



<b>RF TEST REPORT</b>					
Report No.:	SET2021-01244				
Product Name:	Mobile Data Terminal				
FCC ID:	2AC6AC90				
Model No. :	C90				
Applicant:	Shenzhen Chainway Information Technology Co.,Ltd.				
A ddraea.	9F Building2,Daqian Industrial Park,District 67, XingDong				
Address:	Community,Xin'an street,Bao'an District,Shenzhen,Guangdong,China.				
Dates of Testing:	12/20/2020 — 01/26/2021				
Issued by:	CCIC Southern Testing Co., Ltd.				
Lab Location:	Electronic Testing Building, No.43 Shahe Road Xili Street, Nanshan				
	District, Shenzhen, Guangdong, 518055 China.				
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# **Test Report**

Product:	Mobile Data Terminal			
Brand Name:	CHAINWAY			
Trade Name:	CHAINWAY			
Applicant:	Shenzhen Chainway Information Technology Co.,Ltd. 9F Building2,Daqian Industrial Park,District 67, XingDong			
Applicant Address:	Community,Xin'an street,Bao'an District,Shenzhen, Guangdong,China			
Manufacturer:	Shenzhen Chainway Information Technology Co.,Ltd.			
Manufacturer Address:	9F Building2,Daqian Industrial Park,District 67, XingDong			
	Community,Xin'an street,Bao'an District,Shenzhen,			
Taat Standarda	Guangdong,China			
	47 CFR FCC Part 2/22/24/27			
Test Result:	PASS			
Tested by:	Vincent 2021.01.26			
	Vincent, Test Engineer			
Reviewed by:	Chris 1 on 2021.01.26			
	Chris You, Senior Engineer			
Approved by:	: 2021.01.26			
	Shuangwen Zhang, Manager			



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	Change History				
Issue	Date	Reason for change			
1.0	2021.01.27	First edition			



# 1. GENERAL INFORMATION

# **1.1 EUT Description**

EUT Type	Mobile Data Terminal		
EUT supports Radios application	GPRS/EDGE/WCDMA/HSPA		
Multi Slot Class	GPRS: Multi slot Class12, EGPRS: Multi slot Class12		
	GSM 850MHz:		
	Tx: 824.2 - 848.8MHz (at intervals of 200kHz);		
	Rx: 869.2 - 893.8MHz (at intervals of 200kHz)		
	GSM 1900MHz:		
	Tx: 1850.2 - 1909.8MHz (at intervals of 200kHz);		
	Rx: 1930.2 - 1989.8MHz (at intervals of 200kHz)		
	WCDMA 850MHz		
Frequency Range	Tx: 826.4 - 846.6MHz (at intervals of 200kHz);		
	Rx: 871.4 - 891.6MHz (at intervals of 200kHz)		
	WCDMA 1700MHz		
	Tx: 1712.4 - 1752.6MHz (at intervals of 200kHz);		
	Rx: 2112.4 - 2152.6MHz (at intervals of 200kHz)		
	WCDMA 1900MHz		
	Tx: 1852.4 - 1907.6MHz (at intervals of 200kHz);		
	Rx: 1932.4 - 1987.6MHz (at intervals of 200kHz)		
	GSM 850: 32.5dBm		
	GSM 1900: 30.4dBm		
Maximum Output Power to	EDGE 850: 26.1dBm		
Antenna	EDGE 1900: 25.8dBm		
7 Antenna	WCDMA 850: 22.66dBm		
	WCDMA 1700:23.53dBm		
	WCDMA 1900: 23.22dBm		
	GSM / GPRS:GMSK		
	EDGE:GMSK / 8PSK		
Type of Modulation	WCDMA: QPSK(Uplink)		
	HSDPA:QPSK(Downlink)		
	HSUPA:QPSK(Uplink)		
Antenna Type	Internal Antenna		



1.2	2 Maximum Designator	ERP/EIRP	Power, Freq	uency Tolerance	e, and Emissi	on
	System	Type of Modulation	Emission Designator	Frequency Tolerance (ppm)	Maximum ERP/EIRP(W)	
	GSM 850	GMSK	245KGXW	0.012	1.778	
	GSM 1900	GMSK	245KGXW	0.017	1.050	
	EDGE 850	8PSK	238KG7W	0.024	0.409	
	EDGE 1900	8PSK	250KG7W	0.021	0.382	
	WCDMA 850 RMC 12.2Kbps	QPSK	4M18F9W	0.023	0.179	
	WCDMA 1900 RMC 12.2Kbps	QPSK	4M17F9W	0.016	0.224	
	WCDMA 1700 RMC 12.2Kbps	QPSK	4M17F9W	0.018	0.226	



# **1.3** Test Standards and Results

1. 47 CFR Part 2, 22(H), 24(E)

2. ANSI / TIA / EIA-603-D-2010

3. FCC KDB 971168 D01 Power Meas. License Digital Systems v03r01

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.

2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

Test detailed items/section required by FCC rules and results are as below:

No. Section		Description	Limit	Result
110.	FCC		Emit	Result
1	2.1046	Conducted Output Power	Reporting Only	PASS
2	24.232(d)	Peak to Average Radio	<13dBm	PASS
	27.50(d)		(10 <b>ub</b> hi	11155
	2.1049			
3	22.917(b)	Occupied Bandwidth	Reporting Only	PASS
5	24.238(b)	Occupied Baildwidth	Reporting Only	IASS
	27.53(g)			
	2.1055			
4	22.355	Engagen av Stability	$\leq \pm 2.5$ ppm	PASS
4	24.235	Frequency Stability		PASS
	27.54			
	2.1051			
5	22.917	Conducted Out of Band	< 43+10log10 (P[Watts])	PASS
5	24.238	Emissions		
	27.53			
	2.1051			
C	22.917	DandEdaa	< 43+10log10	PASS
6	24.238	Band Edge	(P[Watts])	PASS
	27.53			
	22.913	Effective Radiated Power	<7Watts	PASS
7	24.232	Equivalent Isotropic Radiated Power	<2Watts	PASS
	27.50(d)	Effective Radiated Power	<1Watts	PASS



8	2.1053 22.917 24.238 27.53	Radiated Spurious Emissions	< 43+10log10 (P[Watts])	PASS
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# **1.4** Test Configuration of Equipment under Test

Antenna port conducted and radiated test items were performed according to KDB 971168 D01 Power Meas. License Digital Systems v03r01 with maximum output power.

Radiated measurements were performed with rotating EUT in different three orthogonal test planes to find the maximum emission.

Radiated emissions were investigated as following frequency range:

1. 30 MHz to 9000 MHz for GSM850 and WCDMA Band V.

2. 30 MHz to 20000 MHz for GSM1900 and WCDMA Band II.

All modes and data rates and positions were investigated.

Test modes are chosen to be reported as the worst case configuration below:

Test Modes				
Band	Band Radiated TCs			
GSM 850	GPRS Link	GPRS Link		
O2W 920	GPRS Link	GPRS Link		
CEM 1000	GPRS Link	GPRS Link		
GSM 1900	GPRS Link	GPRS Link		
WCDMA Band V	RMC 12.2Kbps Link	RMC 12.2Kbps Link		
WCDMA Band II	RMC 12.2Kbps Link	RMC 12.2Kbps Link		
WCDMA Band IV	RMC 12.2Kbps Link	RMC 12.2Kbps Link		

Note: The maximum power levels are chosen to test as the worst case configuration as follows: GSM mode for GMSK modulation,

EDGE multi-slot class 8 mode for 8PSK modulation,

RMC 12.2Kbps mode for WCDMA band V,

RMC 12.2Kbps mode for WCDMA band II, only these modes were used for all tests.

RMC 12.2Kbps mode for WCDMA band IV, only these modes were used for all tests.





# **1.5** Measurement Results Explanation Example

#### For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 6B and 10dB attenuator.

Example:

Offset (dB) = RF cable loss(dB) + attenuator factor(dB).

= 7.5 + 10 = 17.5(dB)

## **1.6** Facilities and Accreditations

#### 1.6.1 Test Facilities

#### FCC- Designation Number: CN5031

CCIC Southern Testing Co., Ltd EMC Laboratory has been registered and fully described in a re port filed with the FCC (Federal Communications Commission). The acceptance letter from the F CC is maintained in our files. Designation Number: CN1283, valid time is until June 30th, 2021.

#### ISED Registration: 11185A-1

#### CAB identifier: CN0064

CCIC Southern Testing Co., Ltd. EMC Laboratory has been registered by Certification and Engin eering Bureau of Industry Canada for the performance of radiated measurements with Registratio n No. 11185A-1 on Aug. 04, 2016, valid time is until June 30th, 2021

#### A2LA Code: 5721.01

CCIC-SET is a third party testing organization accredited by A2LA according to ISO/IEC 17025. The accreditation certificate number is 5721.01.

### **1.6.2** Test Environment Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15°C-35°C
Relative Humidity (%):	30% -60%
Atmospheric Pressure (kPa):	86KPa-106KPa





# 2. 47 CFR PART 2, PART 22H & 24E 27L REQUIREMENTS

# 2.1 Conducted RF Output Power

#### 2.1.1 Definition

A system simulator was used to establish communication with the EUT. Its parameters were set to enforce EUT transmitting at the maximum power. The measured power in the radio frequency on the transmitter output terminals shall be reported.

### 2.1.2 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

#### 2.1.3 Test Procedures

- 1. The transmitter output port was connected to the system simulator.
- 2. Set EUT at maximum power through system simulator.
- 3. Select lowest, middle, and highest channels for each band and different modulation.
- 4. Measure and record the power level from the system simulator.

### 2.1.4 Test Setup





# 2.1.5 Test Results of Conducted Output Power

# 1. Test Verdict:

GSM850		Burst-Averaged output Power (dBm)		
G	0311030		190CH	251CH
GS	SM (CS)	32.5	32.5	32.5
	1 Tx Slot	32.4	32.4	32.4
GPRS	2 Tx Slots	31.8	31.7	31.8
(GMSK)	3 Tx Slots	30.2	30.1	30.3
	4 Tx Slots	29.2	29.3	29.2
	1 Tx Slot	26.0	26.1	26.0
EDGE	2 Tx Slots	25.1	25.3	25.3
(8PSK)	3 Tx Slots	24.8	24.8	24.7
	4 Tx Slots	24.1	24.4	24.3
	SM1900	Burst-Averaged output Power (dBm)		
U.	5141900	512CH	661CH	810CH
GS	SM (CS)	30.2	30.1	30.4
	1 Tx Slot	30.3	30.1	30.4
GPRS	2 Tx Slots	29.7	29.6	29.7
(GMSK)	3 Tx Slots	29.1	29.0	29.3
	4 Tx Slots	28.6	28.8	28.9
	1 Tx Slot	25.8	25.6	25.5
EDGE	2 Tx Slots	24.8	24.7	24.6
(8PSK)	3 Tx Slots	24.1	23.8	24.1
	4 Tx Slots	23.8	23.7	23.4



# 2. WCDMA Model Test Verdict:

UN	UMTS1900		verage Power (dH	Bm)
(Band II)		9262CH	9400CH	9538cH
WCDMA	12.2kbps RMC	23.12	23.22	22.97
	Subtest 1	22.55	22.53	22.19
UCDDA	Subtest 2	22.14	22.12	21.78
HSDPA	Subtest 3	21.75	21.73	21.39
	Subtest 4	21.54	21.52	21.18
	Subtest 1	23.04	23.06	22.69
	Subtest 2	22.74	22.82	22.45
HSUPA	Subtest 3	22.65	22.67	22.30
	Subtest 4	22.37	22.39	22.02
	Subtest 5	22.18	22.20	21.83
UI	MTS850	A	verage Power (dB	Bm)
(E	Band V)	4132CH	4183CH	4233CH
WCDMA	12.2kbps RMC	22.66	22.36	22.27
	Subtest 1	22.48	22.18	22.29
HSDPA	Subtest 2	21.57	21.27	21.18
HSDFA	Subtest 3	21.18	20.88	20.79
	Subtest 4	20.97	20.67	20.58
	Subtest 1	22.30	22.35	22.32
	Subtest 2	22.47	22.21	22.09
HSUPA	Subtest 3	22.08	21.82	21.70
	Subtest 4	21.80	21.54	21.42
	Subtest 5	21.61	21.35	21.23
UN	ITS1700	A	verage Power (dB	Bm)
(E	Band V)	1312CH	1412CH	1513CH
WCDMA	12.2kbps RMC	23.38	22.73	23.52
	Subtest 1	22.70	22.05	22.84
HSDPA	Subtest 2	22.29	21.64	22.43
IISDFA	Subtest 3	21.90	21.25	22.04
	Subtest 4	21.69	21.04	21.83
	Subtest 1	22.37	22.33	22.30
	Subtest 2	22.46	22.50	23.33
HSUPA	Subtest 3	22.07	22.11	22.94
	Subtest 4	21.79	21.83	22.66
	Subtest 5	21.60	21.64	22.47



# 2.2 Peak to Average Radio

#### 2.2.1 Definition

Power Complementary Cumulative Distribution Function (CCDF) curves provide a means for characterizing the power peaks of a digitally modulated signal on a statistical basis. A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth. 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.

#### 2.2.2 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

#### 2.2.3 Test Procedures

1. The testing follows FCC KDB 971168 D01 v03r01 Section 5.7.1.

2. The EUT was connected to the spectrum analyzer and system simulator via a power divider.

3. For GSM/EGPRS operating modes:

a. Set EUT in maximum power output.

b. Set the RBW = 1MHz, VBW = 3MHz, Peak detector on spectrum analyzer for first trace.

c. Set the RBW = 1MHz, VBW = 3MHz, RMS detector on spectrum analyzer for second

trace.

d. The wanted burst signal is triggered by spectrum analyzer, and measured respectively the peak level and Mean level without burst-off time, after system simulator has synchronized with the spectrum analyzer.

4. For UMTS operating modes:

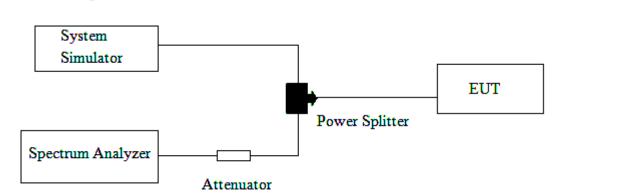
a. Set the CCDF (Complementary Cumulative Distribution Function) option on the spectrum analyzer.

b. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.

5. Record the deviation as Peak to Average Ratio.



# 2.2.4 Test Setup



## 2.2.5 Test Results of Peak-to-Average Ratio

Dand	Channel	Frequency	Peak to Average radio	Limit	Manali at
Band	Channel	(MHz)	dB	dB	Verdict
CSM	512	1850.2	0.4		PASS
GSM 1900MHz	661	1880.0	0.3	13	PASS
1900101112	810	1909.8	0.3		PASS
EDCE	512	1850.2	3.3		PASS
EDGE 1900MHz	661	1880.0	3.5	13	PASS
190010112	810	1909.8	3.5		PASS
WCDMA	9262	1852.4	3.12		PASS
1900MHz	9400	1880.0	3.13	13	PASS
1900/01/12	9538	1907.6	3		PASS
WCDMA	1312	1712.4	2.83		PASS
WCDMA 1700MHz	1412	1732.4	3.05	13	PASS
1700101112	1513	1752.6	2.91		PASS



# 2.3 99% Occupied Bandwidth and 26dB Bandwidth Measurement

#### 2.3.1 Definition

The 99% occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean transmitted power.

The emission bandwidth is defined as the width of the signal between two points, located at

the 2 sides of the carrier frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

### 2.3.2 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

### 2.3.3 Test Procedures

1. The testing follows FCC KDB 971168 D01 v03r01 Section 4.2.

2. The EUT was connected to the spectrum analyzer and system simulator via a power divider.

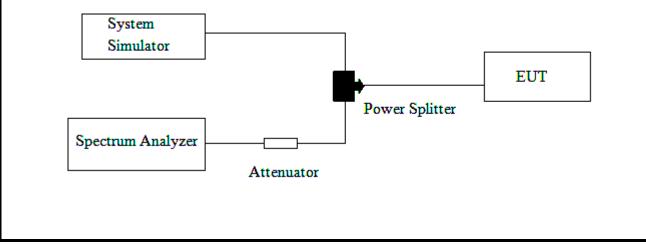
3. The RF output of the EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

4. The 99% occupied bandwidth were measured, set RBW= 1% of span, VBW= 3\*RBW, sample detector, trace maximum hold.

5. The 26dB bandwidth were measured, set RBW= 1% of EBW, VBW= 3\*RBW, peak detector, trace maximum hold.

# 2.3.4 Test Setup



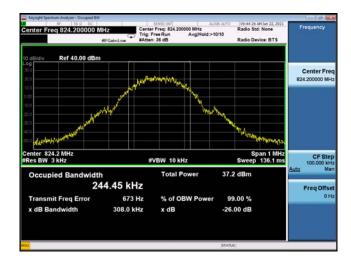


#### 26dB 99% Occupied Frequency Band Channel bandwidth Bandwidth Refer to Plot (MHz) (KHz) (KHz) 128 824.2 308 244.45 Plot A1 GSM 850MHz 190 836.6 313.7 245.24 Plot A2 251 Plot A3 848.8 308.6 244.25 Plot B1 512 1850.2 306.9 245.03 661 1880.0 Plot B2 GSM 1900MHz 311.4 243.24 810 1909.8 311.8 243.97 Plot B3 128 824.2 Plot C1 292.1 234.86 190 292.0 Plot C2 EDGE 850MHz 836.6 234.66 251 Plot C3 848.8 262.9 238.24 512 1850.2 305.3 249.9 Plot D1 1880.0 296.2 Plot D2 661 238.83 EDGE 1900MHz 299.3 810 1909.8 238.72 Plot D3 4132 826.4 Plot E1 4687 4167.7 4183 4171.7 Plot E2 WCDMA 850MHz 836.6 4703 4233 4715 4176.9 Plot E3 846.6 9262 1852.4 4169.6 Plot F1 4702 Plot F2 WCDMA 1900MHz 9400 1880 4684 4169.4 9538 1907.6 4703 4158.3 Plot F3 1312 1712.4 4718 4162.9 Plot G1 1732.4 Plot G2 WCDMA 1700MHz 1412 4704 4172.8 1513 1752.6 4697 4174.5 Plot G3

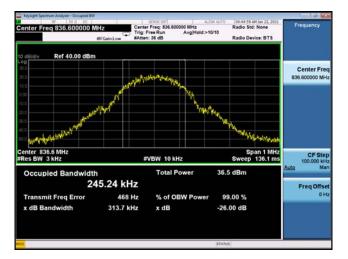
#### 2.3.5 Test Results of 99% Occupied Bandwidth and 26dB Bandwidth



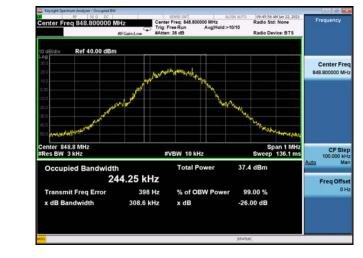
# 2.3.6 Test Results (Plots) of 99% Occupied Bandwidth and 26dB Bandwidth



(Plot A1: GSM 850MHz Channel = 128 Occupied bandwidth)



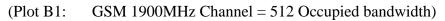
(Plot A2: GSM 850MHz Channel = 190 Occupied bandwidth)

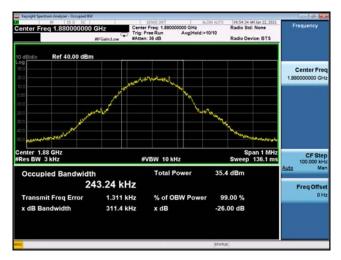


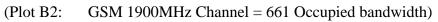
(Plot A3: GSM 850MHz Channel = 251 Occupied bandwidth)

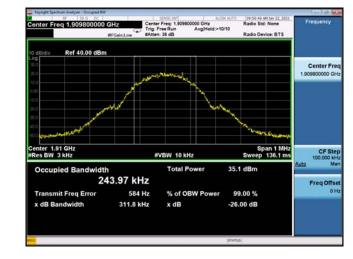








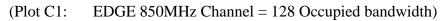




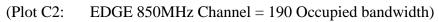
(Plot B3: GSM 1900MHz Channel = 810 Occupied bandwidth)







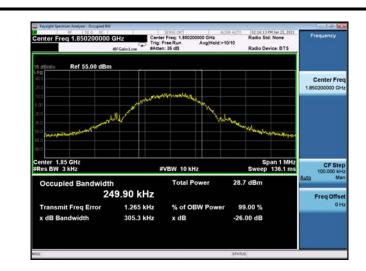


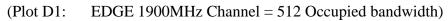


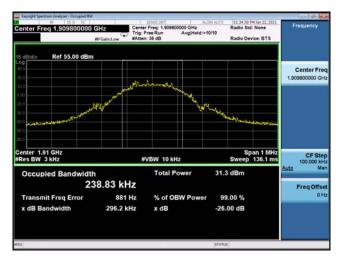


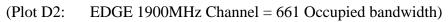
(Plot C3: EDGE 850MHz Channel = 251 Occupied bandwidth)

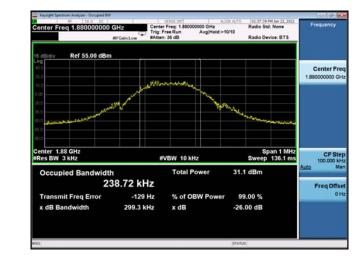












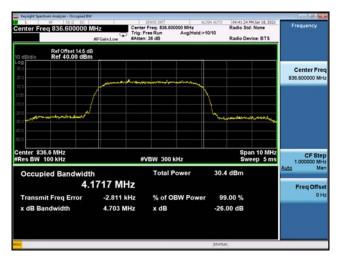
(Plot D3: EDGE 1900MHz Channel = 810 Occupied bandwidth)



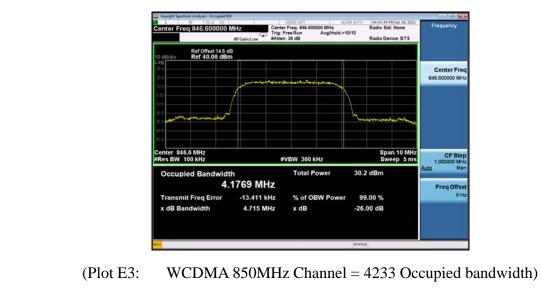
#Res BW 100 kHz #VBW 300 kHz Sweep 5 ms Occupied Bandwidth Total Power 29.9 dBm		2 it Freq Error ndwidth		MHZ 92 kHz 7 MHz	% of OE x dB	3W Power		.00 % 00 dB		Fre	q Offs 01
Center S26.4 MHz Span 10 MHz	Occup				Total P	ower	29.9	dBm			M
10 dBld/v Ref 40.00 dBm Center 20 00 00 00 00 00 00 00 00 00					VBW 300 k	Hz					CF Ste
10 dBld/v Ref 40.00 dBm Center 20 00 00 00 00 00 00 00 00 00	60.0										
10 dBidd/w Ref 40.00 dBm 30 0 10 0	300 200	watthe season and a second					ha	with Heat, a.	water		
10 dBiddir Ref 40.00 dBm 20 0 10 0			1				1				
10 dBld/v Ref 40.00 dBm Center 20 Center 20 Center			1			1					
10 dB/dly Ref 40.00 dBm			مېرىن.	un and the second	enorge starbar	were .					
Ref Offset 14.5 dB	Log	Ref 40.00 di	ыш 							Cen	ter Fr
		Ref Offset 14.5	dB								
Center Freq 826.400000 MHz Center Freq 826.400000 MHz Radio Std: None Frequence #If GainLow States: 3 dB Radio Device: BTS	Center Pre	q 826.40000		Trig: I	Free Run	Avg Hold:>1	0/10				



WCDMA 850MHz Channel = 4132 Occupied bandwidth)

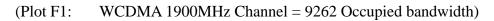


WCDMA 850MHz Channel = 4183 Occupied bandwidth) (Plot E2:



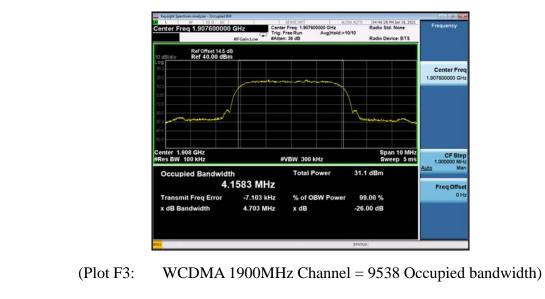


Center Fre	eq 1.852400000	#FGain:Low #Ats	ter Freq: 1.852400000 Gi : Free Run Avg/ en: 36 dB	Hz Hold:>10/10	Radio Std: None Radio Device: BTS	Frequency
10 dB/div	Ref Offset 14.5 dB Ref 40.00 dBm					
30.0			the last transfer and so the			Center Fre 1.852400000 GH
10.0		1 martine		my		
10.0	-	1				
300	manner			14	and the second	
40.0						
Center 1.8 #Res BW			#VBW 300 kHz		Span 10 MHz Sweep 5 ms	CF Ste 1.000000 MH
Occup	ied Bandwidth	1	Total Power	29.	5 dBm	Auto Ma
	4.1	696 MHz				Freq Offse
Transm	it Freq Error	2.682 kHz	% of OBW P	ower 9	9.00 %	OH
x dB Ba	ndwidth	4.702 MHz	x dB	-26	.00 dB	



Keysight Spectrum Analyse - Occupied ID L NF 56 9 DC Center Freq 1.880000000	GHz Cente	SENSE INT r Freq: 1.88000000 GHz Free Run Avg[Hold: n: 36 dB	Radio Sto		Frequency
Ref Offset 14.5 d 10 dB/dlv Ref 40.00 dBn	B		And of		
20.0	الم و مر و	100 mm			Center Freq 1.88000000 GHz
10.0 0.00 10.0	$\int$				
200 300			Human	and a	
Center 1.88 GHz #Res BW 100 kHz		VBW 300 kHz	Spa	n 10 MHz eep 5 ms	CF Step
Occupied Bandwidt		Total Power	29.8 dBm		1.000000 MH Auto Mar Freg Offse
Transmit Freq Error x dB Bandwidth	-6.478 kHz 4.684 MHz	% of OBW Powe x dB	er 99.00 % -26.00 dB		OH
160			STATUS		

(Plot F2: WCDMA 1900MHz Channel = 9400 Occupied bandwidth)

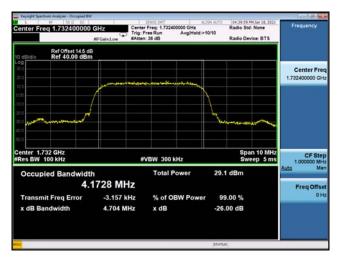




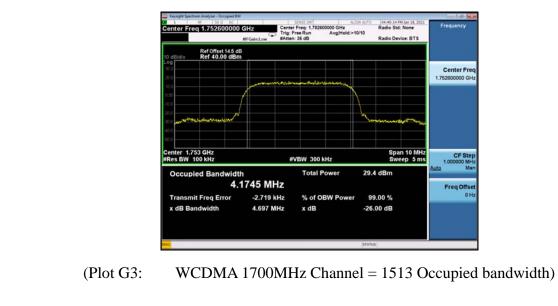
Center 1.712 G #Res BW 100 k Occupied	Hz Bandwidth	629 MHz	#VBW 300 ki			pan 10 MHz weep 5 ms	CF Ste 1.000000 MH Auto Ma
Center 1.712 G			#VBW 300 kt	Hz		weep 5 ms	1,000000 MH
40.0					Vanderson		
300	manual				Maderner		
10.0							
10.00				- Marine			
20.0							Center Fre
10 dB/div Re	f Offset 14.5 dB f 40.00 dBm						
Center Freq 1.		Tr	inter Freq: 1.712400 ig: Free Run itten: 36 dB	0000 GHz Avg Hold:>10	/10	itd: None levice: BTS	Frequency



WCDMA 1700MHz Channel =1313 Occupied bandwidth)



- (Plot G2:
- WCDMA 1700MHz Channel =1413 Occupied bandwidth)





# 2.4 Frequency Stability

#### 2.4.1 Requirement

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within  $\pm 0.00025\%$  ( $\pm 2.5$ ppm) of the center frequency.

#### 2.4.2 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

#### 2.4.3 Test Procedures for Temperature Variation

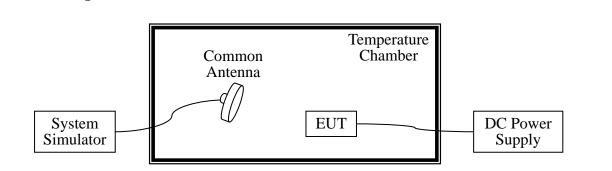
- 1. The testing follows FCC KDB 971168 D01 v03r01 Section 9.0.
- 2. The EUT was set up in the thermal chamber and connected with the system simulator.
- 3. With power OFF, the temperature was decreased to -30°C and the EUT was stabilized before testing. Power was applied and the maximum change in frequency was recorded within one minute.
- 4. With power OFF, the temperature was raised in 10°C steps up to 50°C. The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute.

#### 2.4.4 Test Procedures for Voltage Variation

- 1. The testing follows FCC KDB 971168 D01 v03r01 Section 9.0.
- 2. The EUT was placed in a temperature chamber at 25±5° C and connected with the system simulator.
- 3. The power supply voltage to the EUT was varied from BEP to 115% of the nominal value measured at the input to the EUT.
- 4. The variation in frequency was measured for the worst case.



# 2.4.5 Test Setup



# 2.4.6 Test Results of Frequency Stability

#### GSM 850MHz Band

Band:		GS	M 850	Channel:	190		
Limit(ppm):	Limit(ppm):			Frequency:	836.6MHz		
Power	Temperatu	ire	GSM	EDGE			
(VDC)	(°C)	ne	Deviation	Deviation	Result		
(VDC)	(0)		(ppm)	(ppm)			
	-30		0.003	0.007			
	-20		0.002	0.011			
	-10		0.003	0.003			
	0		0.004	0.024			
3.85	+10		0.012	0.002			
	+20		0.005	0.014	PASS		
	+30		0.008	0.014			
	+40		0.007	0.009			
	+50	0.006		0.003			
4.2	+25		0.007	0.003			
3.4	+25		0.004	0.004			



### GSM 1900MHz Band

Band:		GS	M 1900	Channel:	661		
Limit(ppm):	Limit(ppm):			Frequency:	1880.0MHz		
Power (VDC)	Temperatu (°C)	ıre	GSM Deviation (ppm)	EDGE Deviation (ppm)	Result		
	-30		0.005	0.003			
	-20		0.009	0.003			
	-10		0.007	0.009			
	0		0.017	0.008			
3.85	+10		0.007	0.009			
	+20		0.013	0.020	PASS		
	+30		0.007	0.020			
	+40		0.009	0.021			
	+50	0.011		0.009			
4.2	+25		0.055	0.000			
3.4	+25		0.028	0.007			

#### WCDMA 850MHz Band

Band:	WCDMA Ba	nd V Channel:	4183
Limit(ppm)	: 2.5	Frequency:	836.6MHz
Power (VDC)	Temperature (°C)	RMC 12.2Kbps Deviation (ppm)	Result
	-30 -20	0.002 0.011	
	-10 0	0.021 0.014	
3.85	+10 +20	0.023 0.009	PASS
	+30 +40	0.008 0.008	
4.2	+50 +25	0.009	
3.4	+25	0.013	



CDMA 1900N	AHz Ban	d				
Band:		WCDMA Band II		Channel:	9400	
Limit(ppm):	Limit(ppm): 2.5			Frequency:	1880.0MHz	
Power	Tama		Ι	RMC 12.2Kbps		
	-	perature		Deviation	Result	
(VDC)	(	°℃)		(ppm)		
		-30		0.009		
	-20			0.009		
		-10		0.016		
		0		0.009		
3.85	-	+10		0.009		
	-	+20		0.010	PASS	
	-	+30		0.013		
	-	+40		0.010		
	-	+50	0.009			
4.2	-	+25		0.005		
3.4	-	+25		0.010		

#### WCDMA 1700MHz Band

Band:		WCDMA	Band IV	Channel:	1412
Limit(ppm):		2.5	Frequency:		1732.4MHz
Power (VDC)		Temperature (°C)		AC 12.2Kbps Deviation (ppm)	Result
		-30 -20 -10		0.004 0.007 0.008	
3.85		0 +10	0.013 0.005		
		+20 +30 +40		0.007 0.018 0.012	PASS
4.2	-	+40 +50 +25	0.012 0.014 0.008		
3.4	-	+25		0.008	



# 2.5 Conducted Out of Band Emissions

#### 2.5.1 Requirement

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least  $43 + 10 \log (P) dB$ .

It is measured by means of a calibrated spectrum analyzer and scanned from 30 MHz up to a frequency including its 10th harmonic.

#### 2.5.2 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

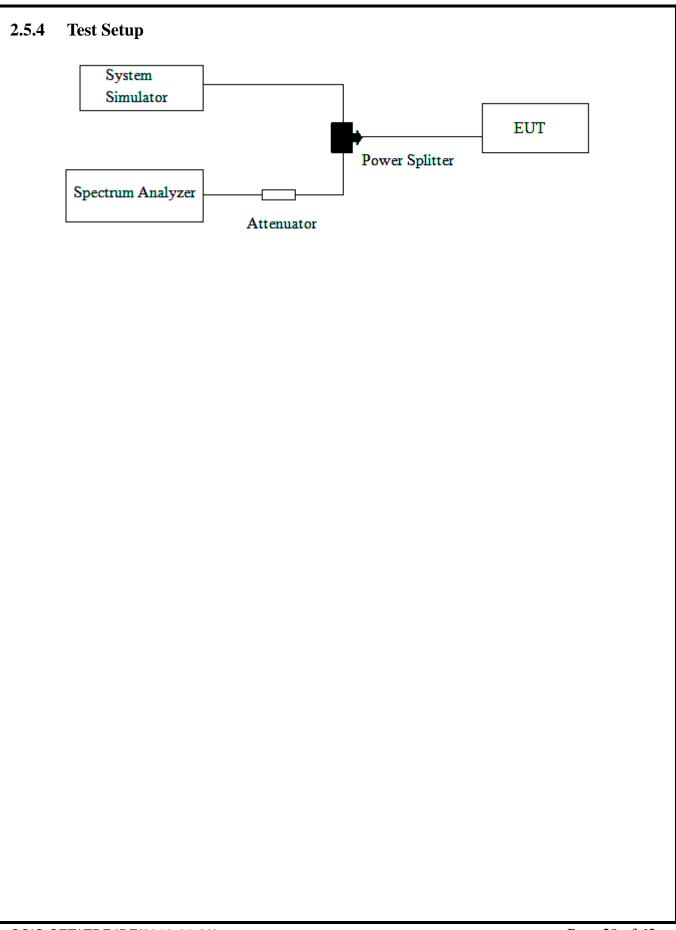
#### 2.5.3 Test Procedures

- 1. The testing follows FCC KDB 971168 D01 v03r01 Section 6.0.
- 2. The EUT was connected to the spectrum analyzer and system simulator via a power divider.
- 3. The RF output of EUT was connected to the spectrum analyzer by an RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 4. The middle channel for the highest RF power within the transmitting frequency was measured.
- 5. The conducted spurious emission for the whole frequency range was taken.
- 6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
- 7. The limit line is derived from  $43 + 10\log(P)$  dB below the transmitter power P(Watts)

= P(W) - [43 + 10log(P)] (dB)

- = [30 + 10log(P)] (dBm) [43 + 10log(P)] (dB)
- = -13dBm.
- For 9KHz to 30MHz: the amplitude of spurious emissions are attenuated by more than 20dB below the permissible value has no need to be reported.

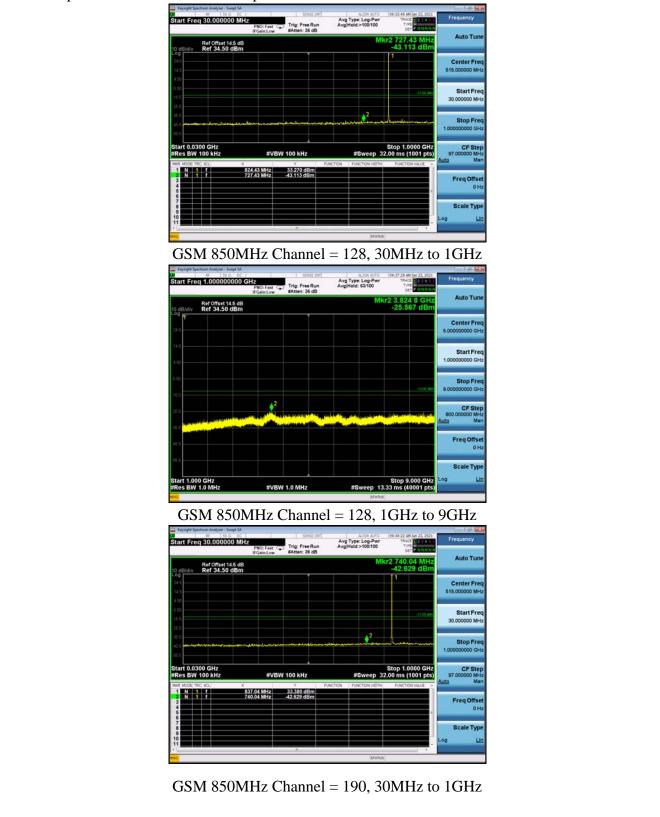






# 2.5.5 Test Result (Plots) of Conducted Spurious Emission

Note: For 9 KHz to 30MHz: the amplitude of spurious emissions is attenuated by more than 20dB below the permissible value, so we not provide the test result here.



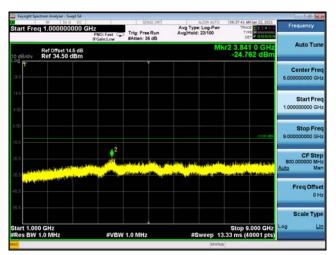


Keysight Spectrum Ana	Ayzer - Swept SA		SENSE INT	A ISN A	710 09-37:35 AM Jan 22, 2021	010 00	
start Freq 1.00		PNO: Fast		Avg Type: Log-P Avg/Hold: 23/100	WT TRACE	Frequency	
		IFGain:Low	#Atten: 36 dB		DET P NNNN	Auto Tune	
Ref Offset 14.5 dB Mkr2 8.297 6 GHz 10 dB/dly Ref 34.50 dBm -26.219 dBm							
o delidiv Ref 3						Center Free	
24.5						5.00000000 GH:	
14.5						Start Free	
4.537						1.000000000 GH:	
6.60						Stop Free	
155					-13.00 dfm	9.00000000 GH:	
25.5					¢ <sup>2</sup>	CF Step	
	N. Harrison				Charles and the second states of the	Auto Mar	
WARDING PART	and the second second					FregOffse	
45.5						0 H:	
15.5						Scale Type	
start 1.000 GHz					Stop 9.000 GHz	Log Lir	
Res BW 1.0 M	IZ	#VBW	/ 1.0 MHz	#Sweep	13.33 ms (40001 pts)		

GSM 850MHz Channel = 190, 1GHz to 9GHz

Start Freq 3	30.000000	PNO: Fast	Trig: Free R	Avg Avg	Type: Log-Pwr Hold:>100/100	TRAC	M.Jan 22, 2621 26 1 2 3 4 5 PE MUNICIPALITY T PLANNING	Frequency		
0 dB/div	Ref Offset 14.5 dB Mkr2 740.04 MH3 dB/dly Ref 34.50 dBm ~43.049 dBm									
24.5						1		Center Free 515.000000 MH		
5.50 15.5							,13.00 #De	Start Fre 30.000000 MH		
35.5 45.5 95.5	el.v	internation internation	banda - Antonia (ang Pang	alaan ya dadare		untur		Stop Fre 1.000000000 GH		
tart 0.0300 Res BW 10	0 kHz	х	/BW 100 kHz	FUNCTION	#Sweep 3	2.00 ms (	0000 GHz 1001 pts)	CF Ste 97.000000 MH <u>Auto</u> Ma		
2 N 1 3 4 5		848.68 MHz 740.04 MHz	33.152 dBn -43.049 dBn	n 				Freq Offse 0 H		
6 7 8 9	=							Scale Type		

GSM 850MHz Channel = 251, 30MHz to 1GHz



GSM 850MHz Channel = 251, 1GHz to 9GHz



Keysight Spectrum Analyzer - Swept SA		N) - 20550371		0.0
tart Freq 30.000000 MH	PNO: Fast CTrig: Free Run #Gain:Low #Atten: 36 dB	Avg Type: Log-Pwr Avg Hold:>100/100	10:49:53 AM Jan 22, 2021 TRACE 2 2 3 4 5 TYPE AMMENT	Frequency
Ref Offset 14.5 dB 0 dB/div Ref 34.50 dBm	In Construction	М	kr1 847.63 MHz -42.474 dBm	Auto Tun
24.5				Center Free 515.000000 MH
4.50				Start Fre 30.000000 MH
6.50			-13.00 dbs	Stop Fre 1.000000000 GH
255				CF Ste 97.000000 MH Auto Ma
	waren generalista an	ugharansing generation applicage	mathemathics	Freq Offse 0 H
				Scale Type
Start 0.0300 GHz Res BW 100 kHz	#VBW 100 kHz	Sweep 3	Stop 1.0000 GHz .200 ms (1001 pts)	

# GSM 1900MHz Channel = 512, 30MHz to 1GHz

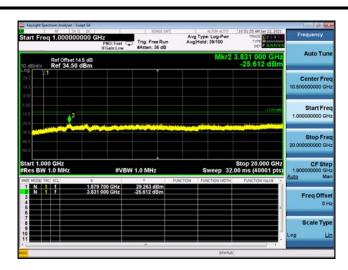
Frequency	10:50:46 AM Jan 22, 2021	ALIGN AUTO		SENSE 27		50 Q DC	RF	1.1.1.1.1
Prequency	TYPE NUMBER	Type: Log-Pwr  Hold:>100/100	n Avg	Trig: Free Run	PNO: Fast C IFGain:Low	000000000	req 1.0	art Fr
Auto Tun	3.861 400 GHz -25.085 dBm	Mkr2			1	Offset 14.5 dl f 34.50 dBr	Ref	dB/div
Center Fre 10.50000000 GH							1	<b>9</b> 15 15
Start Fre 1.000000000 GH	-13 00 404					2 <sup>2</sup>		50
Stop Fre 20.000000000 GH								3 <b>****</b>
CF Ste 1.900000000 GH Auto Ma	Stop 20.000 GHz 00 ms (40001 pts)			V 1.0 MHz	#VB	MHz	000 GH W 1.0 N	es Bl
Freq Offse	FUNCTION VALUE	FUNCTION WOTH	FUNCTION	29.649 dBm -25.085 dBm	850 250 GHz 861 400 GHz	1	TRC SCL	NN
Scale Typ								

## GSM 1900MHz Channel = 512, 1GHz to 20GHz



GSM 1900MHz Channel = 661, 30MHz to 1GHz





GSM 1900MHz Channel = 661, 1GHz to 20GHz



GSM 1900MHz Channel = 810, 30MHz to 1GHz



GSM 1900MHz Channel = 810, 1GHz to 20GHz

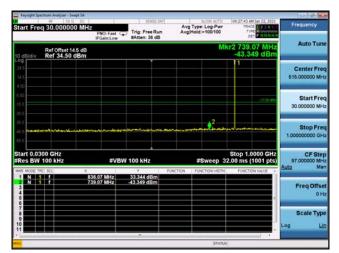


Keysight Spect	NF 50.0 D	A	SENSE INT	ALISN AUTO	09-27-20 AM Jan 22, 2021	0.0.0
tart Freq	30.000000 N	PNO: Fast O IFGain:Low	Trig: Free Run	Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 2 2 4 5 TYPE MUNICIPULATION	Frequency
0 dB/div	Ref Offset 14.5 c Ref 34.50 dB	18 m		М	kr2 727.43 MHz -42.723 dBm	Auto Tun
0g 245 145					¥1	Center Fre 515.000000 MH
15.5 15.5					13.00 atte	Start Fre 30.000000 MH
8.5 6.5	8 m - Mart 19 (19 m mart - 19		and interior and the second	2 p.		Stop Fre 1.000000000 GH
tart 0.030 Res BW 1		#VB	W 100 kHz	#Sweep 3	Stop 1.0000 GHz 2.00 ms (1001 pts)	CF Ste 97.000000 MH
MAR MODE TRO	1	× 824.43 MHz	29.033 dBm	FUNCTION   FUNCTION WOTH	FUNCTION VALUE .	Auto Ma
2 N 1 3 4 5		727.43 MHz	-42.723 dBm			Freq Offse 0 H
6 7 8 9						Scale Typ
10						Log L
50				STATU	5	

EDGE 850MHz Channel = 128, 30MHz to 1GHz



EDGE 850MHz Channel = 128, 1GHz to 9GHz



EDGE 850MHz Channel = 190, 30MHz to 1GHz





## EDGE 850MHz Channel = 190, 1GHz to 9GHz

tart Freq 30.000000 MH:		Trig: Free Run	Avg	ALIGN AUTO Type: Log-Pwr Hold:>100/100	TRAC	PE COMMUNIC	Frequency
	PNO: Fast G IFGain:Low	#Atten: 36 dB			01	68 MHz	Auto Tu
Ref Offset 14.5 dB dB/dlv Ref 34.50 dBm					41.9	58 dBm	
9g 45 45					01		Center Fr 515.000000 M
55 55						(13.90 athe	Start Fr 30.000000 M
55 55 <b>52 2010 - 2010 - 2010 - 2010 - 2010</b> 55	inenstaprenstaturen der	interlarisasi tarbah		2	l.	anthy has made	Stop Fr 1.000000000 G
						1000 CH-	-
Res BW 100 kHz	#VBW	100 kHz	FUNCTION	#Sweep 32		1001 pts)	CF St 97.000000 M <u>Auto</u> N
Res BW 100 kHz IR MODE TRCI SCL X 1 N 1 f 8 2 N 1 f 7 3 4 5	48.68 MHz	100 kHz 26.997 dBm 41.958 dBm	FUNCTION	#Sweep 32	2.00 ms (	1001 pts)	97.000000 M
	48.68 MHz	26.997 dBm	FUNCTION		2.00 ms (	1001 pts)	97.000000 M Auto N Freq Offs

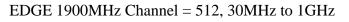
### EDGE 850MHz Channel = 251, 30MHz to 1GHz



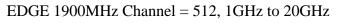
EDGE 850MHz Channel = 251, 1GHz to 9GHz



Keysight Spectrum Analyzer - Swept SA		SENSE INT	ALIGN AUTO	62:11:17 PM Jan 22, 2621	0 0 0
Start Freq 30.000000 MHz		Trig: Free Run #Atten: 36 dB	Avg Type: Log-Pwr Avg Hold:>100/100	TRACE	Frequency
Ref Offset 14.5 dB	1. Gentled H		N	kr1 923.37 MHz -39.814 dBm	Auto Tun
15.0					Center Fre 515.000000 MH
5.00					Start Fre 30.000000 MH
15.0				.13.00 (5%	Stop Fre 1.000000000 GH
350	versen and and a	ومورة عاريبي والعيان	الرجع ويعرف المراجع الم	Allen welcome	CF Ste 97.000000 MH <u>Auto</u> Ma
55.0					Freq Offse 0 H
65 0 Start 0.0300 GHz				Stop 1.0000 GHz	Scale Typ
Res BW 100 kHz	#VBW	100 kHz	Sweep	3.200 ms (1001 pts)	







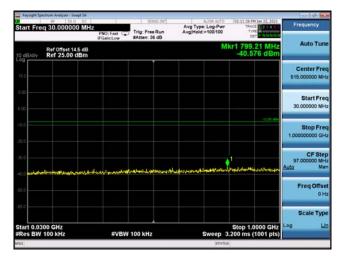


EDGE 1900MHz Channel = 661, 30MHz to 1GHz



Keysight Spectrum Analyzer - Su					0.0
arker 2 3.8604500	PNO: Fast	Trig: Free Run	Avg Type: Log-Pwr Avg[Hold: 41/100	02:12:54 PM Jan 22, 2021 TRACE 2 2 4 5 TYPE PURCHASE	Peak Search
Ref Offset 1- dB/div Ref 40.00	IFGain:Low 4.5 dB dBm	#Atten: 36 dB	Mkr2	3.860 450 GHz -25.485 dBm	NextPeak
					Next Pk Righ
00				-13.00 aD+	Next Pk Lef
0.0	and in the second state		Annon the Manual Line	de la citiza de dititiza de	
					Marker Delt
tart 1.000 GHz Res BW 1.0 MHz	#V8	W 1.0 MHz		Stop 20.000 GHz .00 ms (40001 pts)	
tart 1.000 GHz Res BW 1.0 MHz M 100E TRC Scl.	#VE * 1.879 700 GHz 3.880 450 GHz	W 1.0 MHz 25.375.dBm -25.485.dBm	Sweep 32 PUNCTION FUNCTION WOTH	Stop 20.000 GHz .00 ms (40001 pts) Function value	Marker Delt
tart 1.000 GHz Res BW 1.0 MHz R MODE TRC SCL 1 N 1 f	X 1,879 700 GHz	7 25.375 dBm		.00 ms (40001 pts)	
a : tart 1.000 GHz Res BW 1.0 MHz we Hote The Sc. 1 N 1 f 3 1 f 3 4 6	X 1,879 700 GHz	7 25.375 dBm		.00 ms (40001 pts)	Mkr→Cl

EDGE 1900MHz Channel = 661, 1GHz to 20GHz



EDGE 1900MHz Channel = 810, 30MHz to 1GHz

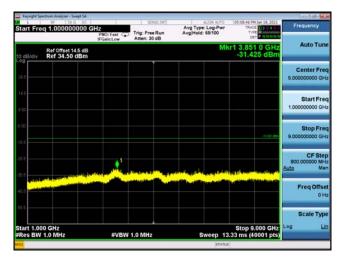


EDGE 1900MHz Channel = 810, 1GHz to 20GHz

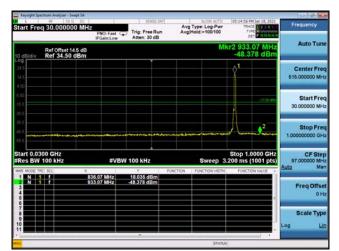


	6.17	SENSE INT	AUGN AUTO Avg Type: Log-Pwr	05:14:34 PM Jan 18, 2021 TRACE DE CONTRACE	Frequency		
tart Freq 30.000000 N	PNO: Fast C IFGain:Low	Trig: Free Run Atten: 30 dB	Avg/Hold:>100/100	TYPE HWWWWW DET P NNNNN	Auto Tun		
Ref offset 145 dB Mkr2 924.34 MHz o dB/d/v Ref 34.50 dBm -47.667 dBm							
24 5 14 5 4 50				¢¹	Center Fre 515.000000 MF		
5.50				13.00 abe	Start Fre 30.000000 MH		
855 855 855	al Part in the Arts of the Part			Å <b>∮</b> <sup>2</sup>	Stop Fre 1.000000000 GH		
tart 0.0300 GHz Res BW 100 kHz	#VB	W 100 kHz	Sweep 3	Stop 1.0000 GHz 200 ms (1001 pts)	CF Ste 97.000000 MH		
AR MODE TRC. SCL	X 825.40 MHz	7 F	UNCTION FUNCTION WOTH	FUNCTION VALUE	Auto Mi		
2 N 1 f 3 4 6 6	924.34 MHz	-47.667 dBm			Freq Offs 01		
7					Scale Typ		
10					Log L		

WCDMA850MHz Channel = 4132, 30MHz to 1GHz



WCDMA850MHz Channel = 4132, 1GHz to 9GHz



WCDMA850MHz Channel = 4183, 30MHz to 1GHz



Keysight Spectrum Analyzer - Swept SA L RF 50 Q DC	. 11	SENSE INT	ALIGN AU		Frequency
Start Freq 1.000000000 GF	PNO: Fast	Trig: Free Run Atten: 30 dB	Avg Type: Log-P Avg Hold: 16/100	WT TRACE 2 2 4 5 5 TYPE N WINN N DET PINNINN	Prequency
Ref Offset 14.5 dB				Mkr1 3.851 0 GHz -32.749 dBm	Auto Tune
24.5					Center Free 5.000000000 GH
4 53					Start Free 1.000000000 GH
6.50				-12.00 (0%	Stop Fre 9.000000000 GH
255			and a start a start	and the second second second second	CF Step 800.000000 MH <u>Auto</u> Ma
		and and the second second	and the second second		Freq Offse 0 H
65.5					Scale Type
Start 1.000 GHz #Res BW 1.0 MHz	#VBW	1.0 MHz	Sweep	Stop 9.000 GHz 13.33 ms (40001 pts)	Log Li

WCDMA850MHz Channel = 4183, 1GHz to 9GHz

		SENSE.2NT		ALIGN AUTO Type: Log-Pwr	05:15:12 PM TRACE	Jan 18, 2021	Fredu	iency
tart Freq 30.000000 MHz	PNO: Fast	Trig: Free Run Atten: 30 dB		Hold:>100/100	TYPE	PINNN		
Ref Offset 14.5 dB 0 dB/dlv Ref 34.50 dBm	I GHILLOW			Mk	48.46	77 MHz 5 dBm	Auto Tun	
0g 24 5 14 5					<b>∂</b> <sup>1</sup>			iter Fred
55 55						.13.00°±0+		tart Free 0000 MH
65 155 65	و مايوال ميد مايوا ميو	3.mar 1.6	und chair and	an de talen a frañes	M	2 <sup>2</sup>		top Free
					Stop 1.0	000 GHz		CF Ste
tart 0.0300 GHz Res BW 100 kHz	#VBW 1	¥ 1	FUNCTION	Sweep 3.			97.00 <u>Aute</u>	
Res BW 100 kHz           NR MODE TRC, SCL         X           1         N         1         6           2         N         1         7         94           3         4         6         6         6	6.74 MHz	100 kHz 16.733 dBm 48.465 dBm	FUNCTION		.200 ms (1		Auto	Mar offse
Res BW 100 kHz wr moterne: scl: x 1 N 1 7 44 2 N 1 7 94 5 5 6 7 8 9 9	6.74 MHz	y 16.733 dBm	FUNCTION		.200 ms (1		Auto Fre Sc	Mar eq Offse 0 H ale Type
Res BW 100 kHz WR MODE TRC SCL X 1 N 1 7 84 2 N 1 7 94 3 4 5 6 6 7 8	6.74 MHz	y 16.733 dBm	FUNCTION		.200 ms (1		<u>Auto</u> Fre	M 100 pe

WCDMA850MHz Channel = 4233, 30MHz to 1GHz



WCDMA850MHz Channel = 4233, 1GHz to 9GHz



Start 0.0300 GHz #Res BW 100 kHz	#VBW 100 kHz	Sweep 3.	Stop 1.0000 GHz 200 ms (1001 pts)	Log Li	
				Scale Typ	
understatespeetstered.	Andria Indexen Addition (1985)	and the second	unanders - Haltalasines	01	
45.5			<b>1</b>	Freq Offs	
36.5				Auto Mi	
255				CF Ste 97.000000 MH	
18.5			(13.00 <del>(25)</del>	1.00000000 G	
6.50				Stop Fre	
4.537				30.000000 M	
14.5				Start Fre	
24.5				Center Fre 515.000000 Mi	
Ref Offset 14.5 dl 10 dB/div Ref 34.50 dBn	3 1 1	-46.062 dBm			
	PNO: Fast Trig: Free Run IFGain:Low Atten: 30 dB	Avg Hold:>100/100	r1 902.03 MHz	Auto Tur	
Start Freg 30.000000 M	Hz	AUGN AUTO Avg Type: Log-Pwr	05:01:57 PH Jan 18, 2021 TRACE	Frequency	
Keysight Spectrum Analyzer - Swept SA				0.0	

WCDMA1900MHz Channel = 9262, 30MHz to 1GHz

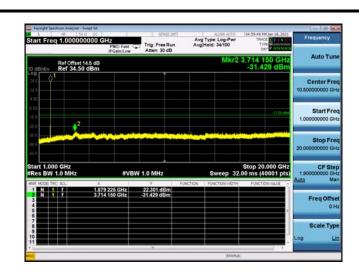
Frequency	04:59:30 PM Jan 18, 2021 TRACE DE DE DE DE	AUGN AUTO		SENSE 3				1
	DET P NNNNN	(Hold: 42/100	n Á	Trig: Free Ru Atten: 30 dB	NO: Fast G	000 GHz	.000000	int Freq
Auto Tur	3.833 850 GHz -31.630 dBm	Mkr2				1.5 dB dBm	of Offset 14	dB/dly
Center Fre 10.500000000 GH								s 1
Start Fre 1.000000000 GF	, 13.00 athu						2	0 5 5
Stop Fre 20.000000000 GH								
CF Ste 1.900000000 GH Auto Mi	Stop 20.000 GHz 00 ms (40001 pts)			1.0 MHz	#VBV		) MHz	art 1.000 es BW 1.
Freq Offs 01	FUNCTION VALUE	FUNCTION WOTH	FUNCTION	22.424 dBm -31.630 dBm		× 1.851 20 3.833 85	1	N 1 N 1
Scale Typ								
LOU								

WCDMA1900MHz Channel = 9262, 1GHz to 20GHz



WCDMA1900MHz Channel = 9400, 30MHz to 1GHz

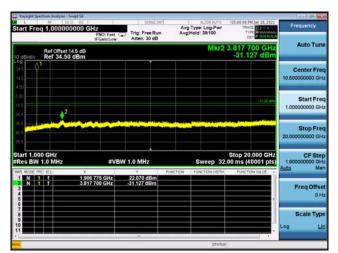




WCDMA1900MHz Channel = 9400, 1GHz to 20GHz

	SENSES			Frequency	
tart Freq 30.000000 Mi	PNO: Fast Trig: Free Rs IFGain:Low Atten: 30 dB	Avg Type: Log-F in Avg Hold:>100/1	00 TYPE MUNICIPAL	Auto Tune	
Ref Offset 14.5 dB dB/div Ref 34.50 dBm		Mkr1 635.28 MHz -46.125 dBm			
og 24.5				Center Free 515.000000 MH	
4.53				Start Free 30.000000 MH	
50			-13 00 181	Stop Free 1.000000000 GH	
55				CF Ste 97.000000 MH Auto Ma	
	العاقب والعارية ومالك أووحه والمعارية ومعاقاتهما	م المجمود مساركة شور معادي الم	n, halfed yn y Mildelman y Parsferdio a gant arffyrgan	Freq Offse 0 H	
55				Scale Type	
tart 0.0300 GHz Res BW 100 kHz	#VBW 100 kHz	Swee	Stop 1.0000 GHz p 3.200 ms (1001 pts)		

WCDMA1900MHz Channel = 9538, 30MHz to 1GHz



WCDMA1900MHz Channel = 9538 1GHz to 20GHz



45.5	alah yakiki kupungi katika	inan lateration for the	ilgen jähnn annan	الإربعينان رميل ريدوال رميان	yang di manang manan Na kanang manang mana	Freq Offse
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-45.5					and the second	FreqOffse
					.1	Children Chi
35.5						Auto Ma
25.5						CF Ste 97.000000 Mi
15.5						
6-50						Stop Fre
4.137						30.000000 Mi
14.5						Start Fre
24.5						515.000000 Mi
						Center Fre
10 dB/div	Ref Offset 14.5 dB Ref 34.50 dBm			м	kr1 855.47 M -45.047 dE	12
Start Free	4 30.000000 Mi	PNO: Fast C	Trig: Free Run Atten: 30 dB	AvgjHold:>100/100	TYPE M WWW DET P NAM	1 1 1
Start Erec	IF 56 9 DC		SENSE INT	AUGN AUTO Avg Type: Log-Pwr	04:56:57 PM Jan 18, 2 TRACE DI 200	Frequency

WCDMA1700MHz Channel = 1312, 30MHz to 1GHz

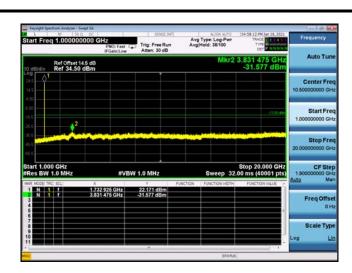
Carlotter and the second	04:57:54 PM Jan 18, 2021	ALIGN AUTO	EINT	SEN	A MARK THE	F 50 Q DC	Keysight Spectrum A
Frequency	TRACE 2 2 4 5 TYPE MONOMIN DET P NNNNN	g Type: Log-Pwr g Hold: 42/100		Trig: Free Atten: 30	PNO: Fast C	000000000	art Freq 1.0
Auto Tun	3.843 825 GHz -31.900 dBm	Mkr2			3	f Offset 14.5 dB f 34.50 dBm	dB/div Ref
Center Fre 10.500000000 GH							9 L5 L5 S0
Start Fre 1.000000000 GH	-13.00 athe					¢2	50 15
Stop Fre 20.000000000 GH			<b>N<sup>al</sup>yrian</b>				15 15 15
CF Ste 1.90000000 GH Auto Ma	Stop 20.000 GHz 00 ms (40001 pts)	Sweep 32.	FUNCT	V 1.0 MHz		MHz	art 1.000 GH Res BW 1.0 M
Freq Offse			m	21.729 dB -31.900 dB	712 025 GHz 843 825 GHz	1	N 1 7

WCDMA1700MHz Channel = 1312, 1GHz to 20GHz



WCDMA1700MHz Channel = 1412, 30MHz to 1GHz

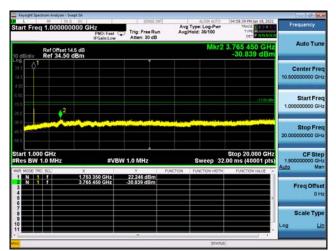




WCDMA1700MHz Channel = 1412, 1GHz to 20GHz



WCDMA1700MHz Channel = 1513, 30MHz to 1GHz



WCDMA1700MHz Channel =1513 1GHz to 20GHz



# 2.6 Bandedge

#### 2.6.1 Requirement

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least  $43 + 10 \log (P) dB$ .

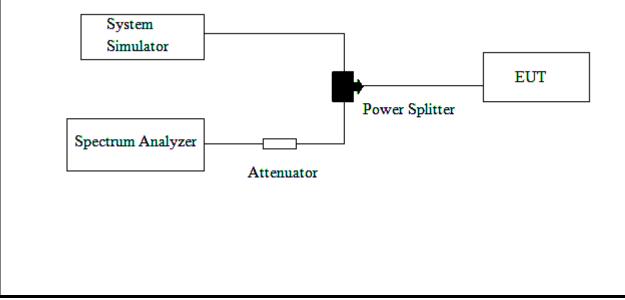
## 2.6.2 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

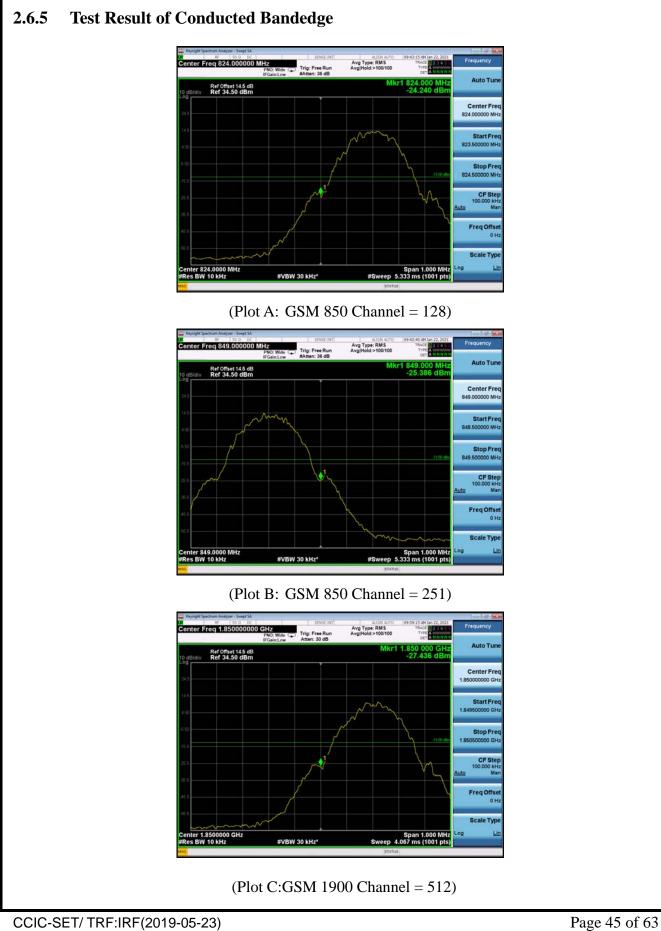
## 2.6.3 Test Procedures

- 1. The testing follows FCC KDB 971168 D01 v03r01 Section 6.0.
- 2. The EUT was connected to the spectrum analyzer and system simulator via a power divider.
- 3. The RF output of EUT was connected to the spectrum analyzer by an RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 4. The band GPRSs of low and high channels for the highest RF powers were measured.
- 5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
- 6. The limit line is derived from  $43 + 10\log(P)$  dB below the transmitter power P(Watts)
  - = P(W) [43 + 10log(P)] (dB)
  - $= [30 + 10\log(P)] (dBm) [43 + 10\log(P)] (dB)$
  - = -13dBm.

## 2.6.4 Test Setup

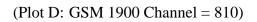




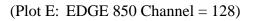








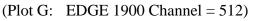




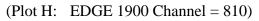




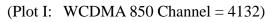






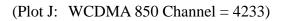




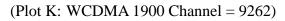














(Plot L: WCDMA 1900 Channel = 9538)





(Plot M: WCDMA 1700 Channel = 1312)



(Plot N: WCDMA 1000 Channel = 1513)



# 2.7 Transmitter Radiated Power (EIRP/ERP)

## 2.7.1 Requirement

The substitution method, in ANSI / TIA / EIA-603-D-2010, was used for ERP/EIRP measurement, and the spectrum analyzer configuration follows KDB 971168 D01 Power Meas. License Digital Systems v03r01. The ERP of mobile transmitters must not exceed 7 Watts (Cellular Band) and the EIRP of mobile transmitters are limited to 2 Watts (PCS Band) and 1 Watts (AWS Band).

## 2.7.2 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

## 2.7.3 Test Procedures

- 1. The testing follows FCC KDB 971168 D01 v03r01 Section 5.2.1. (for CDMA/WCDMA), Section 5.2.2.2 (for GSM/GSM/GPRS) and ANSI / TIA-603-D-2010 Section 2.2.17.
- 2. The EUT was placed on a turntable 1.5 meters high in a fully anechoic chamber.
- 3. The EUT was placed 3 meters from the receiving antenna, which was mounted on the antenna tower.
- 4. GSM operating modes: Set RBW= 1MHz, VBW= 3MHz, RMS detector over burst;

UMTS operating modes: Set RBW= 100 kHz, VBW= 300 kHz, RMS detector over frame, and use channel power option with bandwidth=5MHz, per KDB 971168 D01 v03r01.

- 5. The table was rotated 360 degrees to determine the position of the highest radiated power.
- 6. The height of the receiving antenna is adjusted to look for the maximum ERP/EIRP.
- 7. Taking the record of maximum ERP/EIRP.
- 8. A dipole antenna was substituted in place of the EUT and was driven by a signal generator.





9. The conducted power at the terminal of the dipole antenna is measured.

10. Repeat step 3 to step 5 to get the maximum ERP/EIRP of the substitution antenna.

11. ERP/EIRP = Ps + Et - Es + Gs = Ps + Rt - Rs + Gs

Ps (dBm): Input power to substitution antenna.

Gs (dBi or dBd): Substitution antenna Gain.

Et = Rt + AF Es = Rs + AF

AF (dB/m): Receive antenna factor

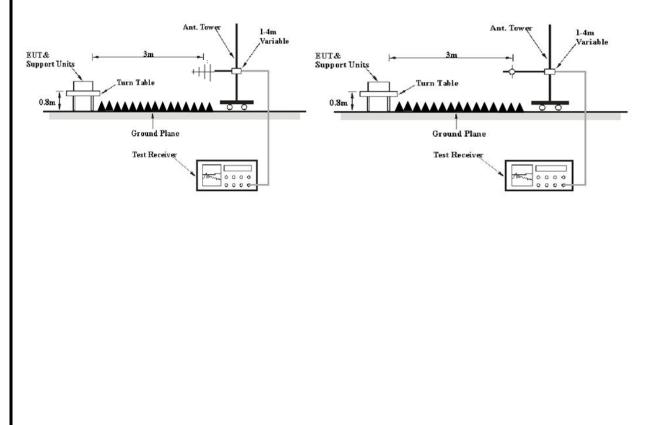
Rt: The highest received signal in spectrum analyzer for EUT.

Rs: The highest received signal in spectrum analyzer for substitution antenna.

# 2.7.4 Test Setup

Below 1GHz

Above 1GHz





# 2.7.5 Test Result of Transmitter Radiated Power

Test Notes:

1. This device employs GMSK technology with GSM capabilities. All configurations were investigated and the worst case emissions were found in GSM mode.

2. This device employs UMTS technology with WCDMA (AMR/RMC), HSDPA, HSUPA capabilities. All configurations were investigated and the worst case UMTS emissions were found in RMC WCDMA mode at 12.2Kbps.

3. This unit was tested with its standard battery.

4. The worst case test configuration was found in the vertical positioning where the EUT is laying on its side. The data reported in the tables below were measured in this test setup.

Dond	Channel	Frequency	DCI	Antenna Pol	Measured ERP	Limit	Vardiat
Band	Dand Channel	(MHz)	PCL	(H/V)	dBm	dBm	Verdict
	128 82	824.20	5	Н	32.50		PASS
	120	824.20	20 5	V	31.38	38.5	
GSM	190	926 60	5	Н	32.45		PASS
850MHz	190	836.60		V	31.25		
	251 848.80	1 040.00	~	Н	32.42		DAGG
		040.00	5	V	31.22		PASS

Band	Channel	Frequency (MHz)	PCL	Antenna Pol (H/V)	Measured EIRP dBm	Limit dBm	Verdict	
512	1850.2	0	Н	30.21		DA GG		
	512 1850.	1830.2	0	V	29.29	- 33	PASS	
GSM	661	1000.0	0	Н	30.17		PASS	
1900MHz	001	1880.0	0	V	29.37			
	<u> </u>	010 1000.0	0	Н	30.09		DA GG	
	810 1909.8	1909.8	0	V	29.37		PASS	

Band	Channel	Frequency (MHz)	PCL	Antenna Pol (H/V)	Measured ERP dBm	Limit dBm	Verdict
	120		_	Н	26.12		PASS
	128	824.20	5	V	25.25	205	
EDGE	100	926.60	F	Н	26.08		DACC
850MHz	190	836.60	5	V	25.36	38.5	PASS
	251	251 040.00	5	Н	26.07		PASS
	251 848	848.80	3	V	25.52		



Band	Channel	Frequency (MHz)	PCL	Antenna Pol (H/V)	Measured EIRP dBm	Limit dBm	Verdict
	512	1850.2	0	Н	25.82		PASS
	312	1830.2	0	V	24.31		FASS
EDGE	661	1880.0	0	Н	25.74	33	PASS
1900MHz	001	1880.0	0	V	24.85	33	FASS
	810	1909.8	0	Н	25.62		DASS
	810	1909.8	0	V	24.64		PASS

Band	Channel	Frequency (MHz)	Antenna Pol (H/V)	Measured ERP dBm	Limit dBm	Verdict
	4122	926.4	Н	22.45		DAGG
	4132	826.4	V	22.25		PASS
WCDMA	4175	835	Н	22.52	38.5	PASS
850MHz	4173	033	V	22.32	36.3	PASS
	4233	846.6	Н	22.46		PASS
	4233	040.0	V	22.32		газэ

Band	Channel	Frequency (MHz)	Antenna Pol (H/V)	Measured EIRP dBm	Limit dBm	Verdict
	0262	1852.4	Н	23.12		DACC
	9262	1832.4	V	22.41		PASS
WCDMA	0400	1000	Н	23.51	22	DACC
1900MHz	9400	1880	V	22.72	33	PASS
	0529	1007.6	Н	22.74		DACC
	9538	1907.6	V	22.28		PASS

Band	Channel	Frequency (MHz)	Antenna Pol (H/V)	Measured EIRP dBm	Limit dBm	Verdict
	1312	1712.4	Н	23.12		DACC
	1312	1/12.4	V	22.41		PASS
WCDMA	1412	1722.4	Н	23.54	22	DACC
1700MHz	1412	1732.4	V	22.72	33	PASS
	1513	1752 6	Н	22.74		DACC
	1313	1752.6	V	22.28		PASS



# 2.8 Radiated Spurious Emissions

#### 2.8.1 Requirement

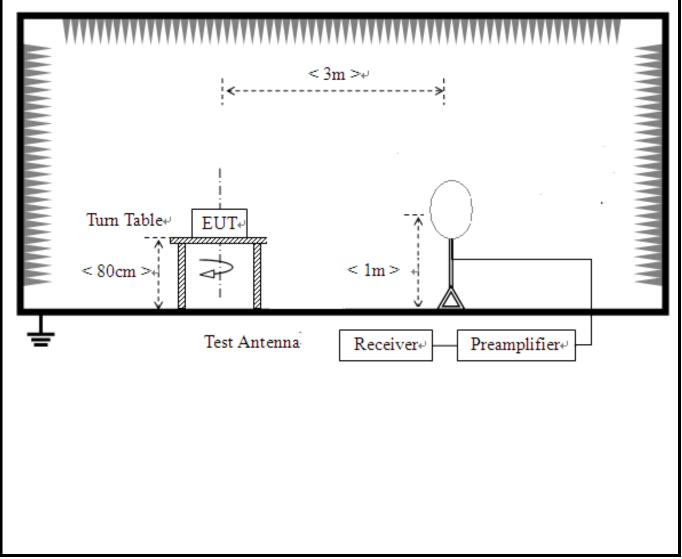
The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least  $43 + 10 \log (P) dB$ . The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

## 2.8.2 Measuring Instruments

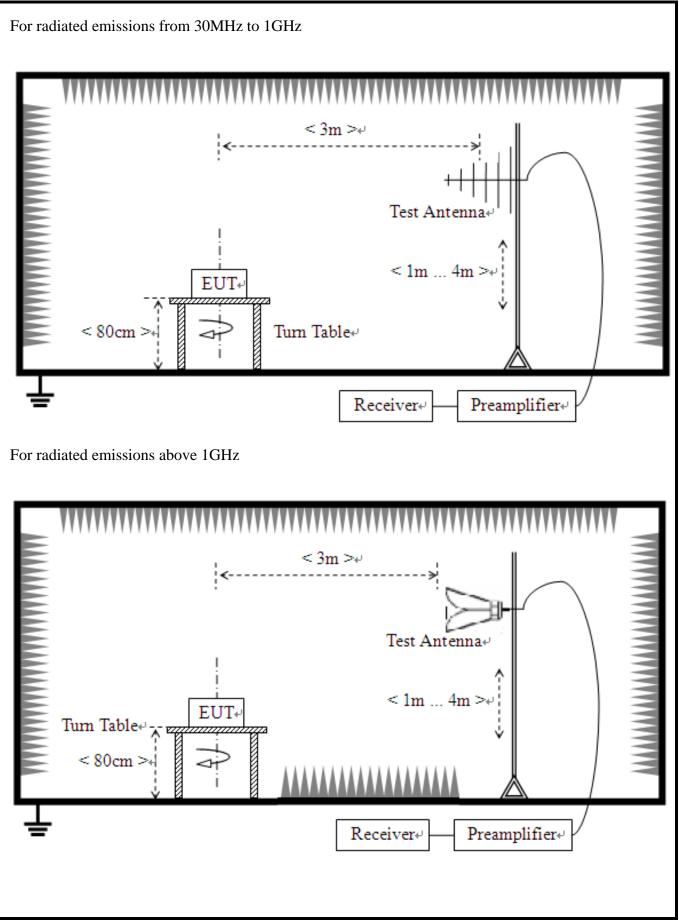
The measuring equipment is listed in the section 3 of this test report.

## 2.8.3 Test Setup

For radiated emissions from 9 kHz to 30MHz









## 2.8.4 Test Procedures

- 1. The testing follows FCC KDB 971168 D01 v03r01 Section 5.8 and ANSI / TIA-603-D-2010 Section 2.2.12.
- 2. The EUT was placed on a rotatable wooden table 0.8 meters above the ground.
- 3. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
- 4. The table was rotated 360 degrees to determine the position of the highest spurious emission.
- 5. The height of the receiving antenna is varied between one meter and four meters to search for the maximum spurious emission for both horizontal and vertical polarizations.
- 6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking record of maximum spurious emission.
- 7. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
- 8. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
- 9. Taking the record of output power at antenna port.
- 10. Repeat step 7 to step 8 for another polarization.
- 11. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
- 12. The limit line is derived from 43 + 10log(P) dB below the transmitter power P(Watts)
  - = P(W) [43 + 10log(P)] (dB)
  - $= [30 + 10\log(P)] (dBm) [43 + 10\log(P)] (dB)$
  - = -13dBm.
- 13. This device employs GMSK technology with GSM and GSM capabilities. All configurations were investigated and the worst case emissions were found in GSM mode.
- 14. This device employs UMTS technology with WCDMA (AMR/RMC), HSDPA, HSUPA capabilities. All configurations were investigated and the worst case UMTS emissions were found in RMC WCDMA mode at 12.2Kbps.
- 15. This unit was tested with its standard battery.
- 16. All Spurious Emission tests were performed in X, Y, Z axis direction and low, middle, high channel. And only the worst axis test condition was recorded in this test report.



- 17. The spectrum is measured from 9 KHz to the 10<sup>th</sup> harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1GHz. The worst case emissions are reported however emissions whose levels were not within 20dB of the respective limits were not reported.
- 18. For 9KHz to 30MHz: the amplitude of spurious emissions are attenuated by more than 20dB below the permissible value has no need to be reported.



# 2.8.5 Test Results of Radiated Spurious Emissions

#### Note: 1. (Absolute)Level=Reading Level + Factor

Worst-Case test data provide as below:

#### GSM850 Middle Channel

30MHz~10GHz:
--------------

Susp	ected List						
	Freq.	Reading	Level	Limit	Margin	Factor	Delerity
NO.	[MHz]	[dBm]	[dBm]	[dBm]	[dB]	[dB]	Polarity
1	41.9673	-93.00	-71.69	-13.00	58.69	21.31	Horizontal
2	512.574	-103.31	-70.34	-13.00	57.34	32.97	Horizontal
3	655.211	-104.16	-68.57	-13.00	55.57	35.59	Horizontal
4	2120.56	-57.63	-54.39	-13.00	41.39	3.24	Horizontal
5	2988.99	-58.27	-50.49	-13.00	37.49	7.78	Horizontal
6	3785.39	-58.89	-49.73	-13.00	36.73	9.16	Horizontal
Susp	ected List						
	Freq.	Reading	Level	Limit	Margin	Factor	Delority
NO.	[MHz]	[dBm]	[dBm]	[dBm]	[dB]	[dB]	Polarity
1	65.2551	-90.64	-69.80	-13.00	56.80	20.84	Vertical
2	610.576	-102.38	-68.81	-13.00	55.81	33.57	Vertical
3	810.140	-103.37	-66.44	-13.00	53.44	36.93	Vertical
4	2172.58	-57.36	-54.45	-13.00	41.45	2.91	Vertical
5	2692.84	-57.82	-52.46	-13.00	39.46	5.36	Vertical
6	3605.30	-58.22	-49.84	-13.00	36.84	8.38	Vertical



Worst-Case test data provide as below:

#### GSM1900 Middle Channel

#### 30MHz~20GHz:

Susp	ected List						
NO.	Freq.	Reading	Level	Limit	Margin	Factor	Delerity
NO.	[MHz]	[dBm]	[dBm]	[dBm]	[dB]	[dB]	Polarity
1	537.117	-87.48	-54.89	-36.00	18.89	32.59	Horizontal
2	671.891	-87.68	-52.16	-36.00	16.16	35.52	Horizontal
3	848.468	-88.00	-49.94	-36.00	13.94	38.06	Horizontal
4	2103.22	-52.07	-48.65	-30.00	18.65	3.42	Horizontal
5	3031.40	-52.89	-45.15	-30.00	15.15	7.74	Horizontal
6	3750.55	-53.59	-44.51	-30.00	14.51	9.08	Horizontal
Sus	pected List	:					
	Freq.	Reading	Level	Limit	Margin	Factor	Delerity
NO.	[MHz]	[dBm]	[dBm]	[dBm]	[dB]	[dB]	Polarity
1	62.6126	-88.13	-67.57	-36.00	31.57	20.56	Vertical
2	657.117	-87.68	-53.63	-36.00	17.63	34.05	Vertical
3	797.657	-87.47	-50.42	-36.00	14.42	37.05	Vertical
4	1180.03	-52.46	-54.18	-30.00	24.18	-1.72	Vertical
5	2197.23	-52.72	-49.74	-30.00	19.74	2.98	Vertical
6	3168.43	-52.39	-44.86	-30.00	14.86	7.53	Vertical





Worst-Case test data provide as below:

#### WCDMA 850 Middle Channel

#### 30MHz~10GHz:

Susp	Suspected List								
	Freq.	Reading	Level	Limit	Margin	Factor	Delerity		
NO.	[MHz]	[dBm]	[dBm]	[dBm]	[dB]	[dB]	Polarity		
1	342.652	-104.97	-75.92	-13.00	62.92	29.05	Horizontal		
2	501.891	-105.25	-72.01	-13.00	59.01	33.24	Horizontal		
3	693.173	-104.32	-69.12	-13.00	56.12	35.20	Horizontal		
4	2152.57	-55.36	-52.47	-13.00	39.47	2.89	Horizontal		
5	3814.40	-58.37	-47.98	-13.00	34.98	10.39	Horizontal		
6	5757.37	-58.57	-42.66	-13.00	29.66	15.91	Horizontal		
Sus	pected List	:							
	Freq.	Reading	Level	Limit	Margin	Factor	Delerity		
NO.	[MHz]	[dBm]	[dBm]	[dBm]	[dB]	[dB]	Polarity		
1	62.0420	-92.53	-72.04	-13.00	59.04	20.49	Vertical		
2	468.878	-104.30	-74.03	-13.00	61.03	30.27	Vertical		
3	608.698	-103.57	-69.98	-13.00	56.98	33.59	Vertical		
4	1209.10	-57.50	-59.08	-13.00	46.08	-1.58	Vertical		
5	2156.57	-56.36	-53.49	-13.00	40.49	2.87	Vertical		
6	3796.39	-58.43	-48.09	-13.00	35.09	10.34	Vertical		





Worst-Case test data provide as below:

## WCDMA 1900 Middle Channel

#### 30MHz~20GHz:

Susp	Suspected List								
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Polarity		
1	508.688	-104.63	-72.03	-13.00	59.03	32.60	Horizontal		
2	656.276	-103.81	-68.98	-13.00	55.98	34.83	Horizontal		
3	945.625	-101.96	-64.56	-13.00	51.56	37.40	Horizontal		
4	3756.75	-58.08	-47.62	-13.00	34.62	10.46	Horizontal		
5	6355.35	-58.82	-40.56	-13.00	27.56	18.26	Horizontal		
6	8189.18	-61.35	-36.51	-13.00	23.51	24.84	Horizontal		
Sus	pected List	:							
	Freq.	Reading	Level	Limit	Margin	Factor	Delerity		
NO.	[MHz]	[dBm]	[dBm]	[dBm]	[dB]	[dB]	Polarity		
1	68.8388	-92.08	-71.00	-13.00	58.00	21.08	Vertical		
2	830.080	-102.45	-66.83	-13.00	53.83	35.62	Vertical		
3	1234.23	-61.04	-62.72	-13.00	49.72	-1.68	Vertical		
4	3224.22	-58.24	-48.74	-13.00	35.74	9.50	Vertical		
5	3756.75	-57.35	-47.00	-13.00	34.00	10.35	Vertical		
6	6387.38	-59.84	-41.23	-13.00	28.23	18.61	Vertical		

WCDMA 1700 Middle Channel

#### 30MHz~20GHz:

Susp	Suspected List							
	Freq.	Reading	Level	Limit	Margin	Factor	Delerity	
NO.	[MHz]	[dBm]	[dBm]	[dBm]	[dB]	[dB]	Polarity	
1	542.654	-87.46	-55.71	-36.00	19.71	31.75	Horizontal	
2	661.357	-89.84	-55.03	-36.00	19.03	34.81	Horizontal	
3	923.991	-89.04	-51.87	-36.00	15.87	37.17	Horizontal	
4	2014.20	-56.85	-53.42	-30.00	23.42	3.43	Horizontal	
5	3044.85	-59.10	-50.02	-30.00	20.02	9.08	Horizontal	
6	3809.41	-59.44	-48.99	-30.00	18.99	10.45	Horizontal	
Sus	pected List	:						
	Freq.	Reading	Level	Limit	Margin	Factor	Dalarit	
NO.	[MHz]	[dBm]	[dBm]	[dBm]	[dB]	[dB]	Polarity	
1	37.4391	-85.02	-64.52	-36.00	28.52	20.50	Vertical	
2	602.814	-87.98	-55.04	-36.00	19.04	32.94	Vertical	
3	922.374	-87.89	-50.30	-36.00	14.30	37.59	Vertical	
4	2224.24	-57.93	-54.05	-30.00	24.05	3.88	Vertical	
5	3216.49	-59.03	-49.46	-30.00	19.46	9.57	Vertical	
6	4977.69	-59.44	-45.32	-30.00	15.32	14.12	Vertical	



# 3. UNCERTAINTY OF EVALUATION

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Conducted Emission Measurement (150KHz~30MHz)

Measuring Uncertainty for a level of	2.8dB
confidence of 95%(U=2Uc(y))	2.80D

Uncertainty of Radiated Emission Measurement (30MHz~1GHz)

Measuring Uncertainty for a level of	5.0dB
confidence of 95%(U=2Uc(y))	5.0dB

Uncertainty of Radiated Emission Measurement (1GHz~18GHz)

Measuring Uncertainty for a level of	5 1 JD
confidence of 95%(U=2Uc(y))	5.1dB

Uncertainty of Radiated Emission Measurement (18GHz~40GHz)

Measuring Uncertainty for a level of	5.1dB
confidence of 95%(U=2Uc(y))	5:100



# 4. LIST OF MEASURING EQUIPMENT

Description	Manufacturer	Model	Serial No.	Cal. Date	Due Date	Remark
EMI Test Receiver	R&S	ESU8	A0805559	2020.04.03	2021.04.02	Radiation
Loop Antenna	Schwarz beck	HFH2-Z2	100047	2019.04.26	2022.04.25	Radiation
Broadband antenna (30MHz~1GHz)	Schwarbeck	BBHA 9120 J	A190503537	2019.01.07	2022.01.06	Radiation
Broadband antenna (30MHz~1GHz)	R&S	VULB9160	A0805560	2019.05.24	2022.05.23	Radiation
Double ridge horn antenna (1GHz~18GHz)	R&S	HF906	100150	2019.04.27	2022.04.26	Radiation
Double ridge horn antenna (1GHz~18GHz)	R&S	HF906	100149	2019.04.17	2022.04.16	Radiation
Horn antenna (18GHz~26.5GHz)	AR	AT4510	A0804450	2020.06.19	2023.06.18	Radiation
Horn antenna (18GHz~26.5GHz)	AR	AT4003A	0329293	2020.09.17	2021.09.16	Radiation
Amplifier 30M~1GHz	MILMEGA	80RF1000-10004	A140101634	2020.03.24	2021.03.23	Radiation
Amplifier 1G~18GHz	MILMEGA	AS0104R-800/40 0	A160302517	2020.03.24	2021.03.23	Radiation
Spectrum Analyzer	KEYSIGHT	N9030A	A160702554	2020.05.18	2021.05.17	Conducted
Test Receiver	R&S	ESIB26	A0304218	2020.04.29	2021.04.28	Conducted
Temperature chamber	XSM	DNF810C	A0501375	2020.05.26	2021.05.25	Conducted
Wideband Radio Communication tester	R&S	CMW500	A130101034	2019.07.30	2021.07.29	Conducted
Power Supply	R&S	WYJ-60100	A141102031	2020.01.16	2023.01.15	Conducted

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