

FCC TEST REPORT

Product Name: LTE Desk Router
Trade Mark: Eltel
Model No.: R520
Add. Model No.: N/A
Report Number: 180905005RFM-1
Test Standards: FCC 47 CFR Part 22 Subpart H
FCC 47 CFR Part 2
FCC ID: 2AQ5T-R520
Test Result: PASS
Date of Issue: October 12, 2018

Prepared for:

Eltel Group Inc.
19 Calle 5-65 Zona 10, Guatemala

Prepared by:

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Date: October 12, 2018



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CONTENTS

1. GENERAL INFORMATION	4
1.1 CLIENT INFORMATION	4
1.2 EUT INFORMATION	4
1.2.1 GENERAL DESCRIPTION OF EUT	4
1.2.2 DESCRIPTION OF ACCESSORIES	4
1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD	4
1.4 DESCRIPTION OF SUPPORT UNITS	5
1.5 TEST LOCATION	5
1.6 TEST FACILITY	5
1.7 DEVIATION FROM STANDARDS	6
1.8 ABNORMALITIES FROM STANDARD CONDITIONS	6
1.9 OTHER INFORMATION REQUESTED BY THE CUSTOMER	6
1.10 MEASUREMENT UNCERTAINTY	6
2. TEST SUMMARY	7
3. EQUIPMENT LIST	8
4. TEST CONFIGURATION	9
4.1 ENVIRONMENTAL CONDITIONS FOR TESTING	9
4.1.1 NORMAL OR EXTREME TEST CONDITIONS	9
4.2 TEST SETUP	10
4.2.1 FOR RADIATED EMISSIONS TEST SETUP	10
4.2.2 FOR CONDUCTED RF TEST SETUP	12
4.3 TEST CHANNELS	13
4.4 SYSTEM TEST CONFIGURATION	13
4.5 PRE-SCAN	13
5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION	15
5.1 REFERENCE DOCUMENTS FOR TESTING	15
5.2 EFFECTIVE RADIATED POWER (ERP)	15
5.3 CONDUCTED OUTPUT POWER	17
5.4 PEAK-TO-AVERAGE RATIO	18
5.5 99%&26dB BANDWIDTH	22
5.6 BAND EDGE AT ANTENNA TERMINALS	26
5.7 SPURIOUS EMISSIONS AT ANTENNA TERMINALS	30
5.8 FIELD STRENGTH OF SPURIOUS RADIATION	34
5.9 FREQUENCY STABILITY	47
APPENDIX 1 PHOTOS OF TEST SETUP	49
APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS	49

1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Eltel Group Inc.
Address of Applicant:	19 Calle 5-65 Zona 10, Guatemala
Manufacturer:	Shanghai BroadMobi Communication Technology Co., Ltd
Address of Manufacturer:	15F,Building9,No99.Tianzhou Rd.,Xuhui District,Shanghai,P.R.China

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	LTE Desk Router	
Model No.:	R520	
Add. Model No.:	N/A	
Trade Mark:	Eltel	
DUT Stage:	Identical Prototype	
EUT Supports Function:	GSM Bands:	GSM850/1900
	UTRA Bands:	Band II/ Band V
	E-UTRA Bands:	FDD Band 4/ Band 7/ Band 66
	2.4 GHz ISM Band:	IEEE 802.11b/g/n
Software Version:	1.01	
Hardware Version:	2.0	
Sample Received Date:	September 5, 2018	
Sample Tested Date:	September 5, 2018 to September 24, 2018	

1.2.2 Description of Accessories

Adapter 1	
Trade Mark:	AMIGO
Model No.:	AMS159A-1201000FU
Input:	100-240 V~50/60 Hz 0.5 A
Output:	12.0 V $\equiv$ 1.0 A
DC Cable:	1.20 Meter, Shielded without ferrite
Manufacturer:	GLOBAL YEOU DIANN ELECTRIC INDUSTRIAL CO., LTD.

Adapter 2	
Trade Mark:	GANGQI
Model No.:	GQ12-120100-HU
Input:	100-240V~50/60Hz 0.4A
Output:	12.0 V $\equiv$ 1.0 A
DC Cable:	1.20 Meter, Shielded without ferrite
Manufacturer:	DONGGUAN GANGQI ELECTRONICS CO.,LTD

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

Support Networks:	GSM, GPRS, EDGE, WCDMA, HSDPA, HSUPA, LTE	
Type of Modulation:	GSM/GPRS:	GMSK
	EDGE:	GMSK, 8PSK
	WCDMA	BPSK
	HSDPA:	QPSK

	HSUPA:	QPSK
Frequency Range:	GSM/GPRS/EDGE 850:	824.2-848.8 MHz
	WCDMA Band V:	826.4-846.6 MHz
Max RF Output Power:	GSM/GPRS 850:	32.41dBm
	EDGE 850:	26.60dBm
	WCDMA Band V:	23.91dBm
Type of Emission:	GSM/GPRS 850:	245KGXW
	EDGE 850:	244KG7W
	WCDMA Band V:	4M18F9W
IEMI:	Radiation: 869601016155397	
	Conducted: 869601016155389	
Antenna Type:	Integral Antenna	
Antenna Gain:	-3 dBi	
Normal Test Voltage:	12 Vdc	
Extreme Test Voltage:	10.8 to 13.2Vdc	
Extreme Test Temperature:	-30 °C to +50 °C	

1.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

1) Support Cable

Cable No.	Description	Connector	Length	Supplied by
1	Antenna Cable	SMA	0.30 Meter	UnionTrust

1.5 TEST LOCATION

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China 518109
Telephone: +86 (0) 755 2823 0888
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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.

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

FCC Accredited Lab.

Designation Number: CN1194

Test Firm Registration Number: 259480

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

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product 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.

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

FCC 47 CFR Part 22 Subpart H Test Cases			
Test Item	Test Requirement	Test Method	Result
Effective Radiated Power (ERP)	FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 22.913(a)	ANSI/TIA-603-E-2016 & KDB 971168 D01v03r01	PASS
Conducted Output Power	FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 22.913(a)	ANSI/TIA-603-E-2016 & KDB 971168 D01v03r01	PASS
Peak-to-average ratio	FCC 47 CFR Part 22.913(a)	ANSI/TIA-603-E-2016 & KDB 971168 D01v03r01	PASS
99%&26dB Bandwidth	FCC 47 CFR Part 2.1049(h)	ANSI/TIA-603-E-2016 & KDB 971168 D01v03r01	PASS
Band Edge at antenna terminals	FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 22.917(a)	ANSI/TIA-603-E-2016 & KDB 971168 D01v03r01	PASS
Spurious emissions at antenna terminals	FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 22.917(a)(b)	ANSI/TIA-603-E-2016 & KDB 971168 D01v03r01	PASS
Field strength of spurious radiation	FCC 47 CFR Part 2.1053 & FCC 47 CFR Part 22.917(a)(b)	ANSI/TIA-603-E-2016 & KDB 971168 D01v03r01	PASS
Frequency stability	FCC 47 CFR Part 2.1055 & FCC 47 CFR Part 22.355	ANSI/TIA-603-E-2016 & KDB 971168 D01v03r01	PASS
Note: 1) N/A: In this whole report not application.			

3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm dd, yyyy)	Cal. Due date (mm dd, yyyy)
☒	3M Chamber & Accessory Equipment	ETS-LINDGREN	3M	N/A	Dec. 20, 2015	Dec. 19, 2018
☒	Receiver	R&S	ESIB26	100114	Dec. 10, 2017	Dec. 10, 2018
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	Dec. 17, 2017	Dec. 17, 2018
☒	Preamplifier	HP	8447F	2805A02960	Dec. 10, 2017	Dec. 10, 2018
☒	Broadband Antenna (Pre-amplifier)	ETS-LINDGREN	3142E-PA	00201891	May 19, 2018	May 19, 2019
☒	Horn Antenna	ETS-LINDGREN	3117	00164202	Dec. 17, 2017	Dec. 17, 2018
☒	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201874	May 22, 2018	May 22, 2019
☒	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☒	Test Software	Audix	e3	Software Version: 9.160323		

2/3/4G RF Test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm dd, yyyy)	Cal. Due date (mm dd, yyyy)
☒	Receiver	R&S	ESR7	1316.3003K07-101181-K3	Dec. 10, 2017	Dec. 10, 2018
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	Dec.10, 2017	Dec. 10, 2018
☒	Wideband Radio Communication Tester	R&S	CMW500	116254	June 07, 2018	June 07, 2019
☐	Universal Radio Communication Tester	R&S	CMU200	114713	Dec. 10, 2017	Dec. 10, 2018
☒	DC Source	KIKUSUI	PWR400L	LK003024	Sep. 14, 2018	Sep. 13, 2019
☒	Temp & Humidity chamber	Votisch	VT4002	58566133290020	June 05, 2018	June 05, 2019
☒	Test Software	ECIT	AutomationTestSystem		Software Version: 2.170530	

4. TEST CONFIGURATION

4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

4.1.1 Normal or Extreme Test Conditions

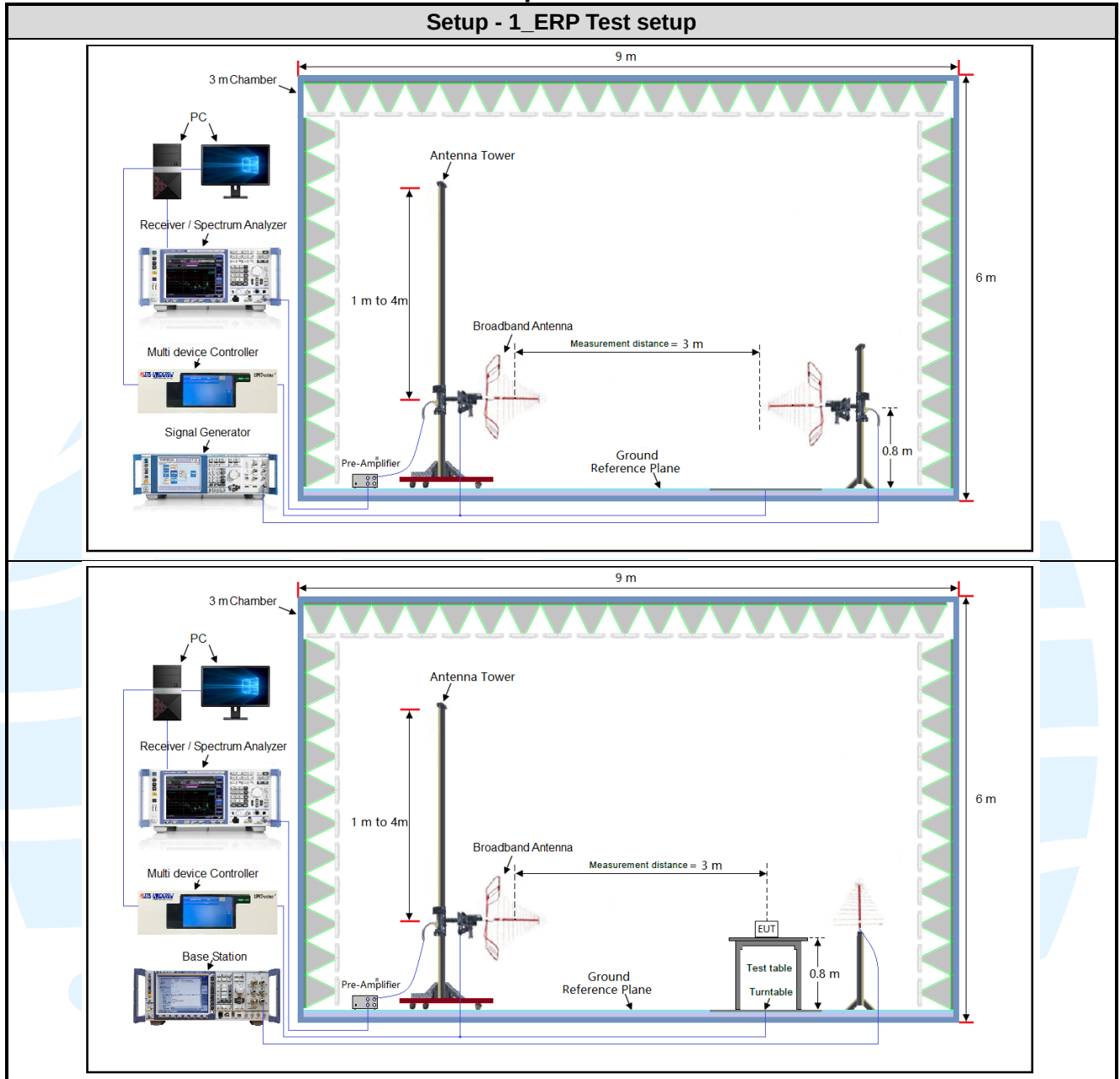
Test Environment	Selected Values During Tests		
Test Condition	Ambient		
	Temperature (°C)	Voltage (V)	Relative Humidity (%)
TN/VN	+15 to +35	12	20 to 75
TL/VL	-30	10.8	20 to 75
TH/VL	+50	10.8	20 to 75
TL/VH	-30	13.2	20 to 75
TH/VH	+50	13.2	20 to 75

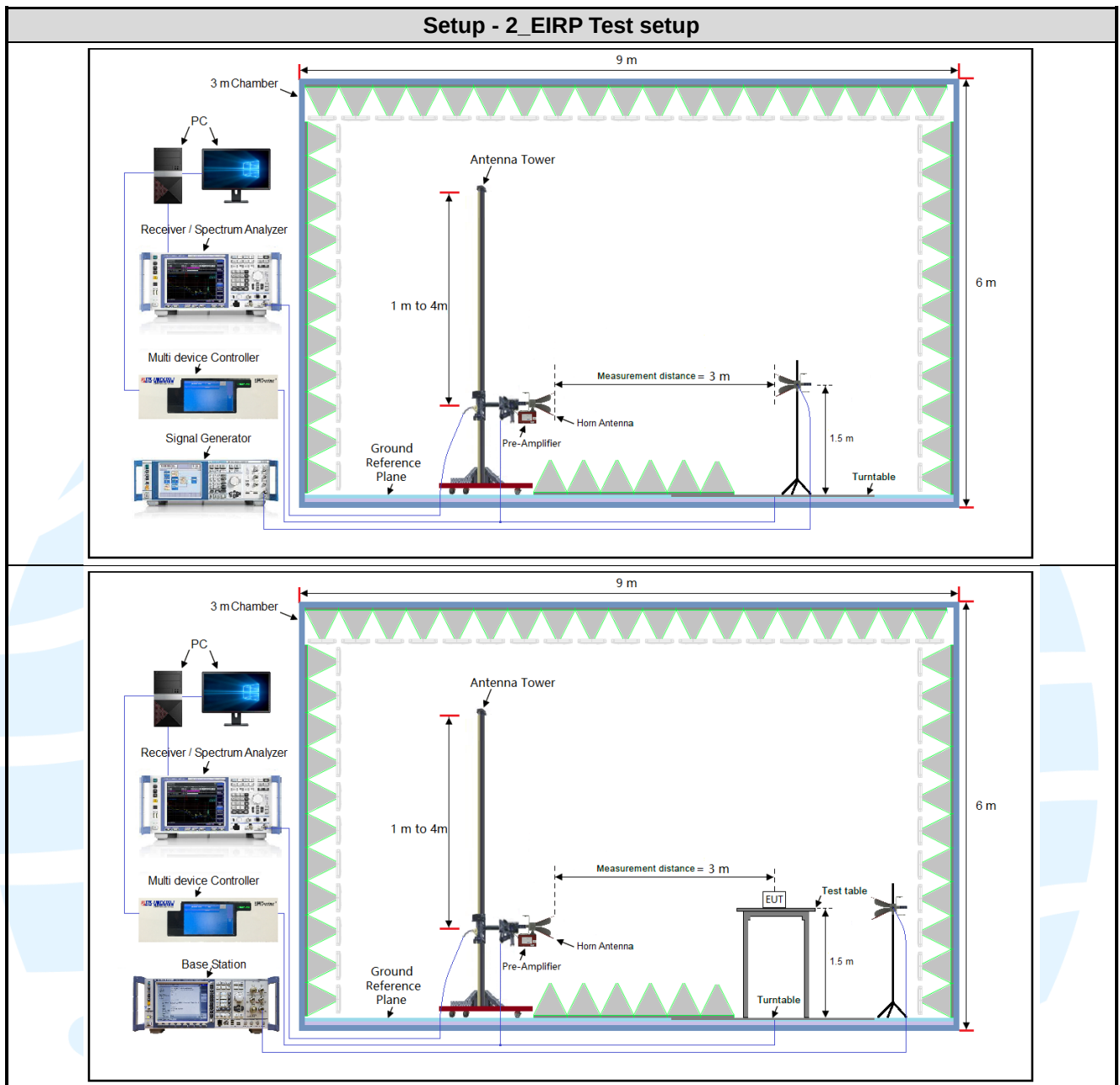
Remark:

- 1) The EUT just work in such extreme temperature of -30 °C to +50 °C and the extreme voltage of 10.8 V to 13.2 V, so here the EUT is tested in the temperature of -30 °C to +50 °C and the voltage of 10.8 V to 13.2 V.
- 2) VN: Normal Voltage; TN: Normal Temperature;
TL: Low Extreme Test Temperature; TH: High Extreme Test Temperature;
VL: Low Extreme Test Voltage; VH: High Extreme Test Voltage.

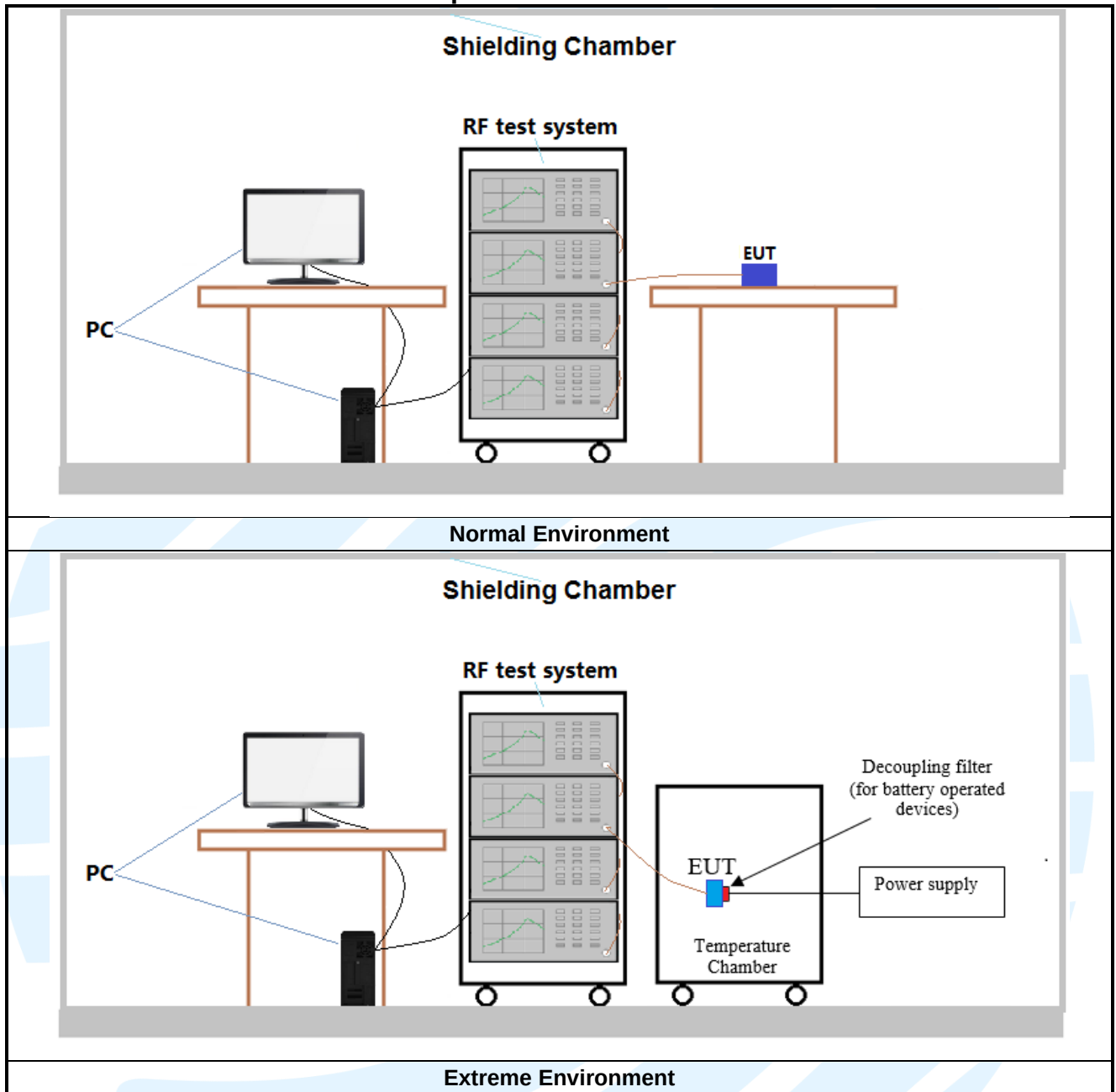
4.2 TEST SETUP

4.2.1 For Radiated Emissions test setup





4.2.2 For Conducted RF test setup



4.3 TEST CHANNELS

Band	Tx/Rx Frequency	RF Channel		
		Low(L)	Middle(M)	High(H)
GSM/GPRS/ EDGE850	Tx (824 MHz ~ 849 MHz)	Channel 128	Channel 190	Channel 251
		824.2 MHz	836.6 MHz	848.8 MHz
WCDMA band V	Tx (824 MHz ~ 849 MHz)	Channel 4132	Channel 4182	Channel 4233
		826.4 MHz	836.4 MHz	846.6 MHz

4.4 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 12Vdc adapter. 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.

Band	Mode	Antenna Port	Worst-case axis positioning
GSM 850	1TX	Chain 0	Y axis
EDGE 850	1TX	Chain 0	Y axis
WCDMA Band V	1TX	Chain 0	Y axis

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.

4.5 PRE-SCAN

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.

GSM 850 Maximum Average Power (dBm)			
Channel	128	190	251
Frequency(MHz)	824.2 MHz	836.6 MHz	848.8 MHz
GSM (GMSK, 1Tx-slot)	32.41	32.25	31.83
GPRS (GMSK, 1Tx-slot)	32.06	32.00	31.81
GPRS (GMSK, 2Tx-slot)	29.86	29.69	29.74
GPRS (GMSK, 3Tx-slot)	28.71	28.46	28.49
GPRS (GMSK, 4Tx-slot)	27.63	27.50	27.29
EDGE (8PSK, 1Tx-slot)	26.60	26.35	26.59
EDGE (8PSK, 2Tx-slot)	24.65	24.45	24.63
EDGE (8PSK, 3Tx-slot)	23.37	23.08	23.37
EDGE (8PSK, 4Tx-slot)	22.11	21.75	22.01

WCDMA Band V Maximum Average Power (dBm)			
Channel	4132	4182	4233
Frequency(MHz)	826.4 MHz	836.4 MHz	846.6 MHz
RMC 12.2K	23.81	23.91	23.82
HSDPA Subtest-1	22.29	22.38	22.31
HSDPA Subtest-2	22.24	22.30	22.23
HSDPA Subtest-3	21.85	21.90	21.74
HSDPA Subtest-4	21.80	21.87	21.82
HSUPA Subtest-1	22.32	22.38	22.33
HSUPA Subtest-2	21.81	21.98	21.84
HSUPA Subtest-3	22.35	22.41	22.32
HSUPA Subtest-4	22.45	22.45	22.41
HSUPA Subtest-5	21.69	21.85	21.83

Pre-scan all bandwidth and RB, find worse case mode are chosen to the report, the worse mode applicability and tested channel detail as below:

Band	Radiated	Conducted
GSM/GPRS/EDGE 850	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 V	RMC 12.2Kbps Link	RMC 12.2Kbps Link

5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

5.1 REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part 2 Subpart J	Frequency allocations and radio treaty matters; general rules and regulations
2	FCC 47 CFR Part 22 Subpart H	Cellular Radiotelephone Service
3	ANSI/TIA-603-E-2016	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
4	KDB 971168 D01	KDB 971168 D01 Power Meas License Digital Systems v03r01

5.2 EFFECTIVE RADIATED POWER (ERP)

Test Requirement: FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 22.913(a)

Test Method: KDB 971168 D01v03r01& ANSI/TIA-603-E-2016

Limit:

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

Test Procedure:

Test procedure as below:

- 1) The EUT was powered ON and placed on a 0.8/1.5m high table at a 3 meter semi/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 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 Y 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 4.2.1 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: Pass

Test Data: See table below

Maximum ERP (dBm)					
Channel	GSM 1Tx-slot	EDGE 1Tx-slot	WCDMA RMC 12.2Kbps	Limit (dBm)	Result
Lowest	27.26	21.45	18.66	38.45	Pass
Middle	27.10	21.20	18.76	38.45	Pass
Highest	26.68	21.44	18.67	38.45	Pass



5.3 CONDUCTED OUTPUT POWER

Test Requirement: FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 22.913(a)

Test Method: ANSI/TIA-603-E-2016 & KDB 971168 D01v03r01

Limit:

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

Test Procedure:

The EUT was set up for the maximum power with GSM, GPRS, EDGE, WCDMA, CDMA2000, 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 4.2.2 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: Pass

Test Data: The full result refer to section 4.5 for details.

5.4 PEAK-TO-AVERAGE RATIO

Test Requirement: FCC 47 CFR Part 22.913(a)

Test Method: KDB 971168 D01v03r01

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 4.2.2 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

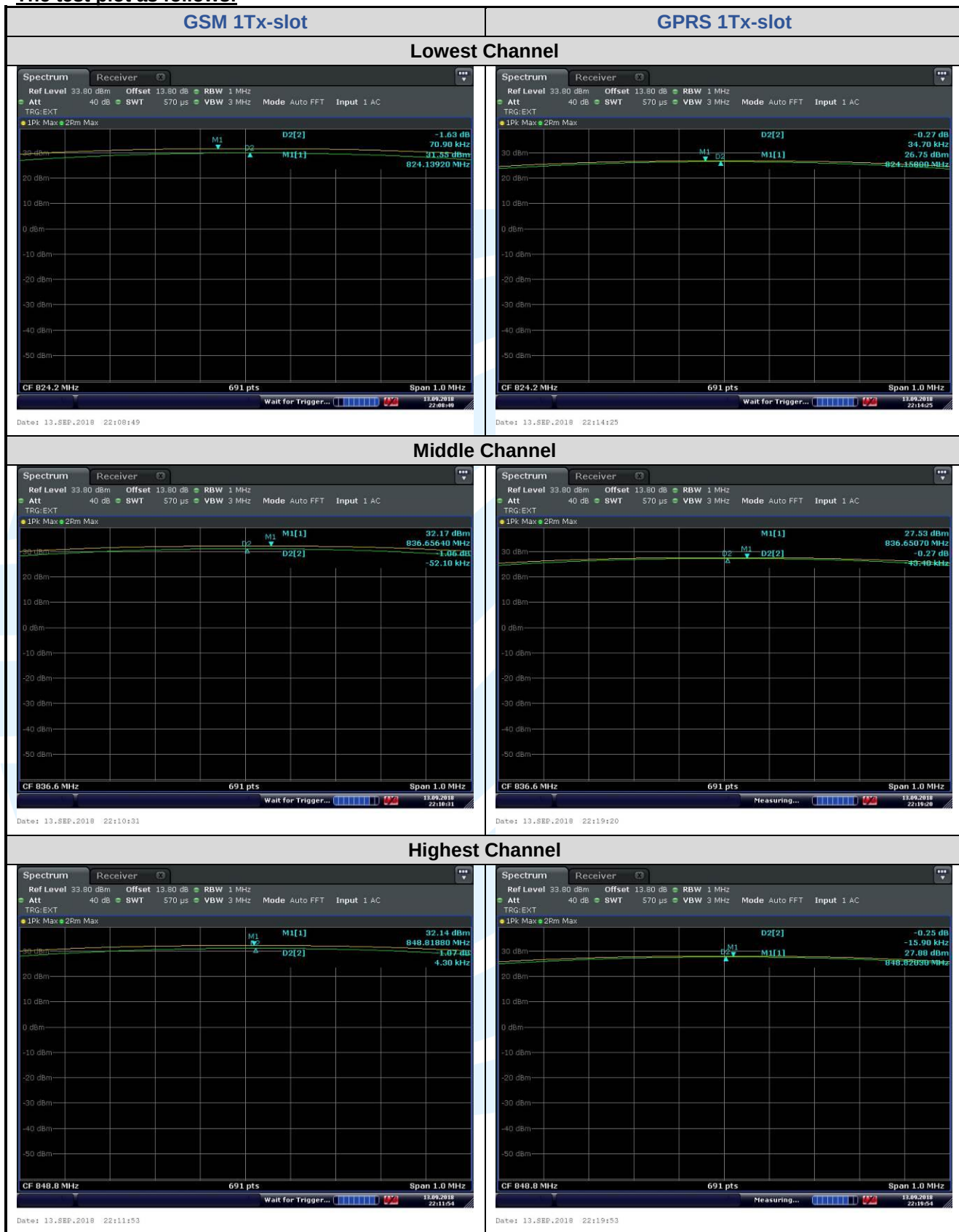
Test Results: Pass

Test Data: See table below

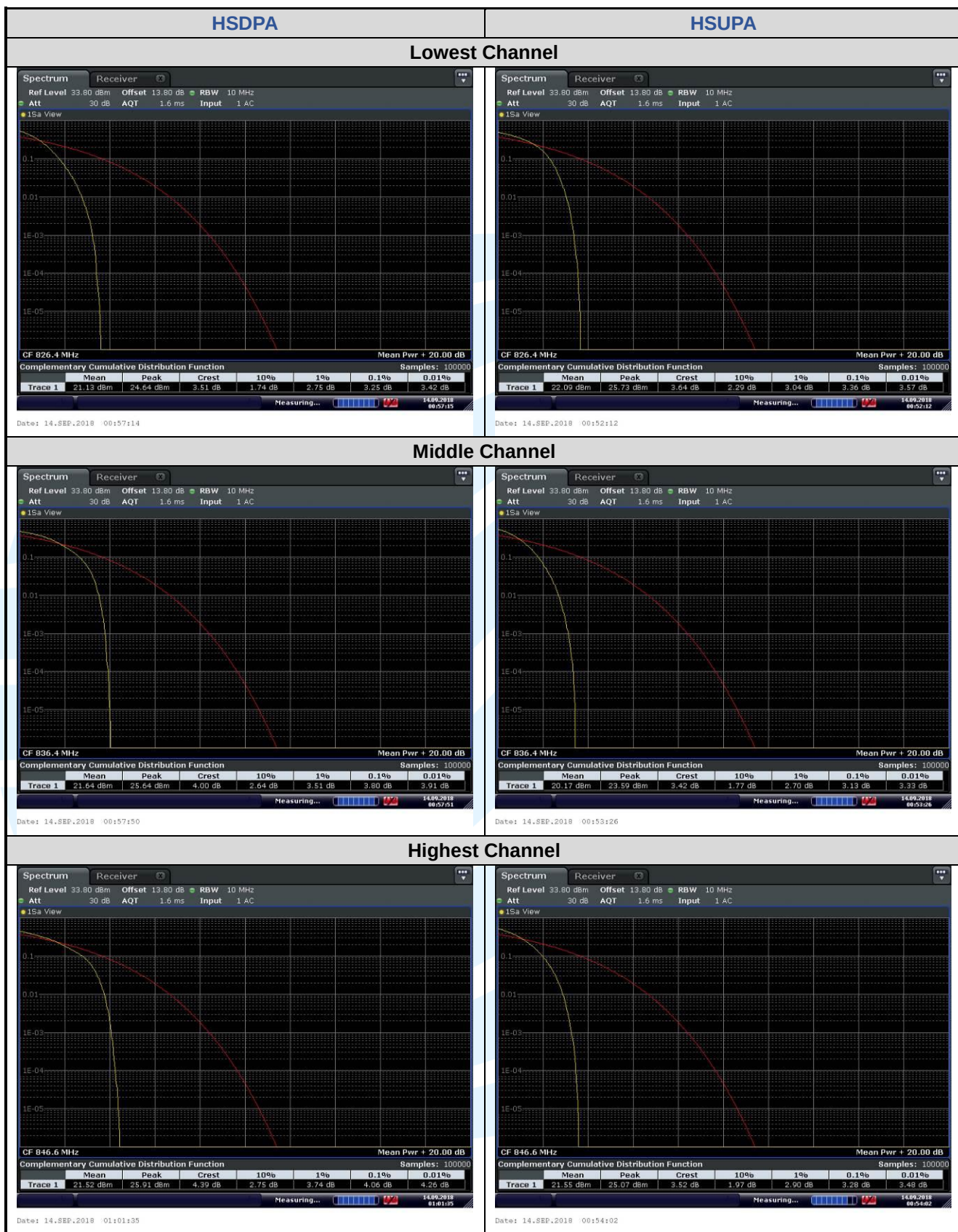
Peak-to-average ratio (dB)					
Channel	GSM 1Tx-slot	GPRS 1Tx-slot	EDGE 1Tx-slot	Limit (dBm)	Result
Lowest	-1.63	-0.27	-0.28	13	Pass
Middle	-1.06	-0.27	-0.23	13	Pass
Highest	-1.07	-0.25	-0.22	13	Pass

Channel	WCDMA RMC 12.2Kbps	HSDPA	HSUPA	Limit (dBm)	Result
Lowest	2.96	3.25	3.36	13	Pass
Middle	2.81	3.80	3.13	13	Pass
Highest	3.10	4.06	3.28	13	Pass

The test plot as follows:







5.5 99%&26DB BANDWIDTH

Test Requirement: FCC 47 CFR Part 2.1049(h) & FCC 47 CFR Part 22.917(b)

Test Method: ANSI/TIA-603-E-2016 & KDB 971168 D01v03r01

Limit: No Limit

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 4.2.2 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: Pass

Test Data: See table below

99% & 26 dB Bandwidth				
Test Mode	Channel	Frequency (MHz)	26 dB BW (kHz)	99% BW (kHz)
GSM 1Tx-slot	128	824.2	311.5	241.27
	190	836.6	303.8	240.70
	251	848.8	298.9	240.43
GPRS 1Tx-slot	128	824.2	314.0	240.54
	190	836.6	319.0	245.21
	251	848.8	321.9	243.32
EDGE 1Tx-slot	128	824.2	312.4	244.14
	190	836.6	310.0	239.53
	251	848.8	316.1	241.35

99% & 26 dB Bandwidth				
Test Mode	Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
WCDMA RMC 12.2Kbps	4132	826.4	4.717	4.1356
	4182	836.4	4.722	4.1230
	4233	846.6	4.726	4.1207
HSDPA	4132	826.4	4.706	4.1323
	4182	836.4	5.962	4.1666
	4233	846.6	4.712	4.1333
HSUPA	4132	826.4	4.708	4.1248
	4182	836.4	5.876	4.1841
	4233	846.6	4.710	4.1435

The test plot as follows:

