

FCC TEST REPORT

Product : Mobile Phone
Trade mark : MI
Model/Type reference : MDG2
Report Number : 170615001RFM-2
Date of Issue : July 11, 2017
FCC ID : 2AFZZ-XMSG2
Test Standards : FCC 47 CFR Part 24 Subpart E
FCC 47 CFR Part 2 Subpart J
Test result : PASS

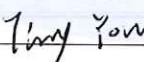
Prepared for:

Xiaomi Communications Co., Ltd.
The Rainbow City of China Resources, NO.68, Qinghe Middle Street,
Haidian District, Beijing, China

Prepared by:

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Version

Version No.	Date	Description
V1.0	July 11, 2017	Original



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1 General Information

1.1 Client Information

Applicant:	Xiaomi Communications Co., Ltd.
Address of Applicant:	The Rainbow City of China Resources, NO.68, Qinghe Middle Street, Haidian District, Beijing, China
Manufacturer:	Xiaomi Communications Co., Ltd.
Address of Manufacturer:	The Rainbow City of China Resources, NO.68, Qinghe Middle Street, Haidian District, Beijing, China

1.2 General Description of EUT

Product Name:	Mobile Phone	
Model No.(EUT):	MDG2	
Add. Mode No.:	N/A	
Trade Mark:	MI	
EUT Supports Radios application:	GSM850/1900 WCDMA Band II/Band V LTE FDD Band 4 /Band 5 /Band 7 LTE TDD Band 38 Wlan 2400MHz-2483.5MHz 802.11b/g/n(HT20&HT40) Wlan 5150MHz-5350MHz, 5470MHz-5725MHz, 5725MHz-5850MHz support 802.11a/n/ac Bluetooth V3.0+EDR&Bluetooth V4.0 BLE GPS, Glonass	
Power Supply:	AC Adapter1	Model: MDY-08-EZ Input: 100-240V~50/60Hz 0.35A MAX Output: 5.0 V \pm 2.0 A Manufacturer: Dongguan Aohai Power Technology Co., Ltd.
	AC Adapter2	Model: MDY-08-EZ Input: 100-240V~50/60Hz 0.35A MAX Output: 5.0 V \pm 2.0 A Manufacturer: Jangsu Chenyang Electron Co., Ltd.
	Battery	Model: BN31 Brand: MI Rated Voltage: 3.85Vdc Battery Capacity: 3000mAh(Li-on Rechargeable)
USB Micro-C Plug Cable:	100cm(Shielded without ferrite)	
USB Changing Cable:	100cm(Shielded without ferrite)	
Sample Received Date:	June 10, 2017	
Sample tested Date:	June 10, 2017 ~ Junly 11, 2017	

1.3 Product Specification subjective to this standard

Support Networks:	GSM, GPRS, EDGE, WCDMA, HSDPA, HSUPA,DC-HSDPA	
Type of Modulation:	GSM/GPRS:	GMSK
	EDGE:	GMSK, 8PSK
	WCDMA:	BPSK, QPSK, 16QAM(DL)
Frequency Range:	GSM/GPRS/EDGE 1900:	1850.2-1909.8 MHz
	WCDMA Band II:	1852.4-1907.6 MHz

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Max RF Output Power:	GSM/GPRS 1900:	30.04dBm
	EDGE 1900:	26.00dBm
	WCDMA Band II:	23.42dBm
Type of Emission:	GSM/GPRS 1900:	245KGXW
	EDGE 1900:	245KG7W
	WCDMA Band II:	4M15F9W
IMEI:	SIM1: 865181030006425	
	SIM2: 865181030006433	
Type of Antenna:	PIFA Antenna	
Antenna Gain:	-1.49 dBi	
GPRS/EDGE Class:	Class 33	
Sample Type:	Portable device	
Normal Test voltage:	3.85Vdc	
Extreme Test voltage:	3.4 to 4.4Vdc	
Software Version:	QL1515-tissot	
Hardware Version:	P3A	

1.4 Description of Support Units

The EUT has been tested with associated equipment below.

1) Cable

Cable No.	Description	Connector Type	Cable Type/Length	Supplied by
1	Antenna Cable	SMA	30cm	UnionTrust

1.5 Test Location

All tests were performed at:

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Telephone: +86 (0) 755 2823 0888 Fax: +86 (0) 755 2823 0886

1.6 Test Facility

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

CNAS-Lab Code: L9069

The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC/EN 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

IC-Registration No.: 21600-1

The 3m Semi-anechoic chamber of Shenzhen UnionTrust Quality and Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 21600-1.

A2LA-Lab Certificate No.: 4312.01

Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005

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General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

1.7 Deviation from Standards

None.

1.8 Abnormalities from Standard Conditions

None.

1.9 Other Information Requested by the Customer

None.

1.10 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty
1	Conducted emission 9KHz-150KHz	3.8 dB
2	Conducted emission 150KHz-30MHz	3.4 dB
3	Radiated emission 9KHz-30MHz	4.9 dB
4	Radiated emission 30MHz-1GHz	4.7 dB
5	Radiated emission 1GHz-18GHz	5.1 dB
6	Radiated emission 18GHz-26GHz	5.2 dB
7	Radiated emission 26GHz-40GHz	5.2 dB

2 Test Summary

Test Item	Test Requirement	Test method	Result
Equivalent Isotropic Radiated Power (EIRP)	FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 24.232(c)	ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02	PASS
Conducted Output Power	FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 24.232(c)	ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02	PASS
Peak-to-average ratio	FCC 47 CFR Part 24.232(d)	KDB 971168 D01v02r02	PASS
99%&26dB Occupied Bandwidth	FCC 47 CFR Part 2.1049(h) & FCC 47 CFR Part 24.238(b)	ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02	PASS
Band Edge at antenna terminals	FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 24.238(a)	ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02	PASS
Spurious emissions at antenna terminals	FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 2.1057 & FCC 47 CFR Part 24.238(a)(b)	ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02	PASS
Field strength of spurious radiation	FCC 47 CFR Part 2.1053 & FCC 47 CFR Part 2.1057 & FCC 47 CFR Part 24.238(a)(b)	ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02	PASS
Frequency stability	FCC 47 CFR Part 2.1055 & FCC 47 CFR Part 24.235	ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02	PASS

Remark:

Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

RF: In this whole report RF means Radiated Frequency.

CH: In this whole report CH means channel.

3 Equipment List

3M Semi/full-anechoic Chamber						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm-dd-yyyy)	Cal. Due date (mm-dd-yyyy)
<input checked="" type="checkbox"/>	3M Chamber & Accessory Equipment	ETS-LINDGREN	3M	N/A	Dec. 20, 2015	Dec. 19, 2018
<input type="checkbox"/>	Receiver	R&S	ESR7	1316.3003K07-101181-K3	Dec. 22, 2016	Dec. 22, 2017
<input checked="" type="checkbox"/>	Receiver	R&S	ESIB26	100114	Dec. 22, 2016	Dec. 22, 2017
<input type="checkbox"/>	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	Dec. 22, 2016	Dec. 22, 2017
<input checked="" type="checkbox"/>	Loop Antenna	ETS-LINDGREN	6502	00202525	Jun. 24, 2015	Jun. 23, 2018
<input checked="" type="checkbox"/>	Broadband Antenna	ETS-LINDGREN	3142E	00201566	Jul. 24, 2015	Jul. 23, 2018
<input checked="" type="checkbox"/>	Preamplifier	HP	8447F	2805A02960	Dec. 22, 2016	Dec. 22, 2017
<input checked="" type="checkbox"/>	Broadband Antenna (Pre-amplifier)	ETS-LINDGREN	3142E-PA	00201891	Dec. 30, 2016	Dec. 30, 2017
<input type="checkbox"/>	Horn Antenna	ETS-LINDGREN	3117	00164202	Jul. 24, 2015	Jul. 23, 2018
<input checked="" type="checkbox"/>	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201874	Dec. 30, 2016	Dec. 30, 2017
<input type="checkbox"/>	Horn Antenna	ETS-LINDGREN	3116C	00200180	Jul. 28, 2015	Jul. 27, 2018
<input type="checkbox"/>	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3116C-PA	00202652	Jul. 29, 2015	Jul. 28, 2018
<input checked="" type="checkbox"/>	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
<input type="checkbox"/>	Band rejection filter (5150MHz~5880MHz)	micro-tronics	BRM50716	G1868	Jun. 21, 2017	Jun. 20, 2018
<input type="checkbox"/>	Band rejection filter (2400MHz~2500MHz)	micro-tronics	BRM50702	G248	Jun. 15, 2017	Jun. 14, 2018
<input checked="" type="checkbox"/>	Highpass Filter (1.2GHz~18GHz)	Micro-Tronics	HPM50108	G552	Jan. 19, 2017	Jan. 19, 2018
<input type="checkbox"/>	Highpass Filter (3GHz~18GHz)	Micro-Tronics	HPM50117	G005	Jan. 30, 2017	Jan. 30, 2018

Conducted RF test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm dd, yyyy)	Cal. Due date (mm dd, yyyy)
<input checked="" type="checkbox"/>	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	Dec. 22, 2016	Dec. 22, 2017
<input type="checkbox"/>	Receiver	R&S	ESR7	1316.3003K07-101181-K3	Dec. 22, 2016	Dec. 22, 2017
<input checked="" type="checkbox"/>	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430035	Dec. 22, 2016	Dec. 22, 2017
<input checked="" type="checkbox"/>	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430023	Dec. 22, 2016	Dec. 22, 2017

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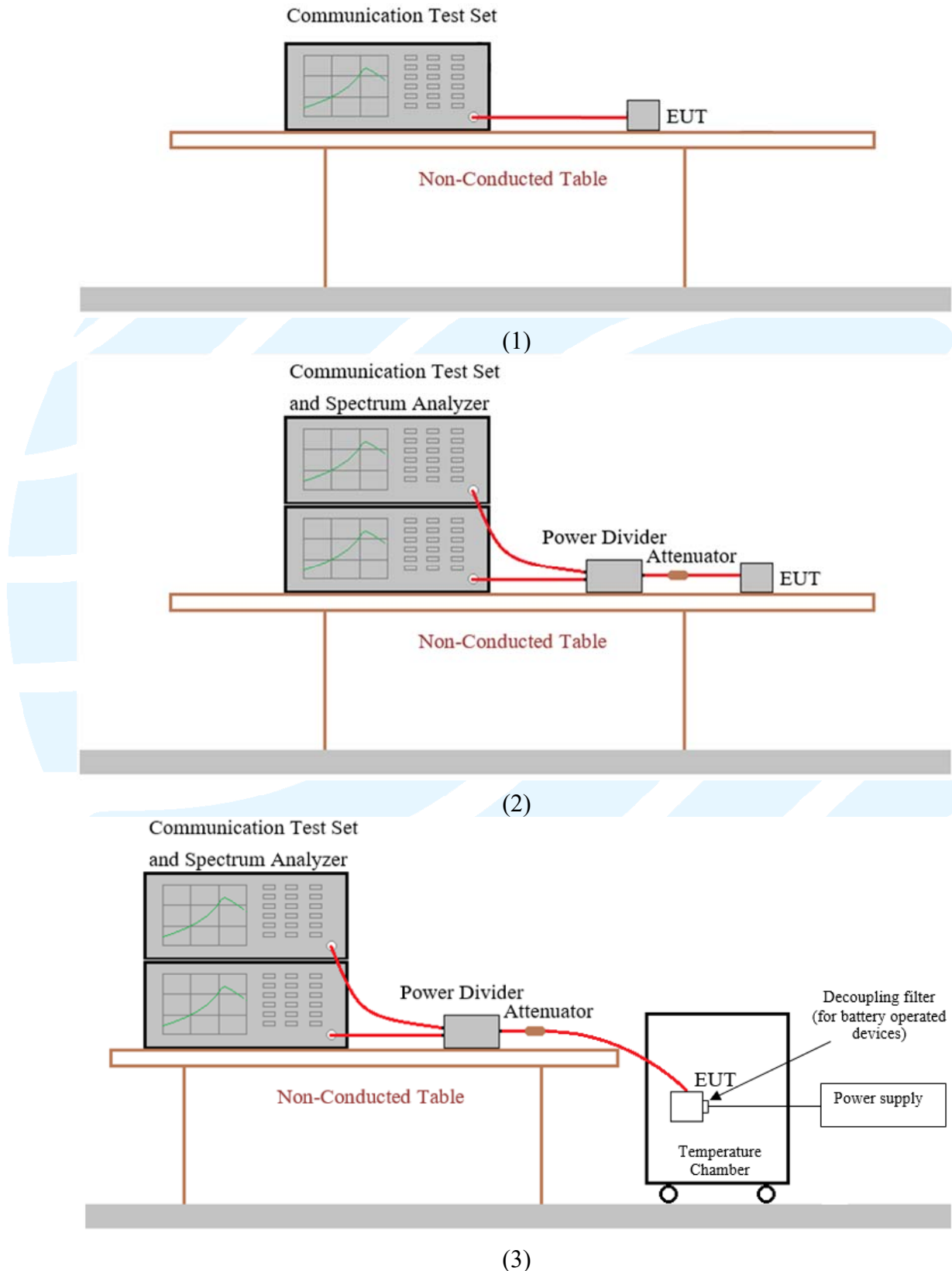
<input checked="" type="checkbox"/>	DC Source	KIKUSUI	PWR400L	LK003024	Sep. 21, 2016	Sep. 20, 2017
<input checked="" type="checkbox"/>	Temp & Humidity chamber	Ispec	GL(U)04KA(W)	1692H201P3	Jun. 19, 2017	Jun. 18, 2018
<input checked="" type="checkbox"/>	Communication test set	R&S	CMW500	130805	Mar. 22, 2017	Mar. 21, 2018



4 Test Requirement

4.1 Test setup

4.1.1 For Conducted test setup



4.1.2 For Radiated Emissions test setup

Radiated Emissions setup:

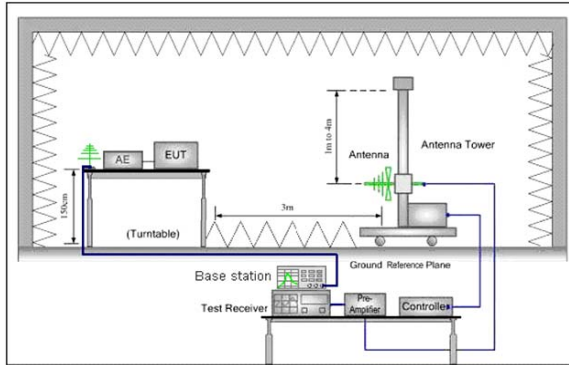


Figure 1. 30MHz to 1GHz

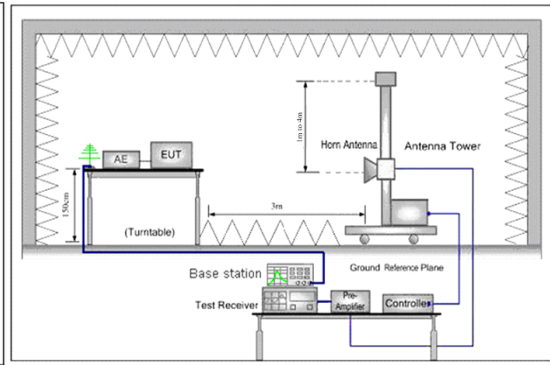


Figure 2. above 1GHz

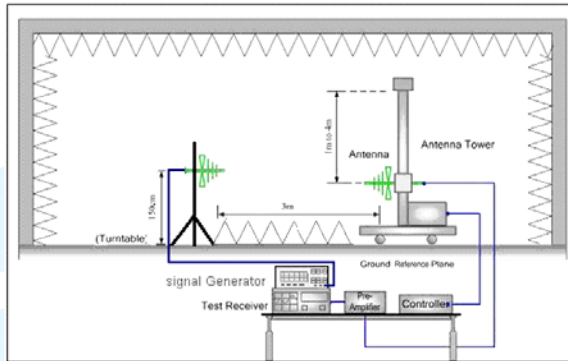


Figure 3. 30MHz to 1GHz

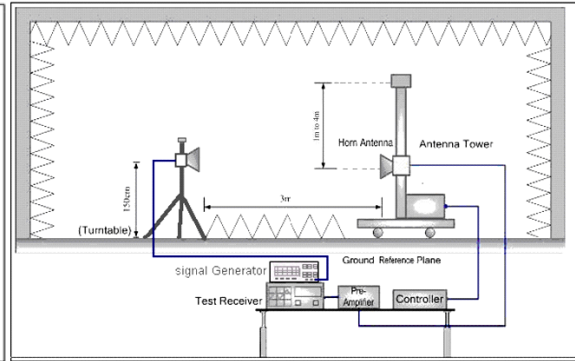


Figure 4. above 1GHz

4.2 Test Environment

Operating Environment:	
Temperature:	24.3 °C
Humidity:	56 % RH
Atmospheric Pressure:	101.3kpa

4.3 System Test Configuration

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. It was powered by a 3.85Vdc rechargeable Li-on battery. Only the worst case data were recorded in this test report.

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, X, Y, Z axis, and antenna ports.

The worst case was found when positioned as the table below.

Mode	Worst-case Orientation	
	EIRP	Radiated Emission
GSM	X axis	X axis
EDGE	X axis	X axis
WCDMA	X axis	X axis
LTE Band 2	X axis	X axis

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All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000MHz. The resolution is 1 MHz or greater for frequencies above 1000MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

4.4 Test Condition

4.4.1 Test channel

Test Mode	Tx/Rx	RF Channel		
		Low(L)	Middle(cm)	High(H)
GSM/GPRE/ EDGE1900	Tx (1850 MHz-1910 MHz)	Channel 512	Channel 661	Channel 810
		1850.2MHz	1880.0 MHz	1909.8 MHz
	Rx (1930 MHz-1990 MHz)	Channel 512	Channel 661	Channel 810
		1930.2 MHz	1960.0 MHz	1989.8 MHz
WCDMA Band II	Tx (1850 MHz-1910 MHz)	Channel 9262	Channel 9400	Channel 9538
		1852.4 MHz	1880.0 MHz	1907.6 MHz
	Rx (1930 MHz-1990 MHz)	Channel 9662	Channel 9800	Channel 9938
		1932.4 MHz	1960.0 MHz	1987.6 MHz

4.4.2 Test mode

Pre-scan under all rate at lowest middle and highest channel, find the transmitter power as below:

SIM 1 Card Conducted transmitter power measurement result (Units: dBm).

band	GSM1900		
Channel	512	661	810
Frequency(MHz)	1850.2MHz	1880MHz	1909.8MHz
GSM	29.94	30.04	29.79
GSM (GMSK, 1Tx-slot)	29.84	30.01	29.99
GPRS (GMSK, 1Tx-slot)	28.23	28.44	28.38
GPRS (GMSK, 2Tx-slot)	25.76	26.00	25.93
GPRS (GMSK, 3Tx-slot)	24.94	25.16	25.10
GPRS (GMSK, 4Tx-slot)	25.94	25.94	26.00
EDGE (8PSK, 1Tx-slot)	23.16	23.16	23.25
EDGE (8PSK, 2Tx-slot)	20.62	20.62	20.63
EDGE (8PSK, 3Tx-slot)	19.31	19.31	19.30
EDGE (8PSK, 4Tx-slot)	29.94	30.04	29.79

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band	WCDMA Band II		
Channel	9262	9400	9538
Frequency(MHz)	1852.4MHz	1880MHz	1907.6MHz
RMC 12.2K	23.30	23.42	23.27
HSDPA Subtest-1	22.13	22.36	22.24
HSDPA Subtest-2	22.22	22.35	22.23
HSDPA Subtest-3	21.70	21.75	21.74
HSDPA Subtest-4	21.68	21.74	21.73
DC-HSDPA Subtest-1	22.10	22.35	22.21
DC-HSDPA Subtest-2	22.21	22.33	22.20
DC-HSDPA Subtest-3	21.68	21.74	21.75
DC-HSDPA Subtest-4	21.65	21.71	21.74
HSUPA Subtest-1	22.08	22.31	22.18
HSUPA Subtest-2	20.01	20.28	20.14
HSUPA Subtest-3	21.02	21.24	21.16
HSUPA Subtest-4	20.06	20.19	20.15
HSUPA Subtest-5	22.09	22.24	22.09

Pre-scan all mode and data rates and positions, find worse case mode are chosen to the report, the worse mode as below:

Band	Radiated	Conducted
GSM/GPRS/EDGE 1900	1) GSM (GMSK, 1Tx-slot) Link 2) GPRS (GMSK, 1Tx-slot) Link 3) EDGE (8PSK, 1Tx-slot) Link	1) GSM (GMSK, 1Tx-slot) Link 2) GPRS (GMSK, 1Tx-slot) Link 3) EDGE (8PSK, 1Tx-slot) Link
WCDMA Band II	RMC 12.2Kbps Link	RMC 12.2Kbps Link

5 Radio Technical Requirements Specification

Reference documents for testing:

No.	Identity	Document Title
1	FCC 47 CFR Part 24 Subpart E	PART 24 – PERSONAL COMMUNICATIONS SERVICES Subpart E – Broadband PCS
2	FCC 47 CFR Part 2 Subpart J	Frequency allocations and radio treaty matters; general rules and regulations
3	ANSI/TIA/EIA-603-D 2010	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
4	KDB 971168 D01	KDB 971168 D01 Power Meas License Digital Systems v02r02

5.1 Equivalent Isotropic Radiated Power

Test Requirement:

FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 24.232(c)

Test Method:

KDB 971168 D01v02r02 & ANSI/TIA/EIA-603-D 2010

Limit:

Mobile and portable stations are limited to 2 watts EIRP.

Test Procedure:

Test procedure as below:

- 1) The EUT was powered ON and placed on a 1.5m high table at a 3 meter fully Anechoic Chamber. The antenna of the transmitter was extended to its maximum length. Modulation mode and the measuring receiver shall be tuned to the frequency of the transmitter under test.
- 2) The EUT was set 3 meters (above 18GHz the distance is 1 meter) away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 3) The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.
- 4) Steps 1) to 3) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.
- 5) The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter.
- 6) A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 3) is obtained for this set of conditions.
- 7) The output power into the substitution antenna was then measured.
- 8) Steps 6) and 7) were repeated with both antennas polarized.
- 9) Calculate power in dBm by the following formula:

$$\text{ERP(dBm)} = \text{Pg(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBd)}$$

$$\text{EIRP(dBm)} = \text{Pg(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBi)}$$

$$\text{EIRP} = \text{ERP} + 2.15\text{dB}$$

where:
Pg is the generator output power into the substitution antenna.
- 10) Test the EUT in the lowest channel, the middle channel the Highest channel
- 11) The radiation measurements are performed in X, Y, Z axis positioning for EUT operation mode, and found the X axis positioning which it is worse case.
- 12) Repeat above procedures until all frequencies measured was complete.

Receiver Setup:

Frequency	Detector	RBW	VBW	Remark
30MHz-1GHz	Peak	100kHz	300kHz	Peak
Above 1GHz	Peak	1MHz	3MHz	Peak

Test Setup:

Refer to section 4.1.2 for details.

Instruments Used:

Refer to section 3 for details

Test Mode:

Link mode

Test Results:

Pass

Test Data:

Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Result	Antenna Polaxis.
GSM 1Tx-slot					
512	1850.2	25.78	33.01	Pass	H
		19.37	33.01	Pass	V
661	1880	26.32	33.01	Pass	H
		19.07	33.01	Pass	V
810	1909.8	27.27	33.01	Pass	H
		18.65	33.01	Pass	V
EDGE 1Tx-slot					
512	1850.2	24.43	33.01	Pass	H
		17.54	33.01	Pass	V
661	1880	23.55	33.01	Pass	H
		16.78	33.01	Pass	V
810	1909.8	24.26	33.01	Pass	H
		16.64	33.01	Pass	V
WCDMA RMC 12.2Kbps					
9262	1852.4	19.88	33.01	Pass	H
		15.56	33.01	Pass	V
9400	1880	20.23	33.01	Pass	H
		16.32	33.01	Pass	V
9538	1907.6	19.45	33.01	Pass	H
		15.54	33.01	Pass	V

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5.2 Conducted Output Power

Test Requirement:	FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 24.232(c)
Test Method:	ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02
Limit:	Mobile and portable stations are limited to 2 watts EIRP.
Test Procedure:	The EUT was set up for the maximum power with GSM, GPRS, EDGE, WCDMA, CDMA, and LTE link data modulation and link up with simulator. Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator. Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.
Test Setup:	Refer to section 4.1.1(1) for details.
Instruments Used:	Refer to section 3 for details
Test Mode:	Link mode
Test Results:	Pass
Test Data:	The full result can be also refer to section 4.4.2 for details.

Note: The following is the worst conducted output power (Units: dBm), the full result can be also refer to section 4.4.2 for details.

For PCS Band			
Channel	512	661	810
Frequency(MHz)	1850.2MHz	1880MHz	1909.8MHz
GSM 1Tx-slot	29.94	30.04	29.79
GPRS 1Tx-slot	28.23	28.44	28.38
EDGE 1Tx-slot	23.16	23.16	23.25

WCDMA RMC 12.2Kbps			
Channel	9262	9400	9538
Frequency(MHz)	1852.4MHz	1880MHz	1907.6MHz
RMC 12.2K	23.30	23.42	23.27

5.3 Peak-to-average ratio

Test Requirement: FCC 47 CFR Part 24.232(d)

Test Method: KDB 971168 D01v02r02

Limit: 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

Test Procedure: The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer.

- Set resolution/measurement bandwidth \geq signal's occupied bandwidth
- Set the number of counts to a value that stabilizes the measured CCDF curve
- Record the maximum PAPR level associated with a probability of 0.1 %

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.1.1(1) for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: Pass

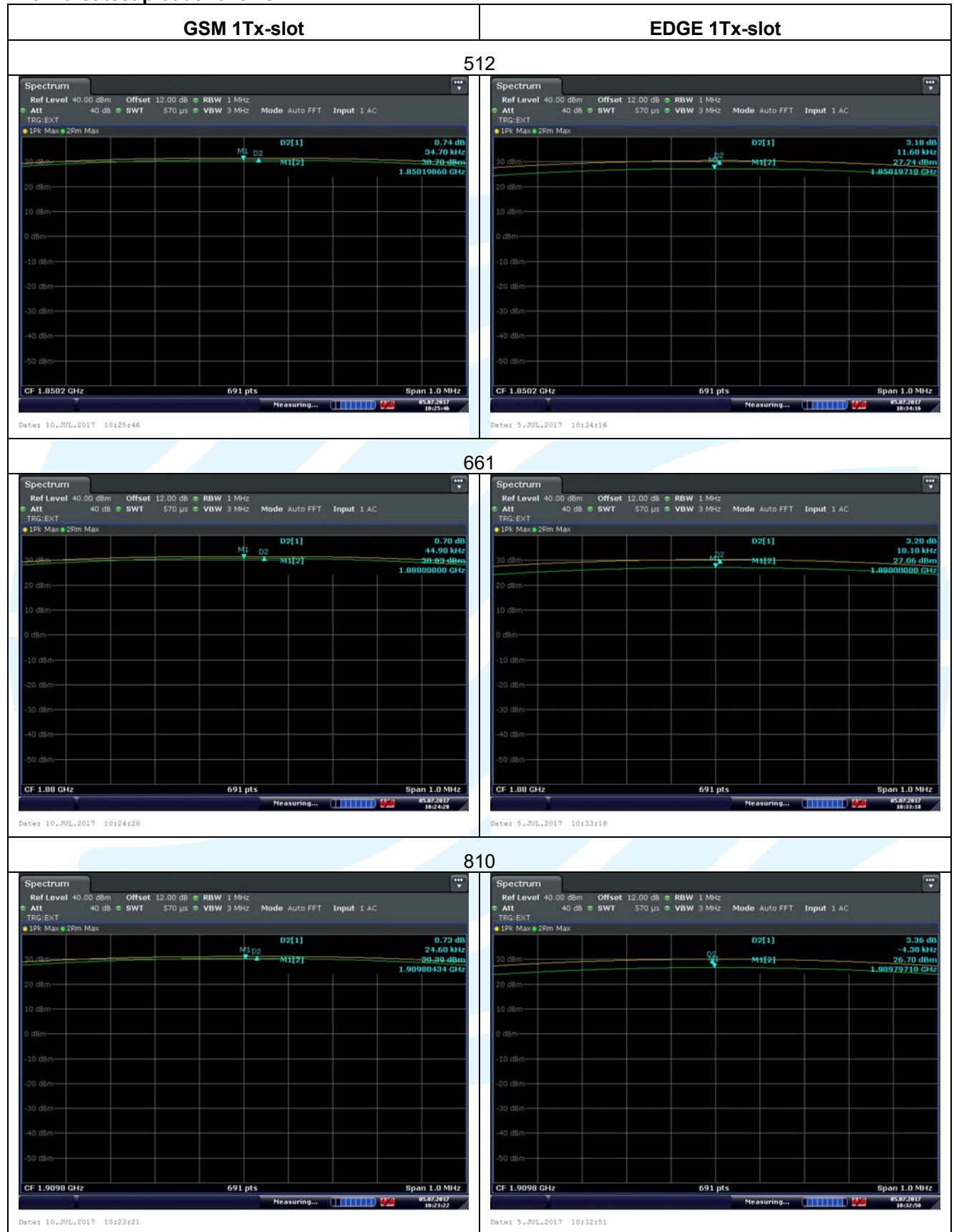
Test Data: The full result can be also refer to section 4.4.2 for details.

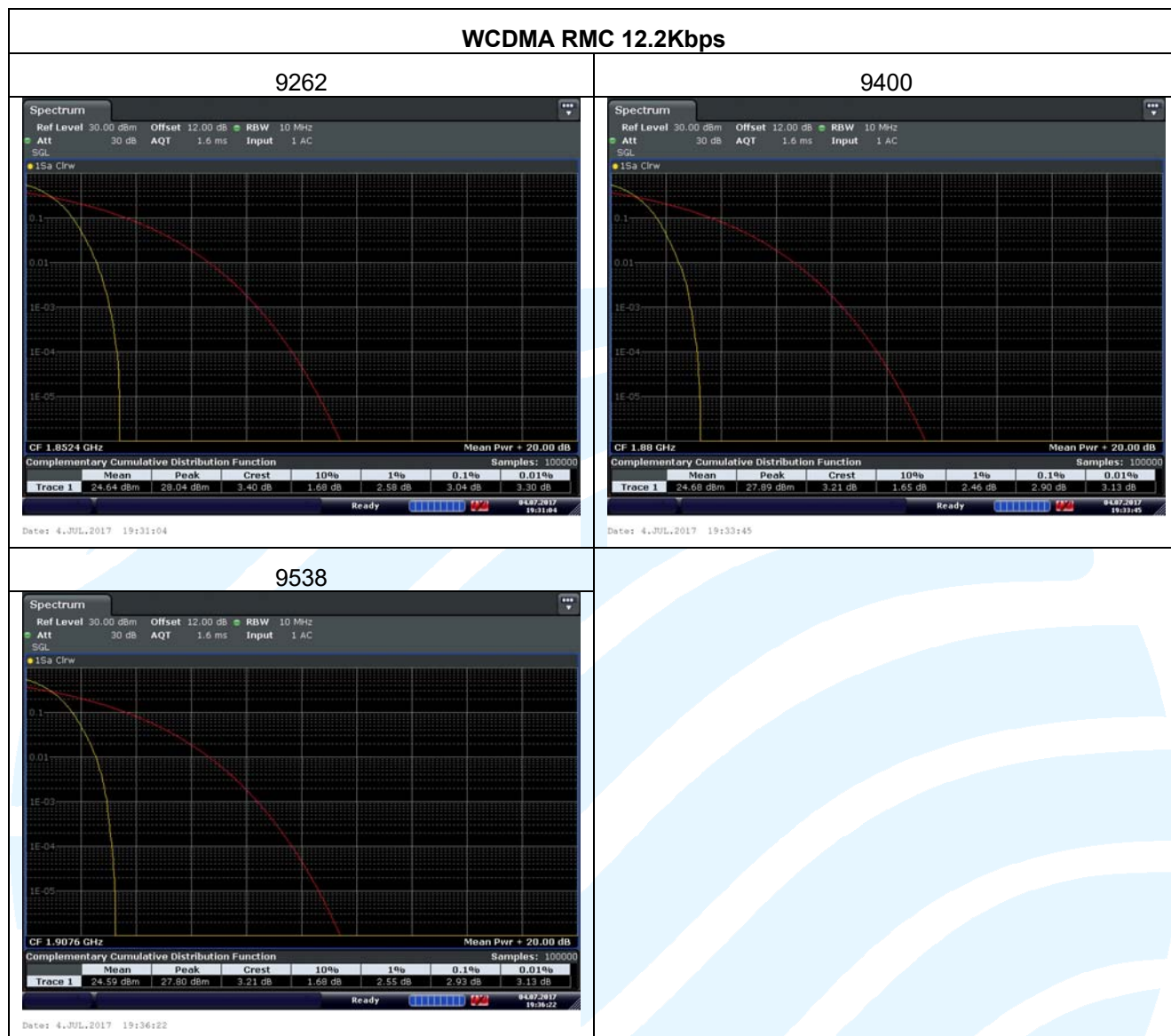
Peak-to-average ratio (dB)

For PCS Band			
Channel	512	661	810
Frequency(MHz)	1850.2MHz	1880MHz	1909.8MHz
GSM 1Tx-slot	0.74	0.70	0.73
EDGE 1Tx-slot	3.18	3.20	3.36

WCDMA			
Channel	9262	9400	9538
Frequency(MHz)	1852.4MHz	1880MHz	1907.6MHz
RMC 12.2Kbps	3.04	2.90	2.93

The worst test plot as follows:





5.4 99%&26dB Occupied Bandwidth

Test Requirement: FCC 47 CFR Part 2.1049(h) & FCC 47 CFR Part 24.238(b)
Test Method: ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02
Test Procedure: The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the low, middle and high channel in each band. The 99% and -26dB bandwidths was also measured and recorded.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.1.1(2) for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

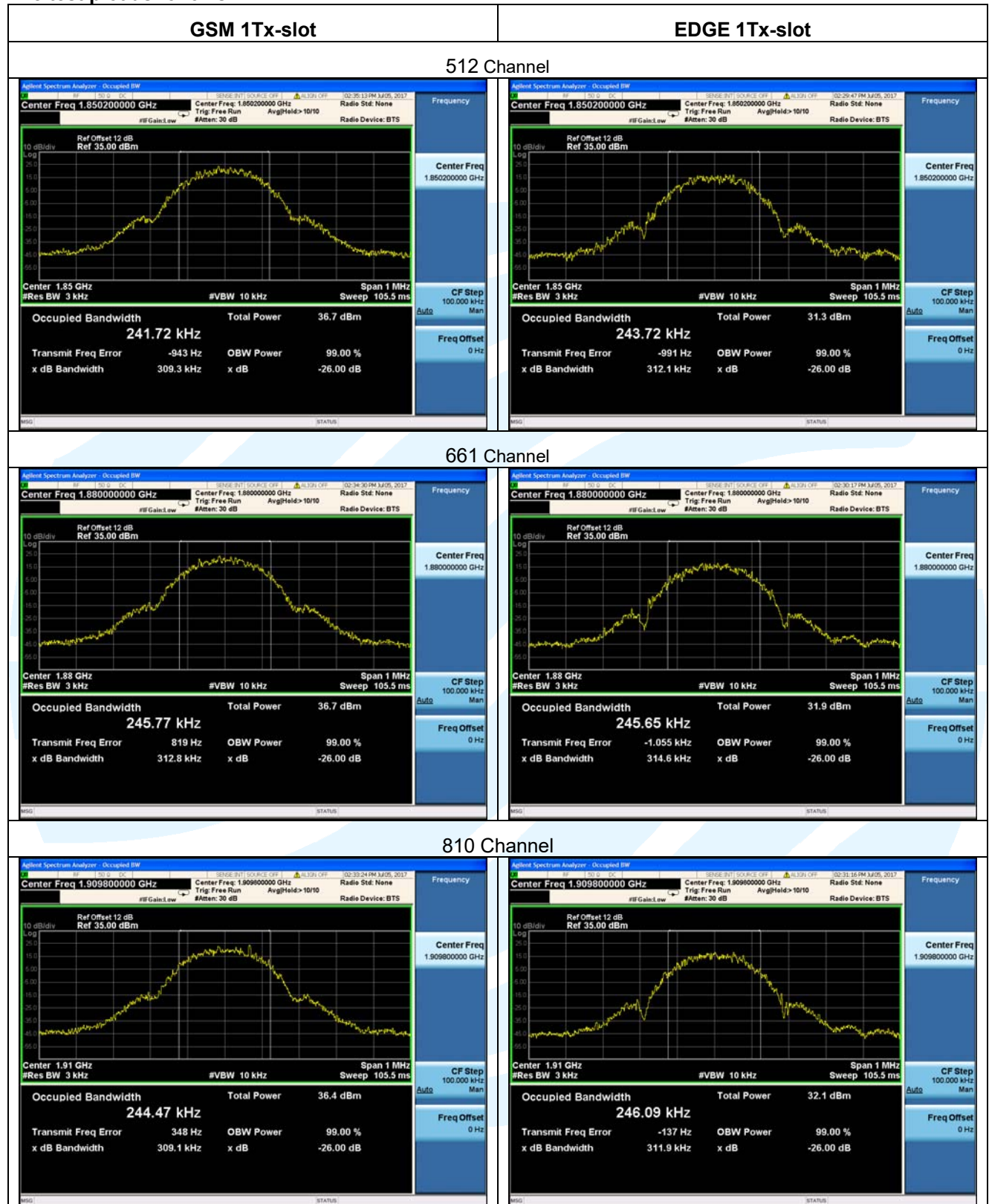
Test Results: Pass

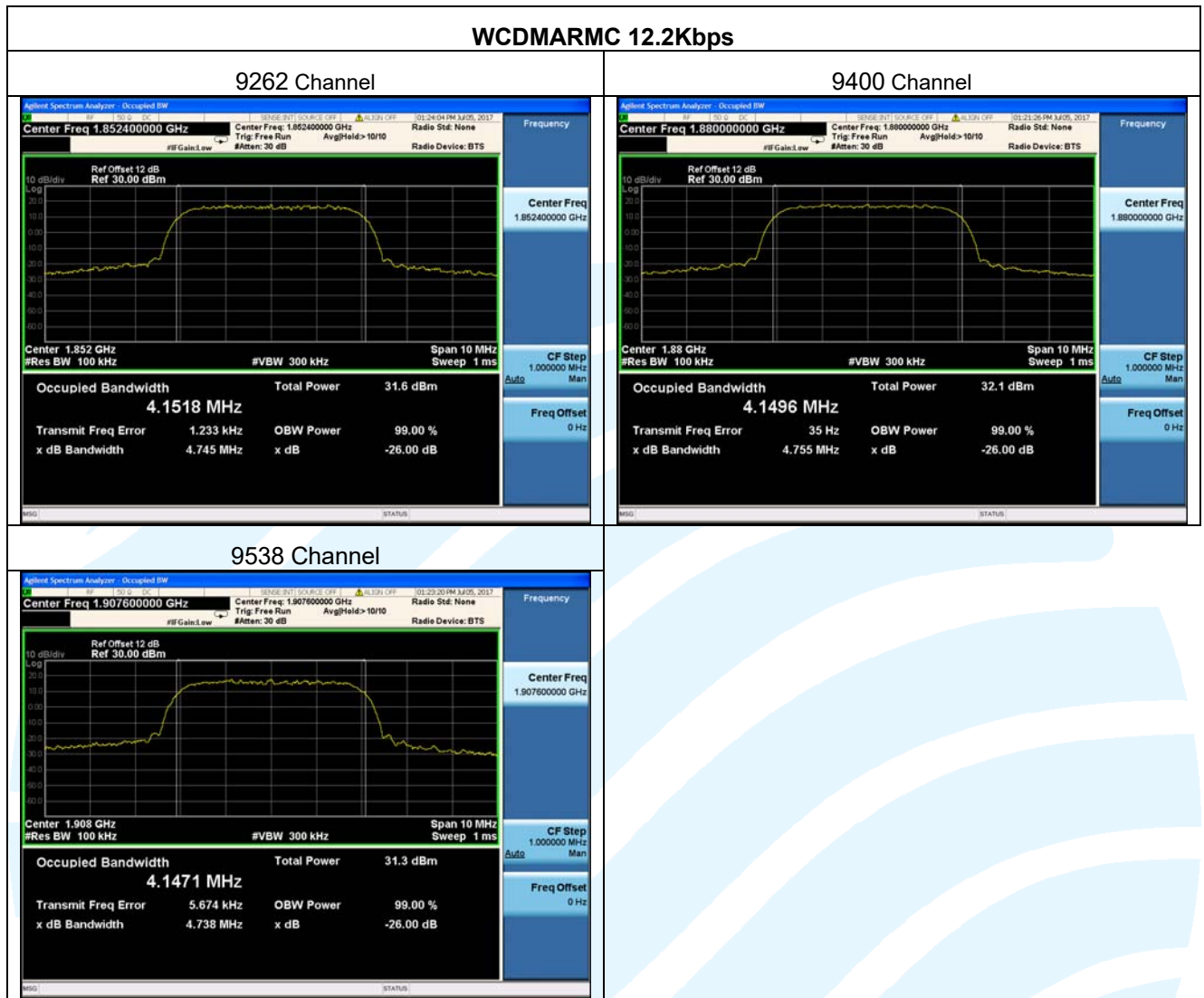
Test Data:

For PCS Band				
Test Mode	Channel	Frequency (MHz)	26 dB BW (kHz)	99% BW (kHz)
For PCS Band				
GSM 1Tx-slot	512	1850.2	309.3	241.72
	661	1880.0	312.8	245.77
	810	1909.8	309.1	244.47
EDGE 1Tx-slot	512	1850.2	312.1	243.72
	661	1880.0	314.6	245.65
	810	1909.8	311.9	246.09

For WCDMA				
Test Mode	Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
RMC 12.2Kbps	9262	1852.4	4.745	4.152
	9400	1880.0	4.755	4.149
	9538	1907.6	4.738	4.147

The test plot as follows:

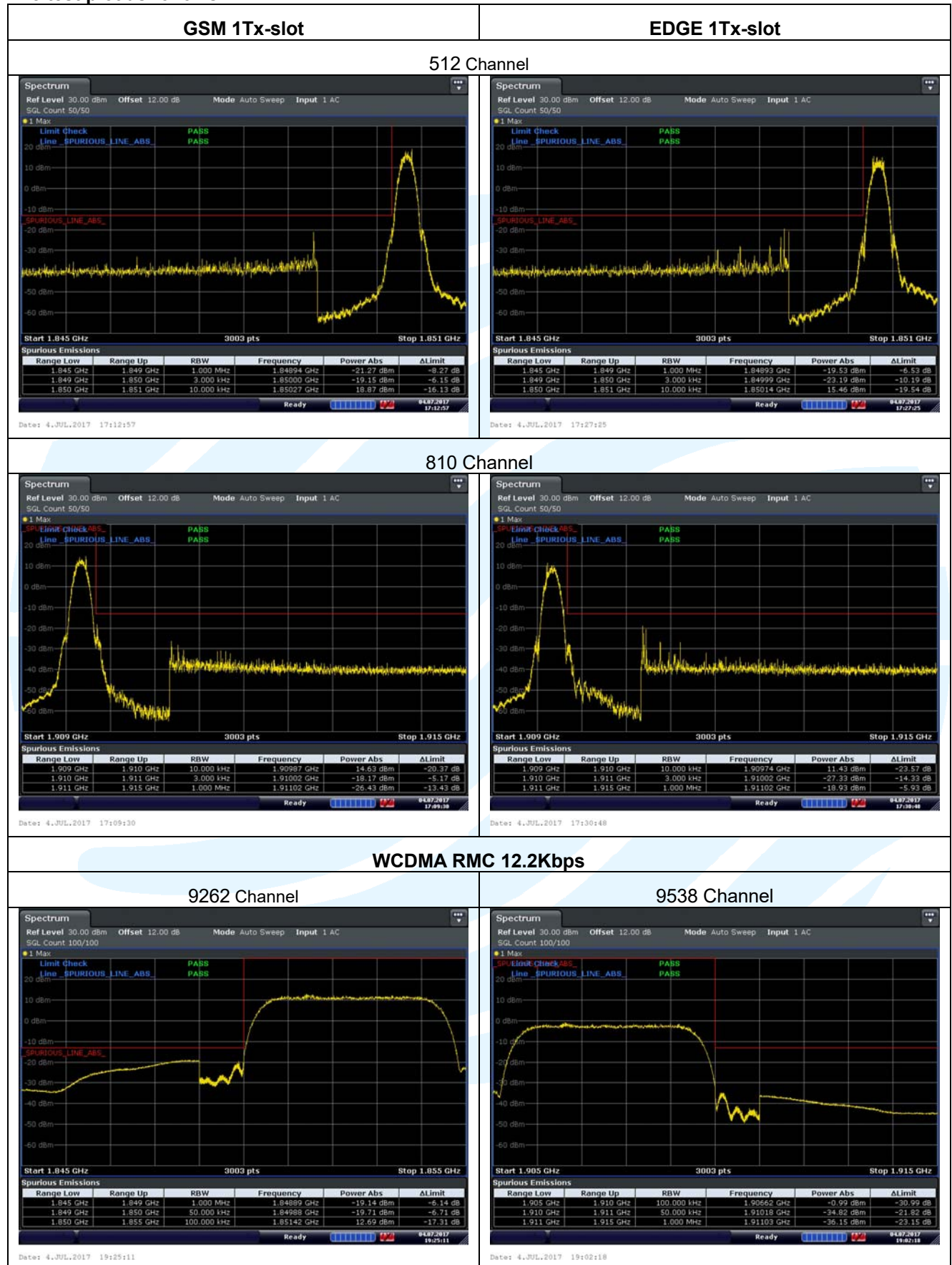




5.5 Band Edge at antenna terminals

Test Requirement:	FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 24.238(a)
Test Method:	ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02
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 $43 + 10 \log(P)$ dB. The emission limit equal to -13 dBm.
Test Procedure:	<p>The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer.</p> <p>For each band edge measurement:</p> <ol style="list-style-type: none">1) Set the spectrum analyzer span to include the block edge frequency.2) Set a marker to point the corresponding band edge frequency in each test case.3) Set display line at -13 dBm4) Set resolution bandwidth to at least 1% of emission bandwidth. <p>Such as:</p> <ol style="list-style-type: none">a) The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 3 kHz and VB of the spectrum is 10 kHz (GSM/GPRS/EDGE).b) The center frequency of spectrum is the band edge frequency and span is 5 MHz. RB of the spectrum is 100 kHz and VB of the spectrum is 300 kHz (WCDMA).c) The center frequency of spectrum is the band edge frequency and span is 2 MHz. RB of the spectrum is 20 kHz and VB of the spectrum is 20 kHz (LTE Bandwidth 1.4 MHz).d) The center frequency of spectrum is the band edge frequency and span is 2 MHz. RB of the spectrum is 30 kHz and VB of the spectrum is 30 kHz (LTE Bandwidth 3 MHz).e) The center frequency of spectrum is the band edge frequency and span is 2 MHz. RB of the spectrum is 51 kHz and VB of the spectrum is 51 kHz (LTE Bandwidth 5 MHz)f) The center frequency of spectrum is the band edge frequency and span is 2 MHz. RB of the spectrum is 100 kHz and VB of the spectrum is 100 kHz (LTE Bandwidth 10 MHz) <ol style="list-style-type: none">5) Record the max trace plot into the test report <p>Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.</p>
Test Setup:	Refer to section 4.1.1(2) for details.
Instruments Used:	Refer to section 3 for details
Test Mode:	Link mode
Test Results:	Pass

The test plot as follows:



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5.6 Spurious emissions at antenna terminals

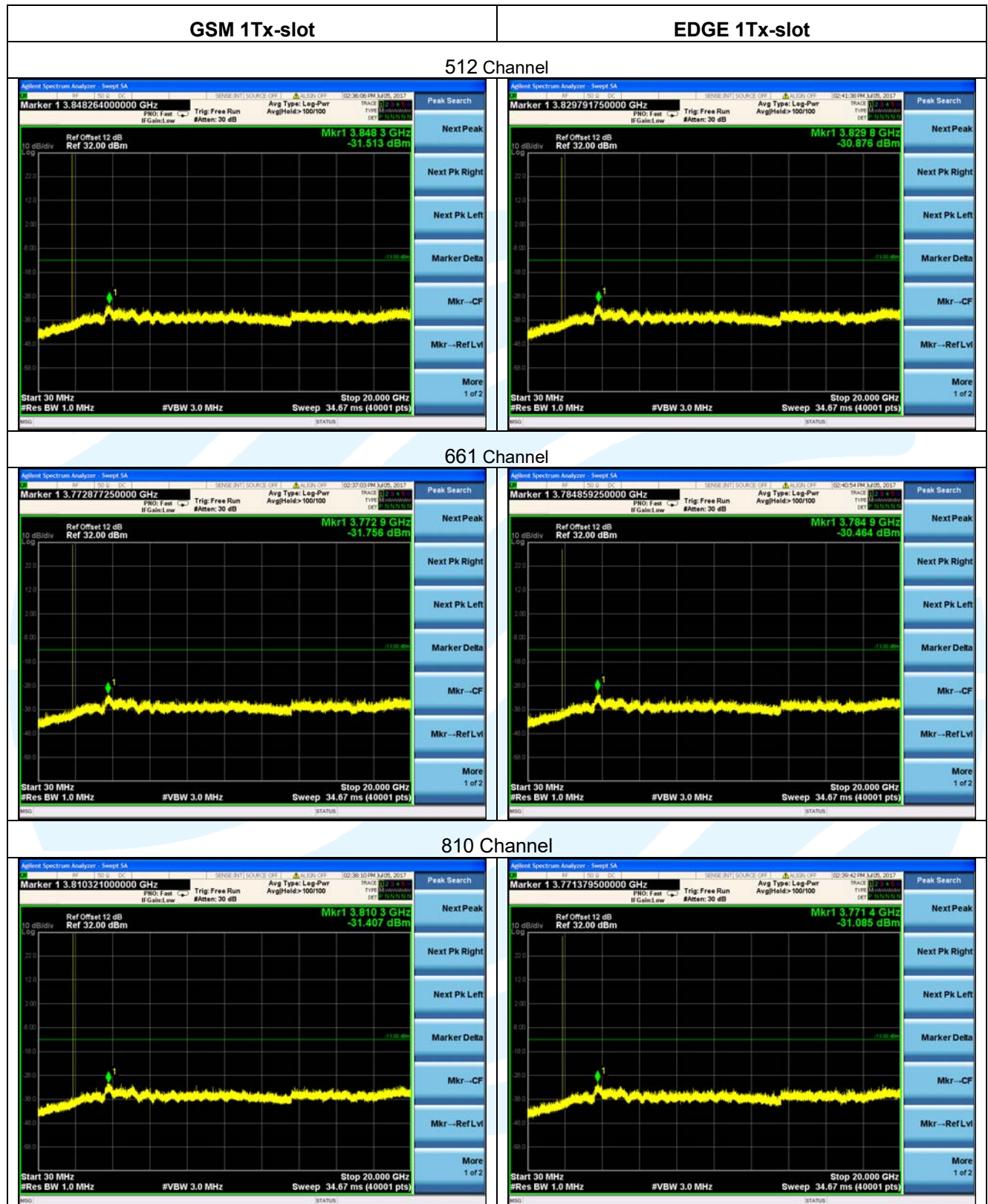
Test Requirement:	FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 2.1057 & FCC 47 CFR Part 24.238(a)(b)
Test Method:	ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02
Limit:	The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB. The emission limit equal to -13 dBm.
Test Procedure:	The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range. b. Measuring frequency range is from 9 kHz to 20 GHz. Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz.
	Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.
Test Setup:	Refer to section 4.1.1(2) for details.
Instruments Used:	Refer to section 3 for details
Test Mode:	Link mode
Test Results:	Pass

The test plot as follows:

Spurious Emission Test Data (9 KHz ~ 30 MHz):

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

Spurious Emission Test Data (30 MHz ~ 20 GHz):



WCDMA RMC 12.2Kbps

9262 Channel



9400 Channel



9538 Channel



5.7 Field strength of spurious radiation

Test Requirement: FCC 47 CFR Part 2.1053 & Part 22.917(a)(b)

Test Method: ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02

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 $43 + 10 \log(P)$ dB. The emission limit equal to -13 dBm.

Test Procedure:

1. Scan up to 10th harmonic, find the maximum radiation frequency to measure.
2. The technique used to find the Spurious Emissions of the transmitter was the antenna substitution method. Substitution method was performed to determine the actual ERP/EIRP emission levels of the EUT.

Test procedure as below:

- 1) The EUT was powered ON and placed on a 1.5m high table at a 3 meter fully Anechoic Chamber. The antenna of the transmitter was extended to its maximum length. Modulation mode and the measuring receiver shall be tuned to the frequency of the transmitter under test.
- 2) The EUT was set 3 meters (above 18GHz the distance is 1 meter) away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 3) The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.
- 4) Steps 1) to 3) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.
- 5) The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter.
- 6) A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 3) is obtained for this set of conditions.
- 7) The output power into the substitution antenna was then measured.
- 8) Steps 6) and 7) were repeated with both antennas polarized.
- 9) Calculate power in dBm by the following formula:
$$\text{ERP(dBm)} = \text{Pg(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBi)}$$
$$\text{EIRP(dBm)} = \text{Pg(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBi)}$$
$$\text{EIRP} = \text{ERP} + 2.15\text{dB}$$

where:
Pg is the generator output power into the substitution antenna.
- 10) Test the EUT in the lowest channel, the middle channel the Highest channel
- 11) The radiation measurements are performed in X, Y, Z axis positioning for EUT operation mode, and found the X axis positioning which it is worse case.
- 12) Repeat above procedures until all frequencies measured was complete.

Receiver Setup:

Frequency	Detector	RBW	VBW	Remark
0.009MHz-30MHz	Peak	10kHz	30kHz	Peak
30MHz-1GHz	Peak	100kHz	300kHz	Peak
Above 1GHz	Peak	1MHz	3MHz	Peak

Test Setup: Refer to section 4.1.2 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

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Test Results: Pass

Test Data:

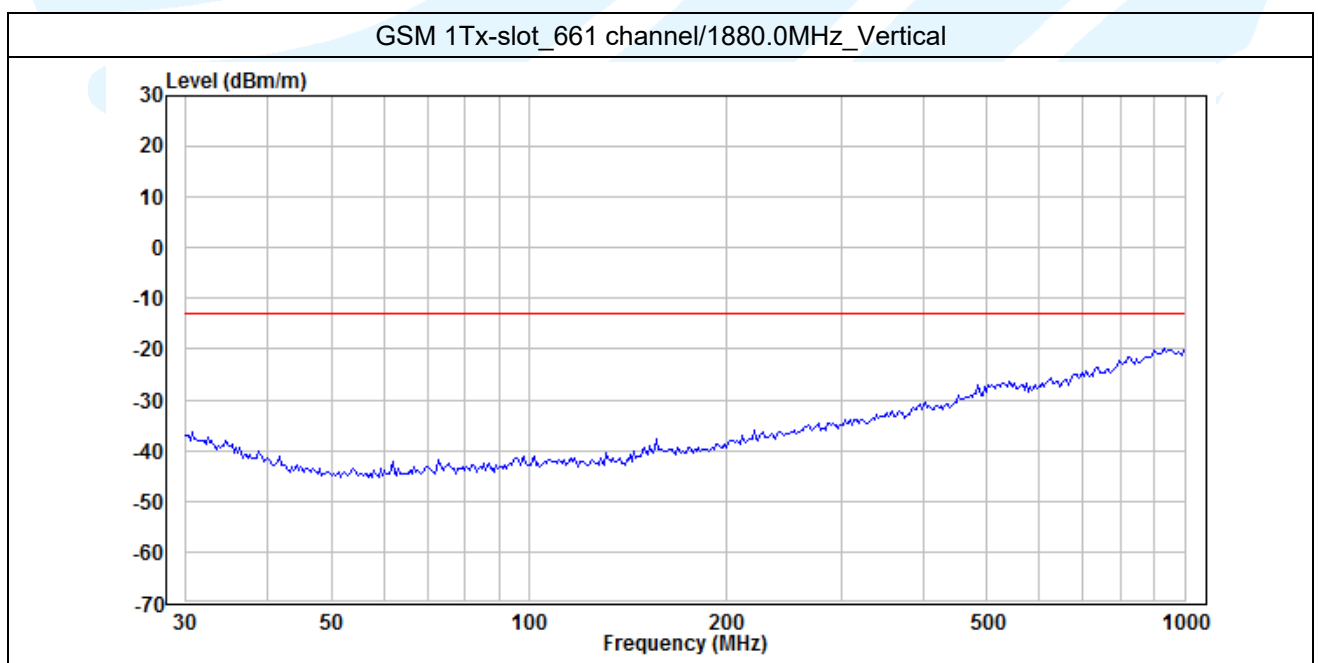
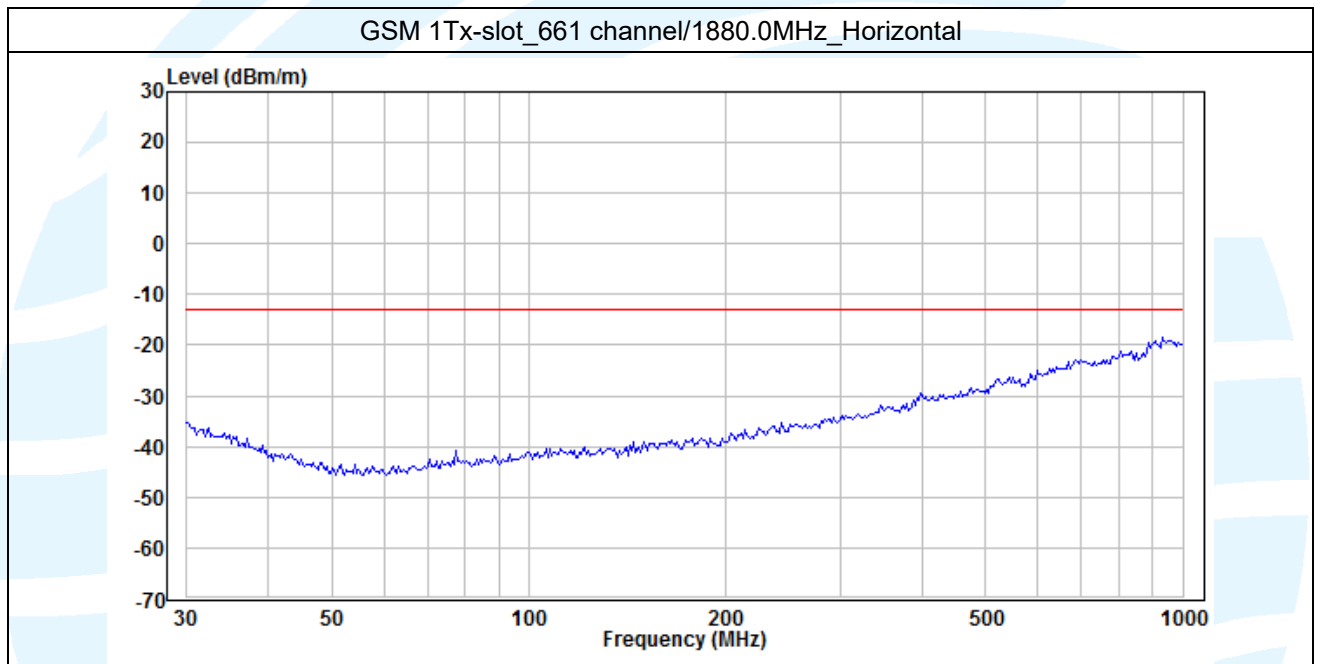
Spurious Emission Test Data (9 KHz ~ 30 MHz)

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

Spurious Emission Test Data (Above 18 GHz)

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

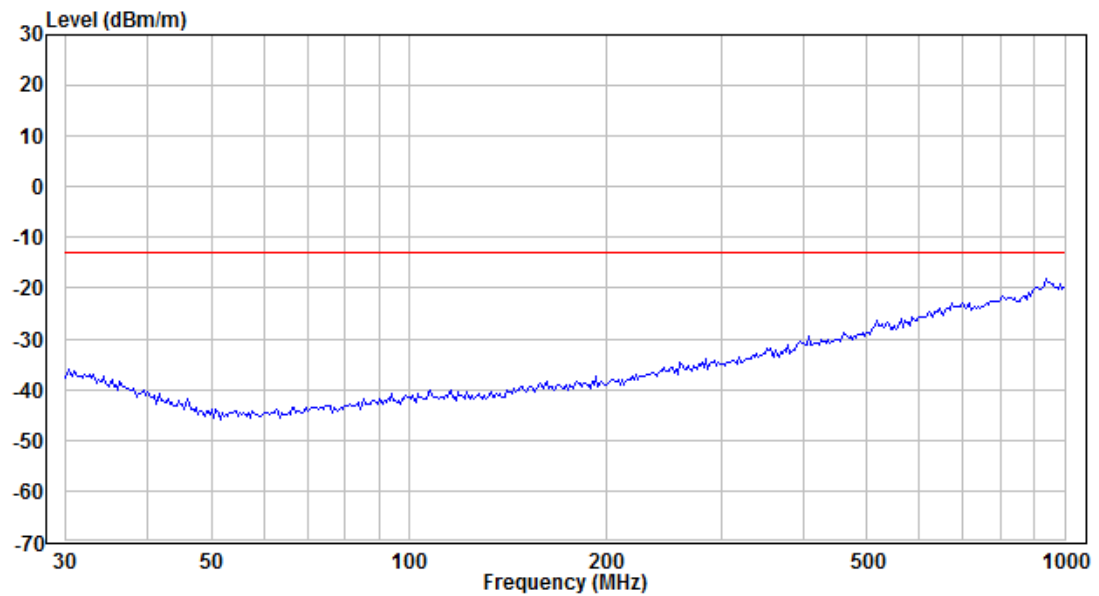
Spurious Emission Test Worst Data (30 MHz ~ 1 GHz)



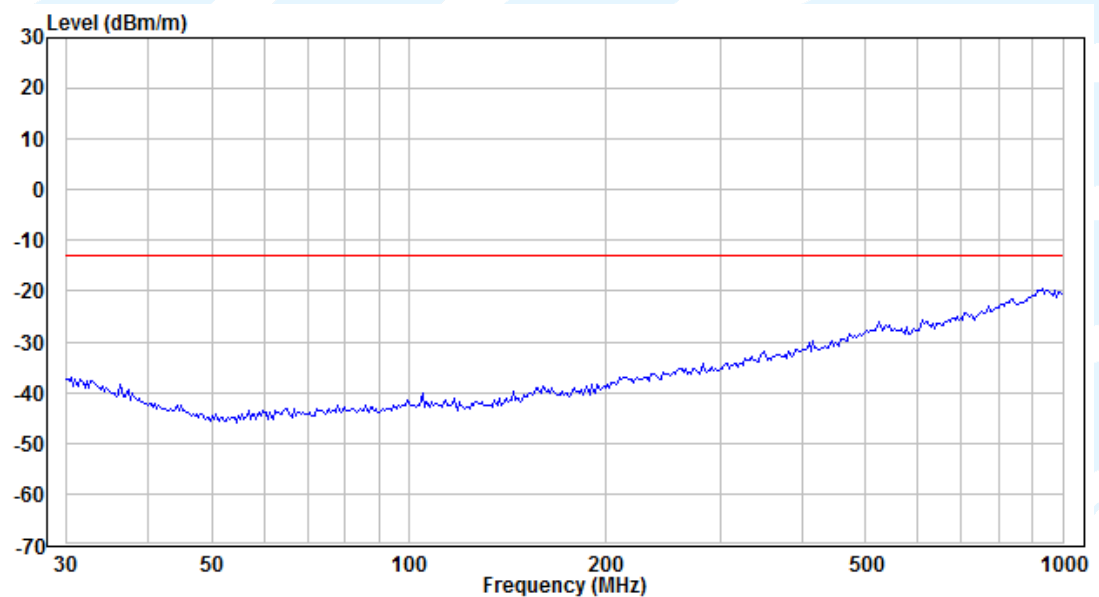
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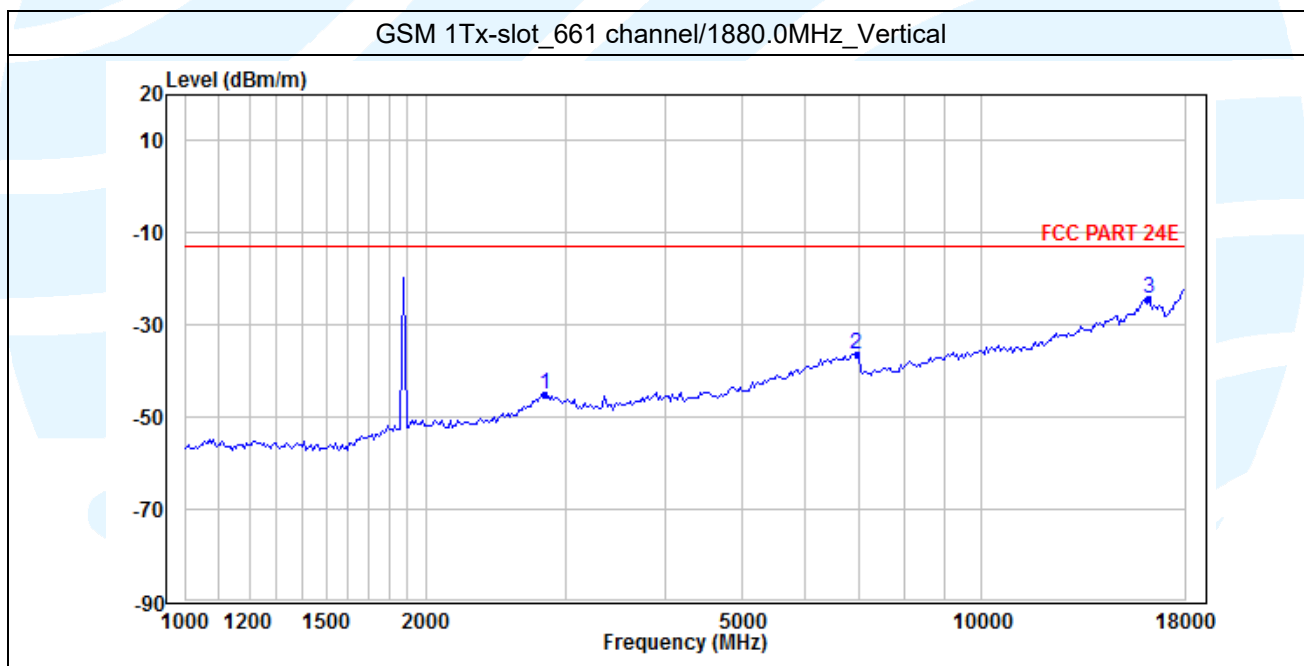
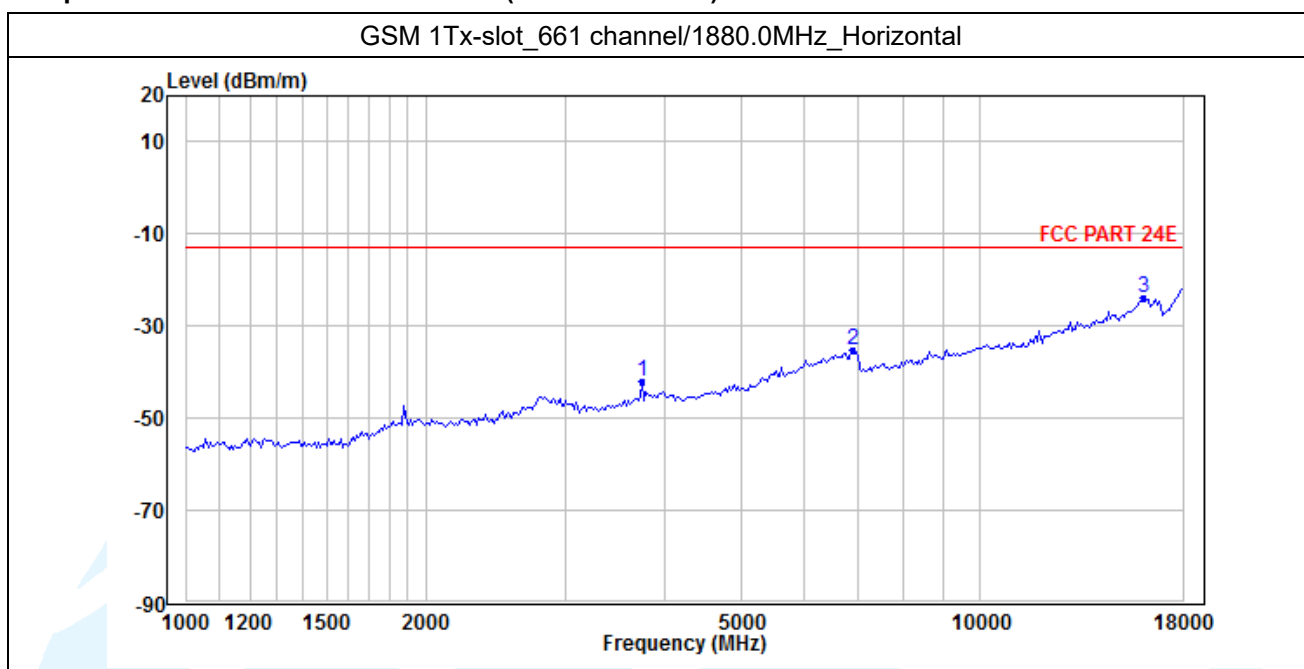
WCDMA RMC 12.2Kbps_ 9400 channel/1880.0MHz_Horizontal

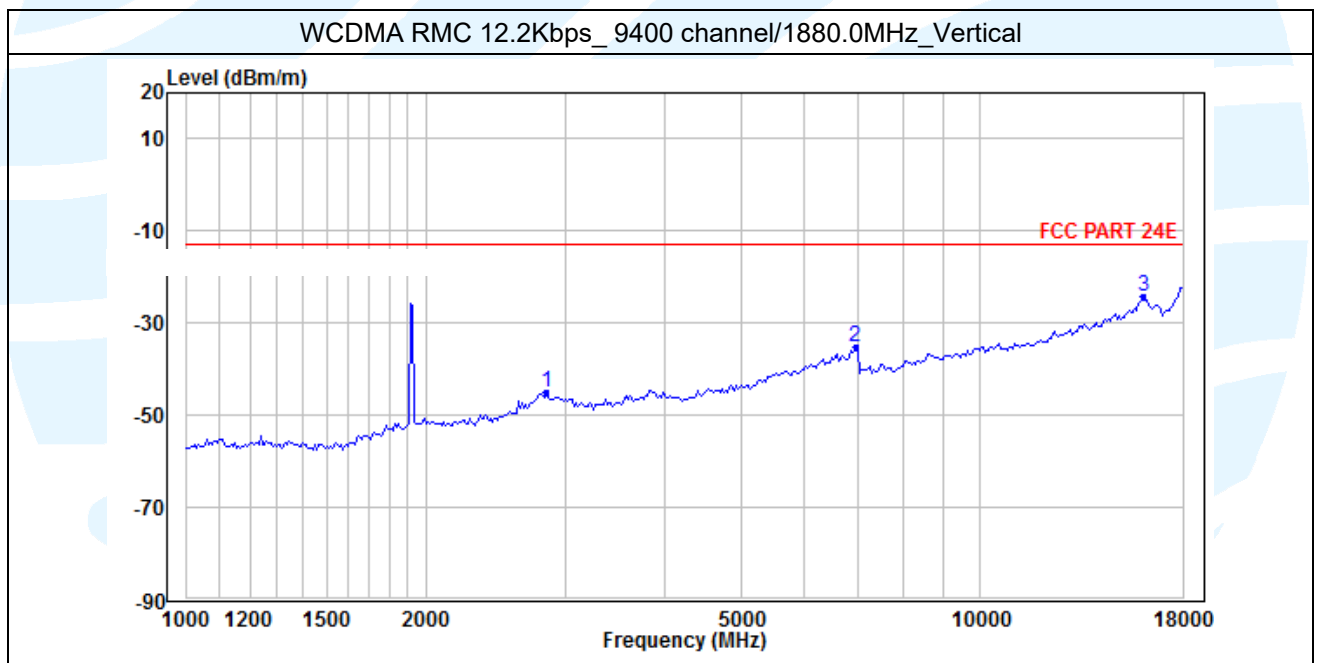
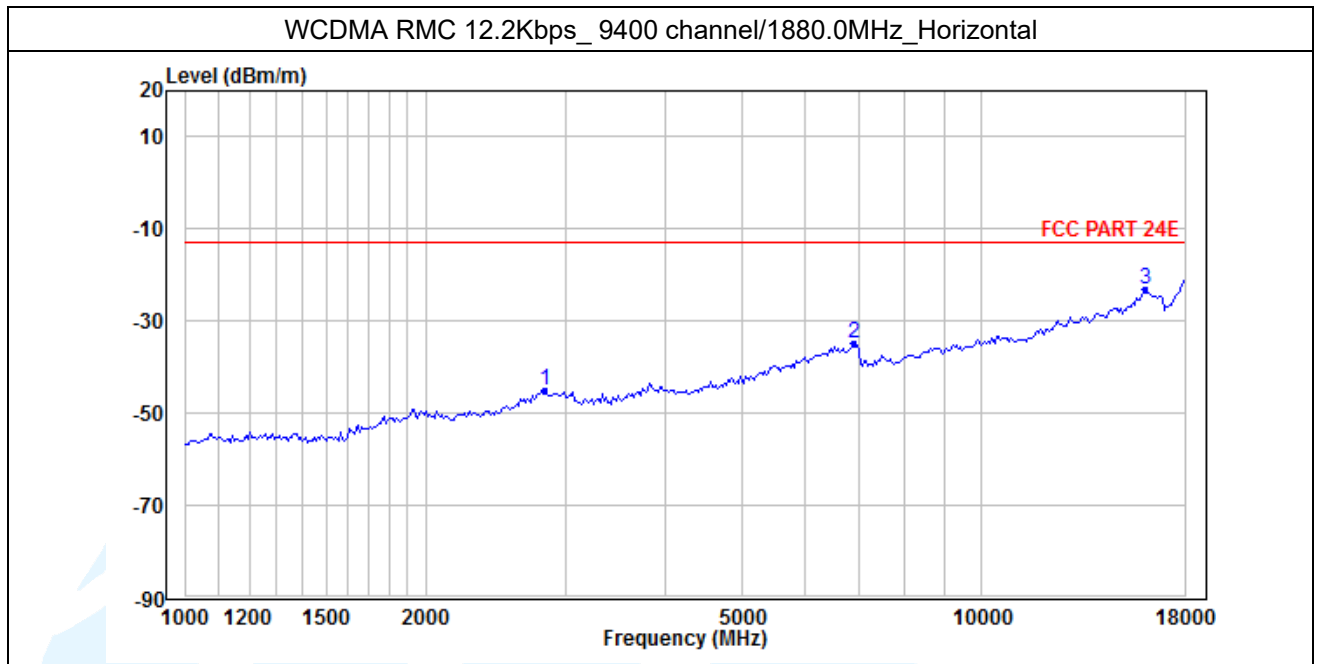


WCDMA RMC 12.2Kbps_ 9400 channel/1880.0MHz_Vertical



Spurious Emission Test Worst Data (1 GHz ~ 18 GHz)





5.8 Frequency stability

Test Requirement:	FCC 47 CFR Part 2.1055 & FCC 47 CFR Part 24.235
Test Method:	ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02
Limit:	The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.
Test Procedure:	<ol style="list-style-type: none"> Use CMW 500 or CMU 200 with Frequency Error measurement capability. <ol style="list-style-type: none"> Temp. = -30° to +50°C Voltage = low voltage, 3.6Vdc, Normal, 3.85Vdc and High voltage, 4.4Vdc. Frequency Stability vs Temperature: The EUT is place inside a temperature chamber. The temperature is set to 20°C and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until +50°C is reached. Frequency Stability vs Voltage: The peak frequency error is recorded (worst-case).
Test Setup:	Refer to section 4.1.1(3) for details.
Instruments Used:	Refer to section 3 for details
Test Mode:	Link mode
Test Results:	Pass
Test Data:	

Modulation	Channel / Frequency (MHz)	Voltage (Vdc)	Temperature (°C)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Pass/Fail
GSM 1Tx-slot							
GMSK	661/ 1880	3.4	Normal	-42	-0.022	± 2.5	PASS
		3.85		-43	-0.023	± 2.5	PASS
		4.4		-44	-0.023	± 2.5	PASS
		3.85	50	-48	-0.026	± 2.5	PASS
			40	-46	-0.024	± 2.5	PASS
			30	-44	-0.023	± 2.5	PASS
			20	-43	-0.023	± 2.5	PASS
			20	-47	-0.025	± 2.5	PASS
			0	-48	-0.026	± 2.5	PASS
			-10	-50	-0.027	± 2.5	PASS
			-20	-54	-0.029	± 2.5	PASS

Modulation	Channel/ Frequency (MHz)	Voltage (Vdc)	Temperature (°C)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Pass/ Fail
EDGE 1Tx-slot							
8PSK	661/ 1880	3.4	Normal	45	0.0128	± 2.5	PASS
		3.85		46	0.0117	± 2.5	PASS
		4.4		47	0.0122	± 2.5	PASS
		3.85	50	44	0.0133	± 2.5	PASS
			40	43	0.0165	± 2.5	PASS
			30	45	0.0144	± 2.5	PASS
			20	45	0.0122	± 2.5	PASS
			20	48	0.0117	± 2.5	PASS
			0	49	0.0144	± 2.5	PASS
			-10	52	0.0128	± 2.5	PASS
			-20	54	0.0160	± 2.5	PASS

Modulation	Channel/ Frequency (MHz)	Voltage (Vdc)	Temperature (°C)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Pass/ Fail
WCDMA RMC 12.2Kbps							
BPSK	9400/1880	3.4	Normal	3.12	0.002	± 2.5	PASS
		3.85		2.57	0.001	± 2.5	PASS
		4.4		2.62	0.001	± 2.5	PASS
		3.85	50	2.27	0.001	± 2.5	PASS
			40	2.34	0.001	± 2.5	PASS
			30	2.33	0.001	± 2.5	PASS
			20	2.57	0.001	± 2.5	PASS
			20	2.63	0.001	± 2.5	PASS
			0	3.22	0.002	± 2.5	PASS
			-10	3.89	0.002	± 2.5	PASS
			-20	4.32	0.002	± 2.5	PASS

APPENDIX 1 PHOTOGRAPHS OF TEST SETUP

See test photographs attached in Appendix 1 for the actual connections between Product and support equipment.

APPENDIX 2 PHOTOGRAPHS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photographs.

*** End of Report ***

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