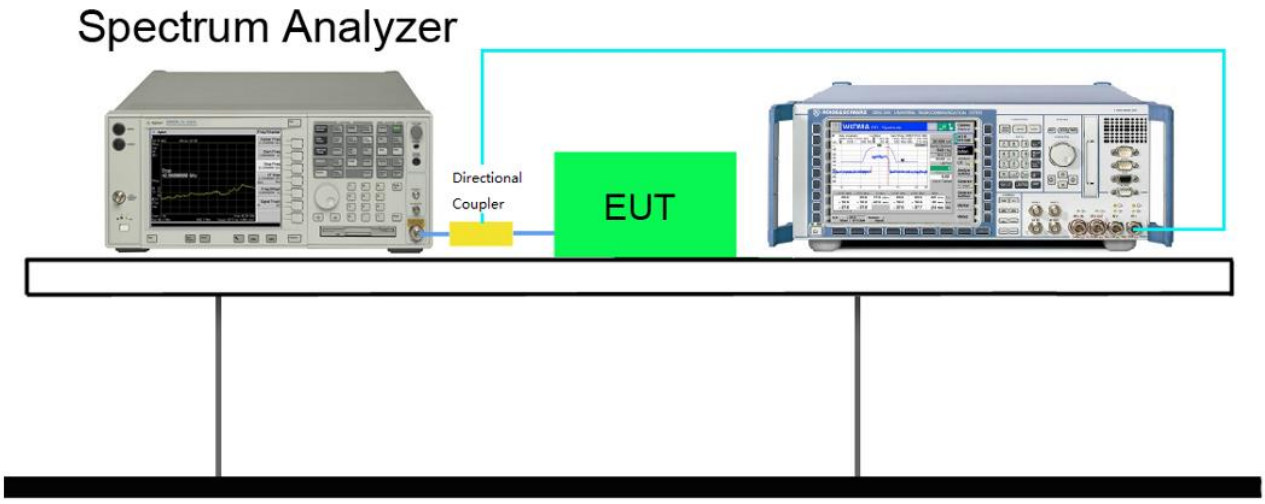
7.6.1 Test Limit

The transmitter's peak-to-average power ratio (PAPR) 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.

7.6.2 Test Procedure

KDB 971168 D01v02r02 - Section 5.7 & ANSI/TIA-603-E-2016

7.6.3 Test Setup



7.6.4 Test Result

Note: Reference Original Report Grant Date: 02/15/2022, FCC ID: WIYSLM500QA.

7.7. Frequency Stability Under Temperature & Voltage Variations

7.7.1 Test Limit

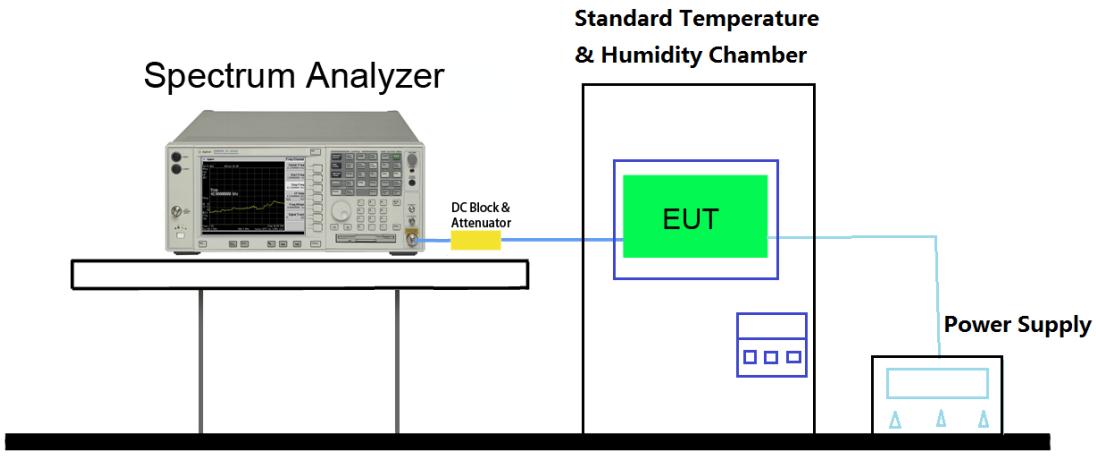
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Limit	< ± 2.5 ppm

7.7.2 Test Procedure

KDB 971168 D01v02r02 - Section 9.0 & ANSI/TIA-603-E-2016

7.7.3 Test Setup



7.7.4 Test Result

Note: Reference Original Report Grant Date: 02/15/2022, FCC ID: WIYSLM500QA.

Appendix A : Test Photograph

Refer to “2310TW8705-UT” file.

Appendix B : External Photograph

Refer to “2310TW8705-UE” file.

Appendix C : Internal Photograph

Refer to “2310TW8705-UI” file.

The End