TESTING LABORATORY
CERTIFICATE # 4821.01

FCC PART 22H, PART 24E

MEASUREMENT AND TEST REPORT

For

TECNO MOBILE LIMITED

ROOM 604 6/F SOUTH TOWER WORLD FINANCE CTR HARBOUR CITY 17 CANTON ROAD TST KL, Hong Kong

FCC ID: 2ADYY-BA2

Report Type:	Product Type:
Original Report	Mobile Phone

Report Number:	RGMA190815008-00D
Report Date:	2019-09-10
Reviewed By:	Simon Wang RF Engineer
Prepared By:	Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008 www.baclcorp.com.cn

Note: This report must not be used by the customer to claim product certification, approval, or endorsement by A2LA* or any agency of the Federal Government. * This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "*".

The information marked # is provided by the applicant, the laboratory is not responsible for its authenticity.

TABLE OF CONTENTS

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Mobile phone
Tested Model	BA2
Frequency Range	Cellular: 824-849 MHz PCS: 1850-1910 MHz WCDMA B2: 1850-1910 MHz WCDMA B5: 824-849 MHz
Conducted Power	Cellular: 32.68dBm，EDGE:27.30 PCS: 28.86dBm, EDGE:25.46 WCDMA B2: 21.96dBm WCDMA B5: 21.74dBm
Modulation Technique	2G: GMSK, 8PSK 3G: BPSK, QPSK, 16QAM
Antenna Specification	FPC Antenna
Voltage Range	DC 3.85V from battery or DC 5.0V from adapter
Date of Test	2019-08-25 to 2019-09-07
Sample serial number	190815008(Assigned by BACL, Shenzhen)
Received date	2019-08-15
Sample/EUT Status	Good condition
Adapter information	Model: A8-501000 Input: AC 100-240V, 50/60Hz, 200mA Output: DC 5.0V, 1.0A

Objective

This type approval report is prepared on behalf of *TECNO MOBILE LIMITED* in accordance with Part 2, Part 22-Subpart H, Part 24-Subpart E of the Federal Communication Commission's rules.

The objective is to determine the compliance of EUT with FCC rules for output power, modulation characteristic, occupied bandwidth, and spurious emission at antenna terminal, spurious radiated emission, frequency stability, and band edge.

Related Submittal(s)/Grant(s)

FCC Part 15.247 DSS & DTS submissions with FCC ID: 2ADYY-BA2.

Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-Part J as well as the following parts:

Part 22 Subpart H - Public Mobile Services
Part 24 Subpart E - Personal Communication Services
TIA/EIA-603-D

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		±5%
RF output power, conducted		±0.5dB
Unwanted Emission, conducted		±1.5dB
Radiated Emissions	Below 1GHz	±4.75dB
	Above 1GHz	±4.88dB
Temperature		±3℃
Supply voltages		±0.4%

Note: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 342867, the FCC Designation No.: CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The EUT was configured for testing according to TIA/EIA-603-D.

The final qualification test was performed with the EUT operating at normal mode.

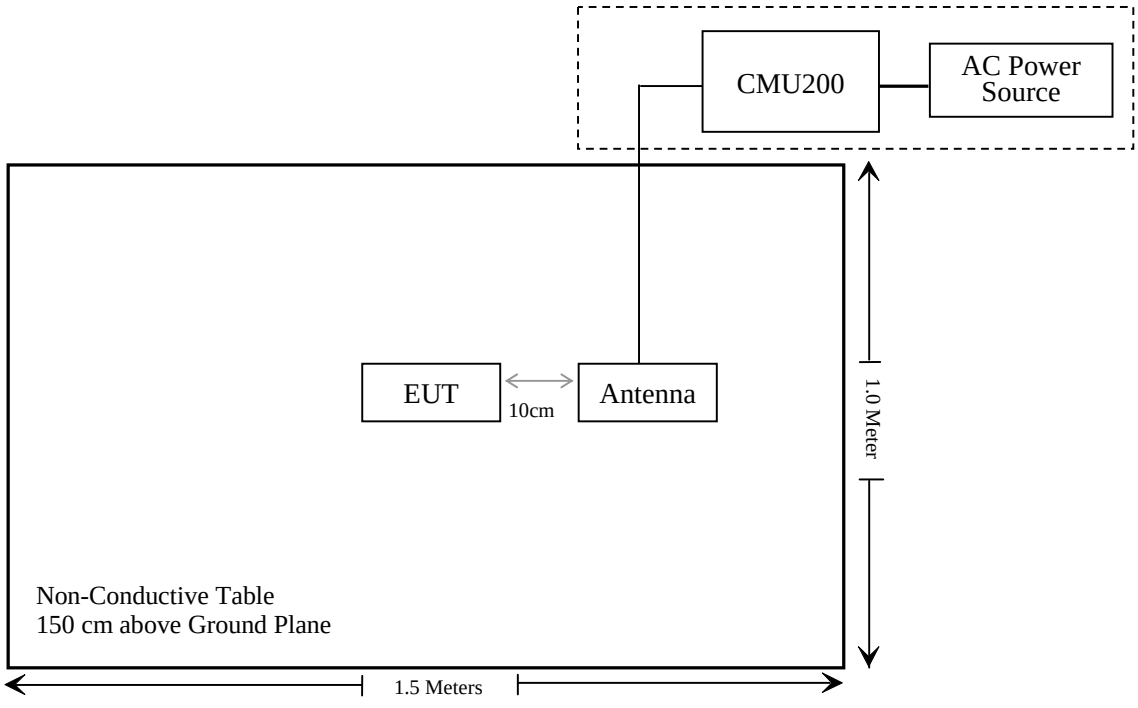
Equipment Modifications

No modification was made to the EUT.

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Rohde & Schwarz	Universal Radio Communication Tester	CMU200	106891

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1307, §2.1093	RF Exposure (SAR)	Compliance*
§2.1046; § 22.913 (a); § 24.232 (c)	RF Output Power	Compliance
§ 2.1047	Modulation Characteristics	Not Applicable
§ 2.1049; § 22.905; § 22.917; § 24.238	Occupied Bandwidth	Compliance
§ 2.1051; § 22.917 (a); § 24.238 (a)	Spurious Emissions at Antenna Terminal	Compliance
§ 2.1053; § 22.917 (a); § 24.238 (a)	Field Strength of Spurious Radiation	Compliance
§ 22.917 (a); § 24.238 (a)	Band Edge	Compliance
§ 2.1055; § 22.355; § 24.235	Frequency stability	Compliance

Compliance*: Please refer to SAR report released by BACL, report number: RGMA190815008-SA.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
Sunol Sciences	Horn Antenna	DRH-118	A052604	2017-12-22	2020-12-21
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017-12-22	2020-12-21
COM-POWER	Pre-amplifier	PA-122	181919	2018-11-12	2019-11-12
Sonoma Instrument	Amplifier	310N	186238	2018-11-12	2019-11-12
Rohde & Schwarz	Spectrum Analyzer	FSV40-N	102259	2019-07-22	2020-07-21
Rohde & Schwarz	EMI Test Receiver	ESR3	102455	2019-07-09	2020-07-08
COM-POWER	Dipole Antenna	AD-100	41000	NCR	NCR
A.H. System	Horn Antenna	SAS-200/571	135	2018-09-01	2021-08-31
UTiFLEX MICRO-C0AX	RF Cable	UFA147A-2362-100100	MFR64639 231029-003	2018-11-12	2019-11-12
Ducommun Technologies	RF Cable	104PEA	218124002	2018-11-12	2019-11-12
Ducommun Technologies	RF Cable	RG-214	1	2019-05-21	2019-11-19
Ducommun Technologies	RF Cable	RG-214	2	2018-11-12	2019-11-12
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-04	2017-12-29	2020-12-28
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-03	2017-12-29	2020-12-28
Heatsink Required	Amplifier	QLW-18405536-J0	15964001002	2018-11-12	2019-11-12
Wainwright Germany	Band Reject Filter	WRCG1850/1910-1835/1925-40/8SS	22	2019-03-02	2020-03-01
Wainwright Germany	Band Reject Filter	WRCG823/850-813/860-40/8SS	7	2019-03-02	2020-03-01
RF Conducted Test					
Rohde & Schwarz	Spectrum Analyzer	FSU26	200120	2019-03-02	2020-03-01
ESPEC	Temperature & Humidity Chamber	EL-10KA	9107726	2019-01-05	2020-01-05
Long Wei	DC Power Supply	TPR-6420D	398363	NCR	NCR
Fluke	Digital Multimeter	287	19000011	2019-04-12	2020-04-12
Rohde & Schwarz	Universal Radio Communication Tester	CMU200	106891	2019-01-15	2020-01-15
Ducommun technologies	RF Cable	RG-214	3	Each Time	
WEINSCHEL	3dB Attenuator	6231	666	Each Time	
N/A	Power Splitter	N/A	N/A	Each Time	

* Statement of Traceability: Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §1.1307(b) & §2.1093 - RF EXPOSURE INFORMATION

Applicable Standard

FCC§1.1310 and §2.1093.

Test Result

Compliance, please refer to the SAR report: RGMA190815008-SA.

FCC §2.1047 - MODULATION CHARACTERISTIC

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

FCC § 2.1046, § 22.913 (a) & § 24.232 (c) - RF OUTPUT POWER

Applicable Standard

According to FCC §2.1046 and §22.913 (a), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

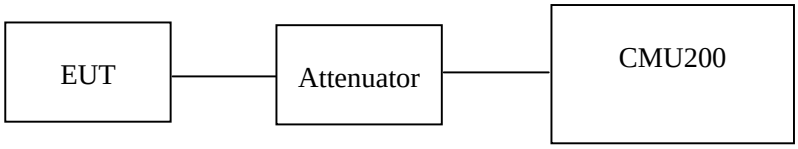
According to FCC §2.1046 and §24.232 (C), mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB.

Test Procedure

Conducted method:

The RF output of the transmitter was connected to the CMU200 through sufficient attenuation.



Radiated method:

TIA 603-D section 2.2.17

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by George Zhong on 2019-08-28.

Conducted Power

Cellular Band (Part 22H)

Mode	Channel	Frequency (MHz)	Average Output Power (dBm)	Limit (dBm)
GSM	128	824.2	32.46	38.45
	190	836.6	32.50	38.45
	251	848.8	32.58	38.45

Mode	Channel	Frequency (MHz)	Average Output Power (dBm)				Limit (dBm)
			1 slot	2 slots	3 slots	4 slots	
GPRS	128	824.2	32.57	28.67	28.16	27.31	38.45
	190	836.6	32.68	28.49	28.21	27.16	38.45
	251	848.8	32.49	28.57	28.13	27.31	38.45

Mode	Channel	Frequency (MHz)	Average Output Power (dBm)				Limit (dBm)
			1 slot	2 slots	3 slots	4 slots	
EGPRS	128	824.2	27.30	24.12	22.86	20.19	38.45
	190	836.6	27.29	24.26	21.89	20.23	38.45
	251	848.8	27.26	24.10	21.96	20.17	38.45

Mode	Test Mode	3GPP Sub Test	Average Output Power (dBm)		
			Low Frequency	Middle Frequency	High Frequency
WCDMA (Band V)	RMC		21.84	21.96	21.75
	HSDPA	1	20.60	20.56	20.72
		2	20.53	20.75	20.41
		3	20.36	20.83	20.45
		4	20.63	20.85	20.52
		5	20.63	20.85	20.55
	HSUPA	1	20.17	20.10	20.18
		2	20.21	20.36	20.19
		3	20.24	20.41	20.22
		4	20.34	20.44	20.30
		5	20.37	20.50	20.34
	$HSUPA^{+}$	1	21.24	21.33	21.40

PCS Band (Part 24E)

Mode	Channel	Frequency (MHz)	Average Output Power (dBm)	Limit (dBm)
GSM	512	1850.2	28.86	33
	661	1880.0	28.65	33
	810	1909.8	28.74	33

Mode	Channel	Frequency (MHz)	Average Output Power (dBm)				Limit (dBm)
			1 slot	2 slots	3 slots	4 slots	
GPRS	512	1850.2	28.75	26.13	24.87	23.59	33
	661	1880.0	28.64	26.28	24.91	23.62	33
	810	1909.8	28.69	26.16	24.96	23.79	33

Mode	Channel	Frequency (MHz)	Average Output Power (dBm)				Limit (dBm)
			1 slot	2 slots	3 slots	4 slots	
EGPRS	512	1850.2	25.45	22.46	20.15	18.62	33
	661	1880.0	25.46	22.65	20.34	18.52	33
	810	1909.8	25.34	22.51	20.21	18.49	33

Mode	Test Mode	3GPP Sub Test	Average Output Power (dBm)		
			Low Frequency	Middle Frequency	High Frequency
WCDMA (Band II)	RMC		21.62	21.74	21.67
	HSDPA	1	20.46	20.53	20.48
		2	20.52	20.61	20.46
		3	20.43	20.49	20.52
			20.48	20.62	20.39
		4	20.42	20.52	20.53
	HSUPA	1	20.16	20.13	20.25
		2	20.20	20.19	20.30
		3	20.15	20.22	20.24
		4	20.09	20.18	20.19
		5	20.15	20.34	20.28
	HSUPA^{+}	1	21.26	21.35	21.38

Peak-to-average ratio (PAR)

Cellular Band

Mode	Channel	PAR (dB)	Limit (dB)
GSM	Low	1.25	13
	Middle	1.42	13
	High	1.25	13

Mode	Channel	PAR (dB)	Limit (dB)
EGPRS	Low	1.33	13
	Middle	1.06	13
	High	1.19	13

Mode	Channel	PAR (dB)	Limit (dB)
WCDMA (BPSK)	Low	3.21	13
	Middle	3.50	13
	High	3.42	13
HSDPA (16QAM)	Low	3.08	13
	Middle	3.04	13
	High	3.04	13
HSUPA (BPSK)	Low	2.94	13
	Middle	3.02	13
	High	2.98	13
HSUPA^{+}	Low	2.97	13
	Middle	3.14	13
	High	3.16	13

PCS Band

Mode	Channel	PAR (dB)	Limit (dB)
GSM	Low	1.43	13
	Middle	1.40	13
	High	1.44	13

Mode	Channel	PAR (dB)	Limit (dB)
EGPRS	Low	1.21	13
	Middle	0.98	13
	High	1.25	13

Mode	Channel	PAR (dB)	Limit (dB)
WCDMA (BPSK)	Low	2.57	13
	Middle	2.29	13
	High	2.37	13
HSDPA (16QAM)	Low	2.48	13
	Middle	2.68	13
	High	2.82	13
HSUPA (BPSK)	Low	2.76	13
	Middle	2.91	13
	High	2.86	13
HSUPA^{+}	Low	3.01	13
	Middle	3.04	13
	High	3.05	13

Radiated Power

GSM Mode:

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	Level (dBm)	Cable loss (dB)	Antenna Gain (dBd/dBi)			
ERP for Cellular Band (Part 22H), Middle Channel										
836.6	84.61	15	2.1	H	25.2	1.90	0.0	23.30	38.45	15.15
836.6	93.12	232	2.3	V	33.1	1.90	0.0	31.20	38.45	9.25
EIRP for PCS Band (Part 24E), Middle Channel										
1880.00	91.28	320	2.2	H	21.6	1.30	9.40	29.70	33	3.3
1880.00	88.83	14	1.8	V	18.9	1.30	9.40	27.00	33	6

EDGE Mode:

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	Level (dBm)	Cable loss (dB)	Antenna Gain (dBi)			
ERP, Cellular Band (Part 22H), Middle Channel										
836.60	80.12	70	2.3	H	20.7	1.90	0.0	18.80	38.45	19.65
836.60	87.93	167	1.7	V	27.9	1.90	0.0	26.00	38.45	14.45
EIRP, PCS Band (Part 24E), Middle Channel										
1880.00	87.12	12	2.5	H	17.4	1.30	9.40	25.50	33	7.50
1880.00	82.06	198	2.1	V	12.2	1.30	9.40	20.30	33	12.70

WCDMA Mode:

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	Level (dBm)	Cable loss (dB)	Antenna Gain (dBd/dBi)			
ERP for WCDMA Band V (Part 22H), Middle Channel										
836.6	77.68	226	2.0	H	18.3	1.90	0.0	16.40	38.45	22.05
836.6	83.25	11	1.2	V	23.3	1.90	0.0	21.40	38.45	17.05
EIRP for WCDMA Band II (Part 24E), Middle Channel										
1880.00	84.03	150	1.2	H	14.4	1.30	9.40	22.50	33	10.5
1880.00	81.43	322	1.5	V	11.5	1.30	9.40	19.60	33	13.4

Note:
All above data were tested with no amplifier.
Absolute Level = Substituted Level - Cable loss + Antenna Gain
Margin = Limit- Absolute Level
dBd is for the ERP, dBi is for EIRP.

FCC §2.1049, §22.917, §22.905 & §24.238 - OCCUPIED BANDWIDTH

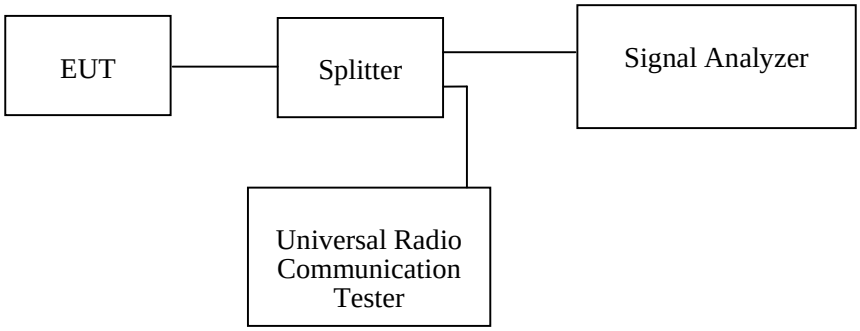
Applicable Standard

FCC 47 §2.1049, §22.917, §22.905 and §24.238.

Test Procedure

The RF output of the transmitter was connected to the simulator and the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 5 kHz (GSM) & 100 kHz (WCDMA) and the 26 dB & 99% bandwidth was recorded.



Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by George Zhong on 2019-08-25.

EUT operation mode: Transmitting

Test Result: Compliance. Please refer to the following tables and plots.

Cellular Band (Part 22H)

Mode	Frequency (MHz)	99% Occupied Bandwidth (kHz)	26 dB Emission Bandwidth (kHz)
GSM(GMSK)	836.6	245.19	313.78
EGPRS(8PSK)	836.6	246.79	320.19

Mode	Frequency (MHz)	99% Occupied Bandwidth (MHz)	26 dB Emission Bandwidth (MHz)
RMC (BPSK)	836.6	4.17	4.7
HSUPA (BPSK)	836.6	4.17	4.71
HSDPA (16QAM)	836.6	4.15	4.69

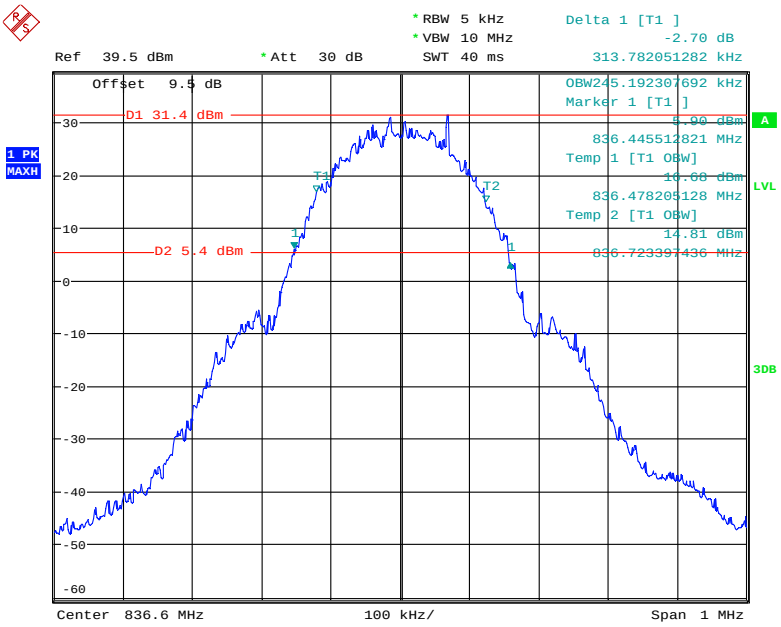
PCS Band (Part 24E)

Mode	Frequency (MHz)	99% Occupied Bandwidth (kHz)	26 dB Emission Bandwidth (kHz)
GSM(GMSK)	1880	243.19	315.06
EGPRS(8PSK)	1880.0	248.4	313.63

Mode	Frequency (MHz)	99% Occupied Bandwidth (MHz)	26 dB Emission Bandwidth (MHz)
RMC (BPSK)	1880.0	4.18	4.7
HSUPA (BPSK)	1880.0	4.18	4.7
HSDPA (16QAM)	1880.0	4.18	4.7

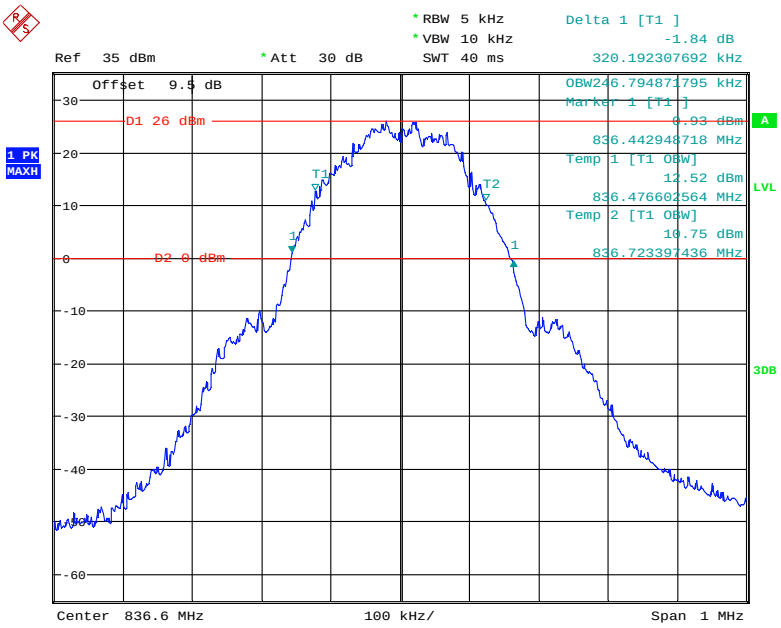
Cellular Band (Part 22H)

26 dB Emissions & 99% Occupied Bandwidth for GSM (GMSK) Mode



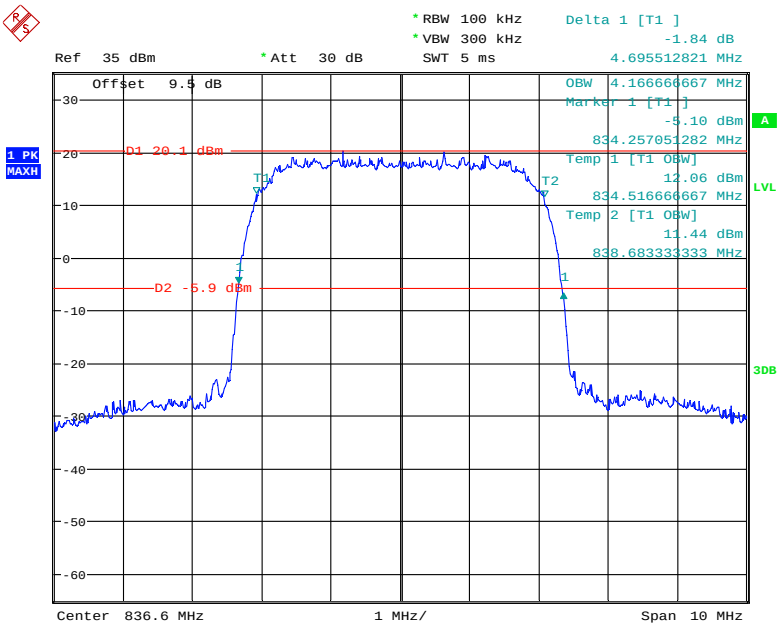
Date: 25.AUG.2019 13:46:05

26 dB Emissions &99% Occupied Bandwidth for EDGE Mode



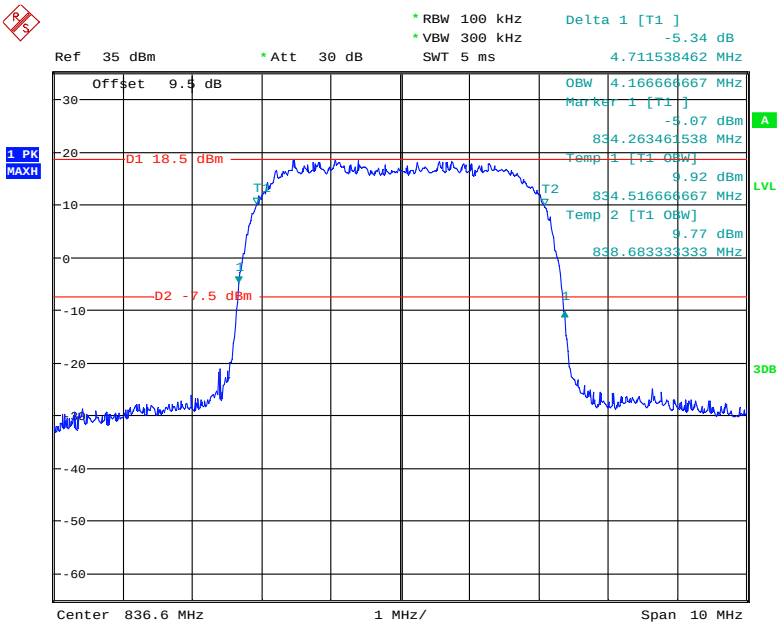
Date: 25.AUG.2019 14:02:29

26 dB Emissions & 99% Occupied Bandwidth for RMC (BPSK) Mode



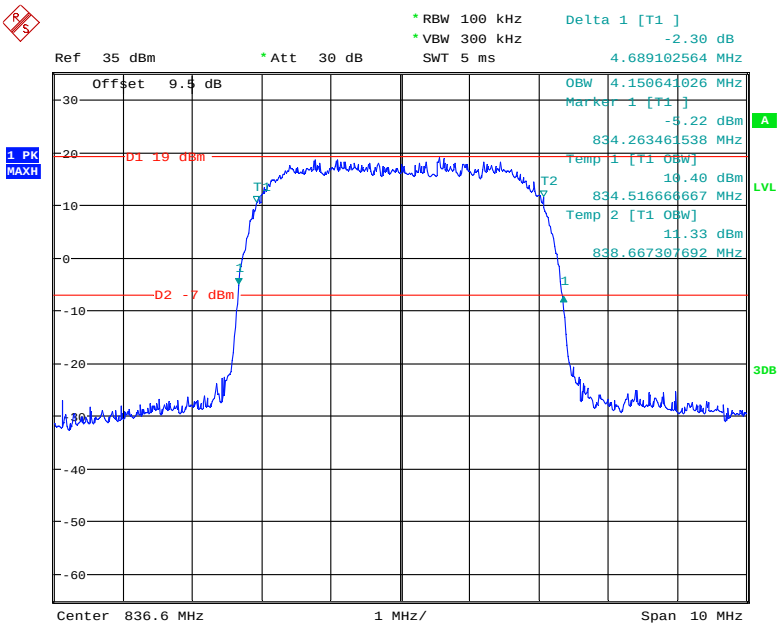
Date: 25.AUG.2019 15:15:54

26 dB Emissions & 99% Occupied Bandwidth for HSUPA (BPSK) Mode



Date: 25.AUG.2019 15:25:00

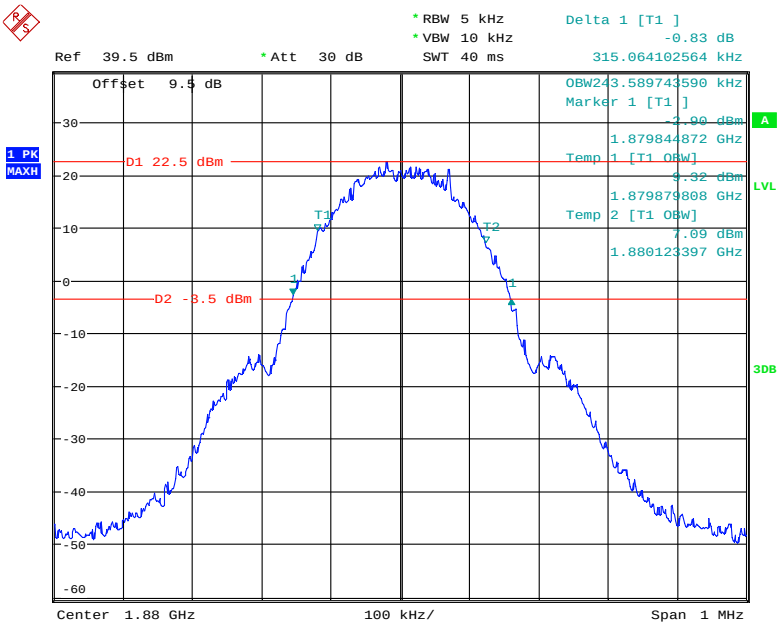
26 dB Emissions & 99% Occupied Bandwidth for HSDPA (16QAM) Mode



Date: 25.AUG.2019 15:18:33

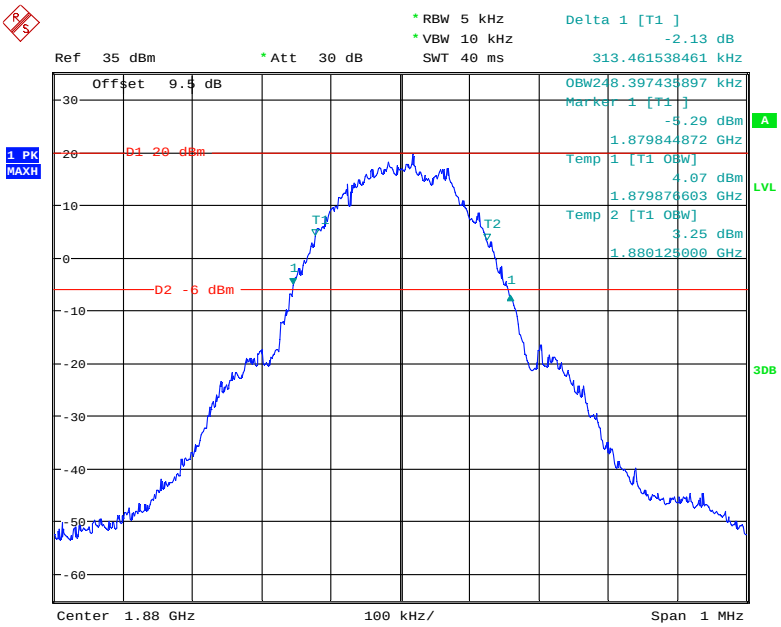
PCS Band (Part 24E)

26 dB Emissions & 99% Occupied Bandwidth for GSM (GMSK) Mode



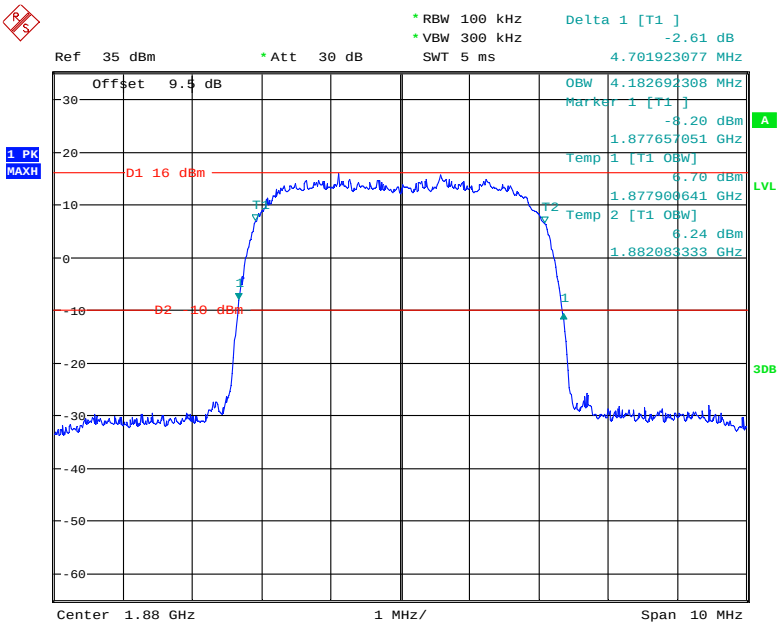
Date: 25.AUG.2019 13:54:06

26 dB Emissions &99% Occupied Bandwidth for EDGE Mode



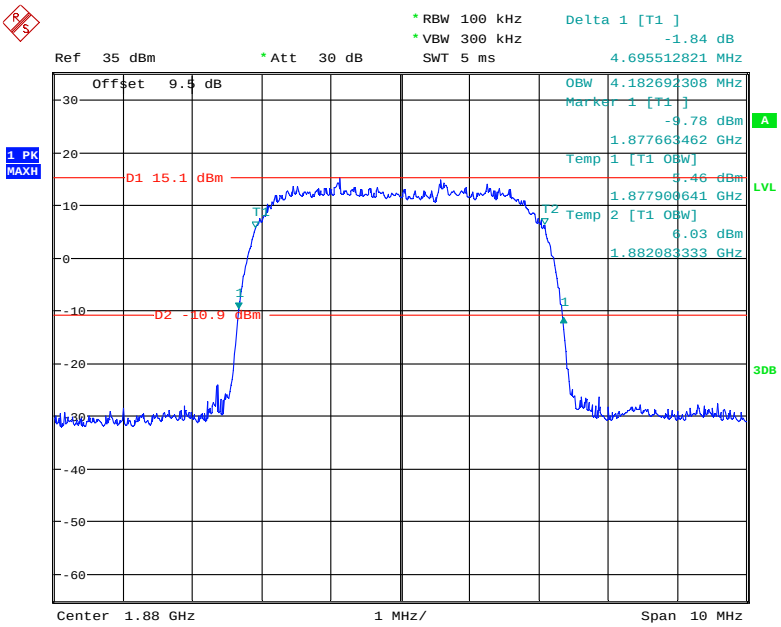
Date: 25.AUG.2019 14:06:20

26 dB Emissions & 99% Occupied Bandwidth for RMC (BPSK) Mode



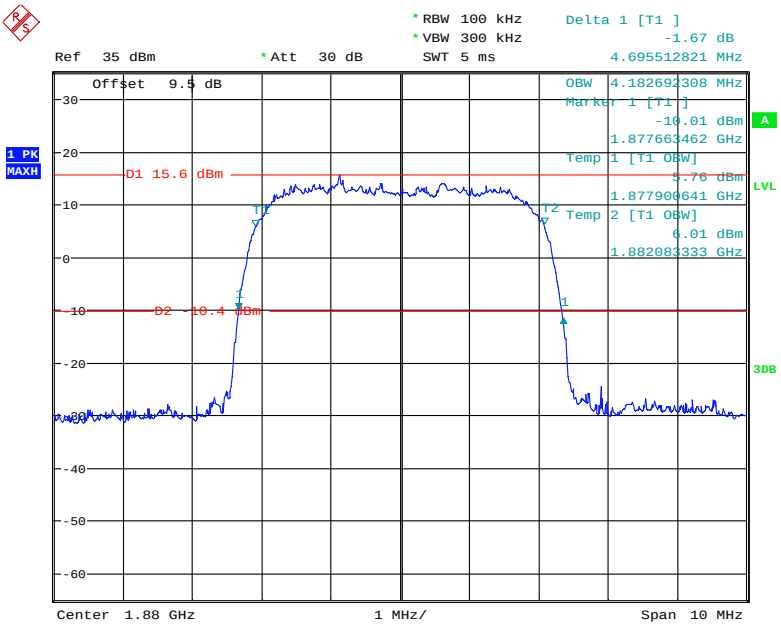
Date: 25.AUG.2019 15:05:06

26 dB Emissions & 99% Occupied Bandwidth for HSUPA (BPSK) Mode



Date: 25.AUG.2019 14:37:19

26 dB Emissions & 99% Occupied Bandwidth for HSDPA (16QAM) Mode



Date: 25.AUG.2019 14:36:18

FCC §2.1051, §22.917(a) & §24.238(a) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

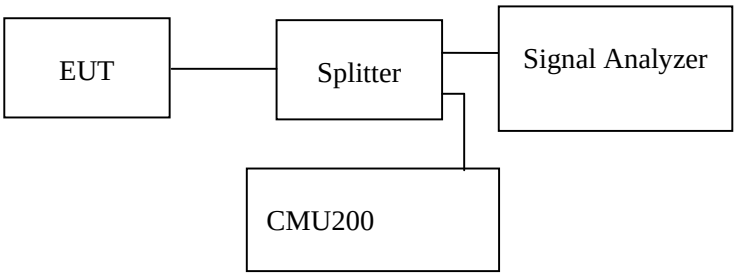
Applicable Standard

FCC §2.1051, §22.917(a) and §24.238(a).

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1051.

Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100kHz for below 1GHz and 1MHz for above 1GHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.



Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

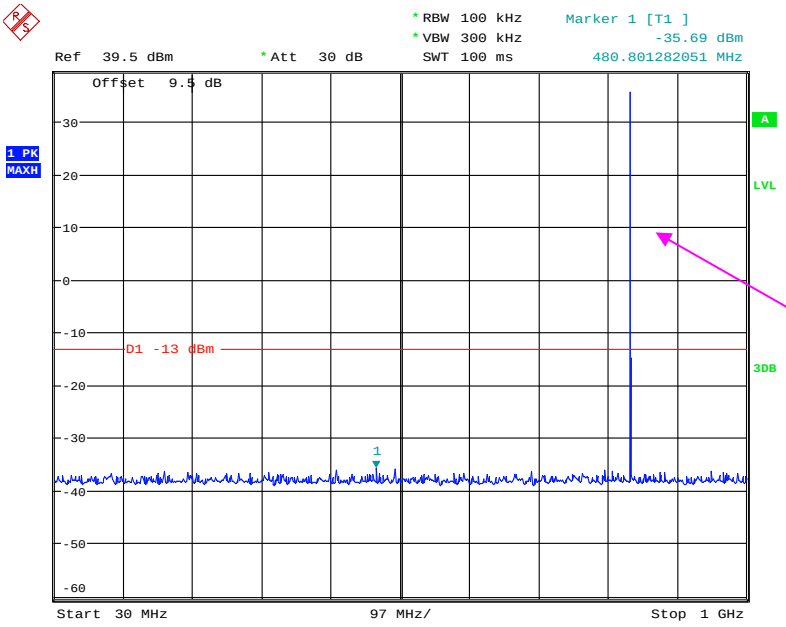
The testing was performed by George Zhong on 2019-08-25.

EUT operation mode: Transmitting

Test result: Compliance, please refer to the following plots.

Cellular Band (Part 22H)

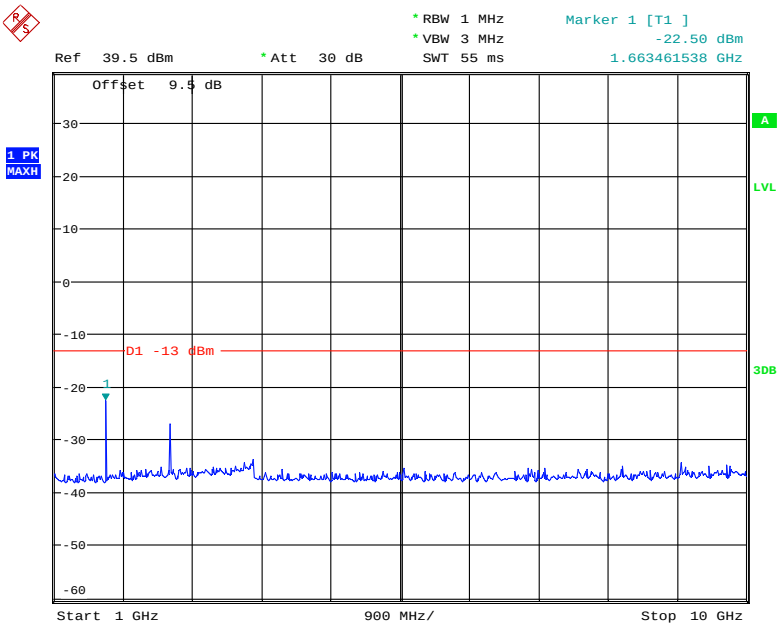
30 MHz – 1 GHz (GSM Mode)



Fundamental test

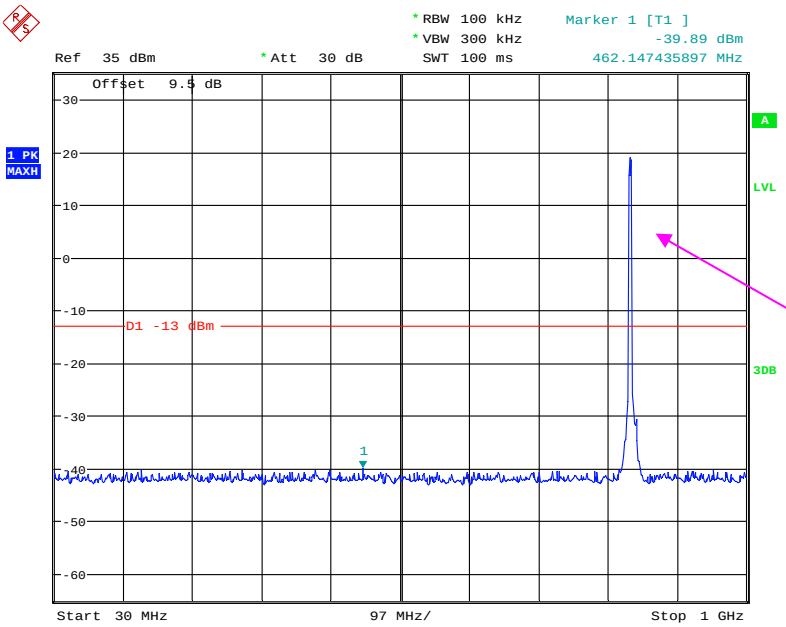
Date: 25.AUG.2019 13:47:40

1 GHz – 10 GHz (GSM Mode)



Date: 25.AUG.2019 13:48:26

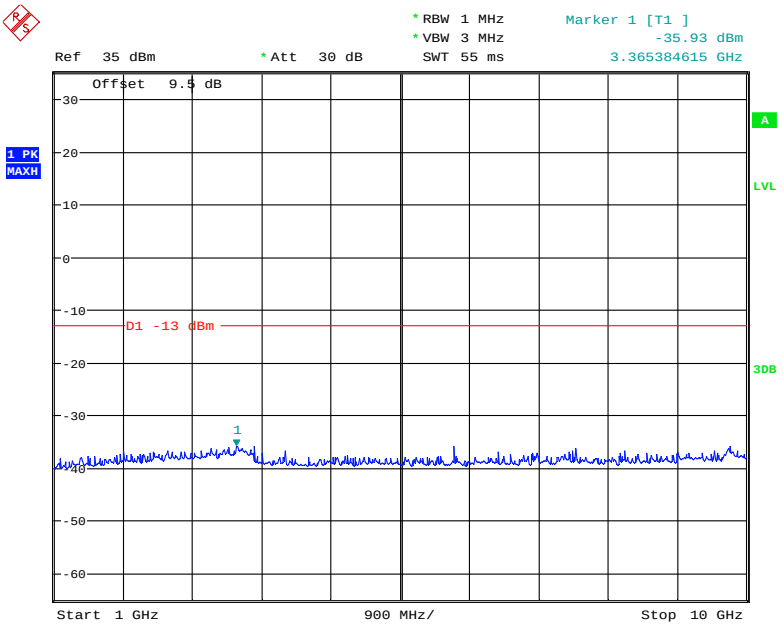
30 MHz – 1 GHz (WCDMA Mode)



Fundamental test

Date: 25.AUG.2019 15:11:36

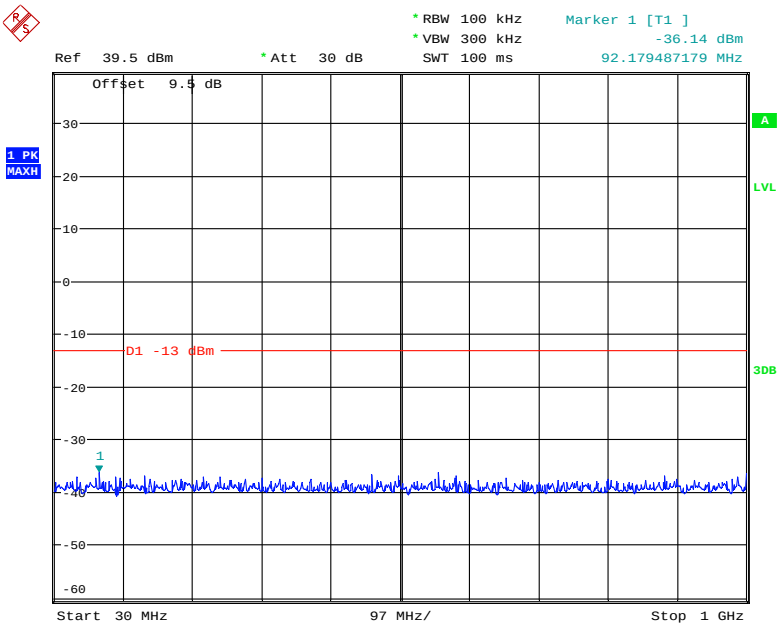
1 GHz – 10GHz (WCDMA Mode)



Date: 25.AUG.2019 15:10:40

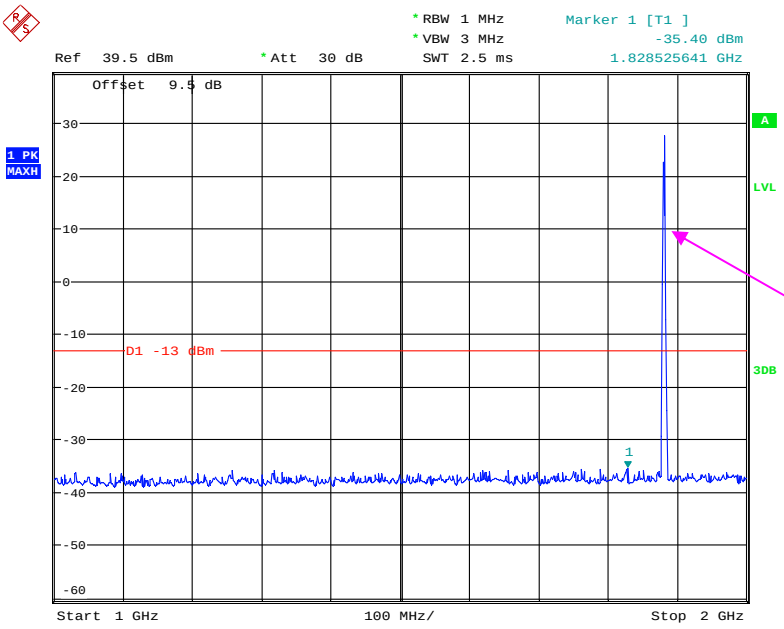
PCS Band (Part 24E)

30 MHz – 1 GHz (GSM Mode)



Date: 25.AUG.2019 13:51:37

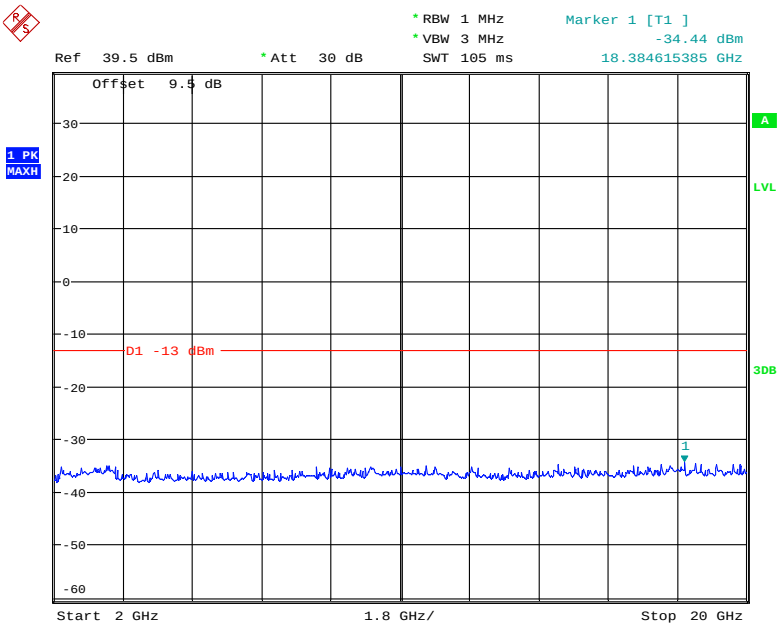
1 GHz – 2 GHz (GSM Mode)



Fundamental test

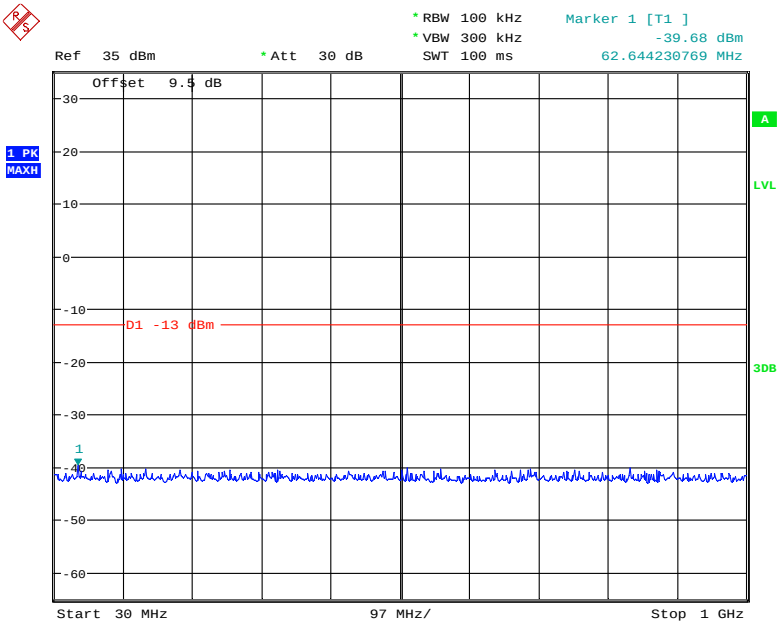
Date: 25.AUG.2019 13:50:42

2 GHz – 20 GHz (GSM Mode)



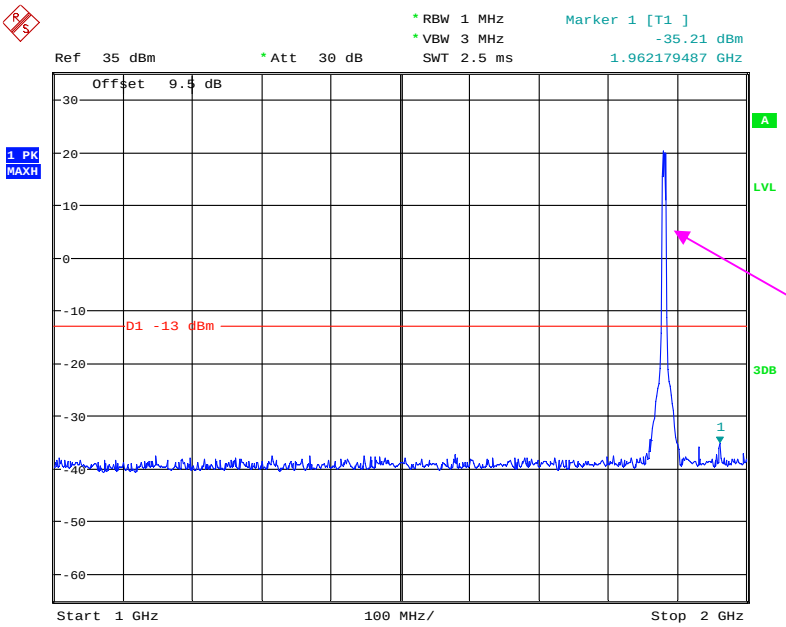
Date: 25.AUG.2019 13:51:12

30 MHz – 1 GHz (WCDMA Mode)



Date: 25.AUG.2019 15:06:38

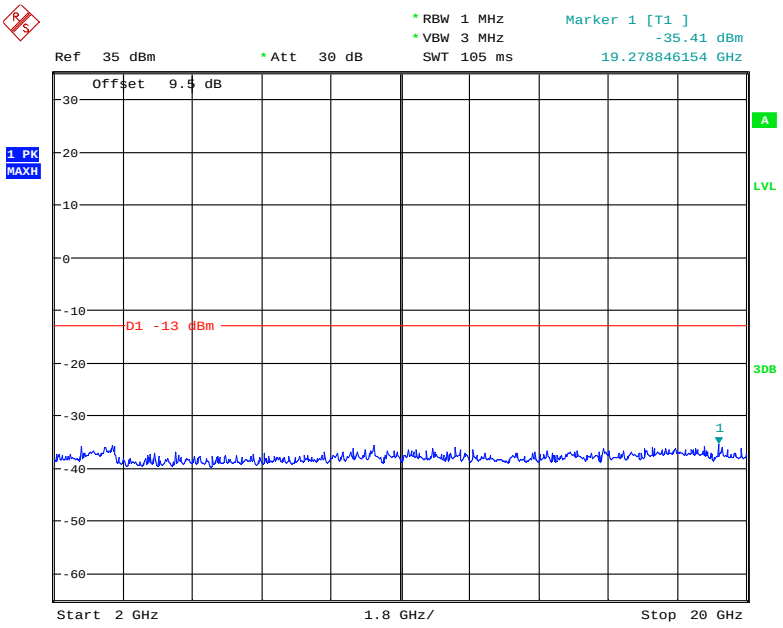
1 GHz – 2 GHz (WCDMA Mode)



Fundamental test

Date: 25.AUG.2019 15:07:15

2 GHz – 20 GHz (WCDMA Mode)



Date: 25.AUG.2019 15:07:33

FCC § 2.1053; § 22.917 (a);§ 24.238 (a) -SPURIOUS RADIATED EMISSIONS

Applicable Standard

FCC § 2.1053, §22.917(a) and § 24.238(a).

Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the receiving antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = 10 lg (TX pwr in Watts/0.001) – the absolute level

Spurious attenuation limit in dB = 43 + 10 Log_{10} (power out in Watts)

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0~101.3 kPa

The testing was performed by Alan He on 2019-09-07.

EUT operation mode: Transmitting

Pre-scan with Low, Middle and High channel, the worst case as below:

30 MHz ~ 10 GHz:

Cellular Band (Part 22H)

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
GSM Mode, Middle channel										
943.69	37.37	163	1.3	H	-63.2	1.37	0.0	-64.57	-13	51.57
943.69	36.07	67	2.4	V	-63.3	1.37	0.0	-64.67	-13	51.67
1673.20	61.94	109	2.5	H	-44.4	1.30	8.90	-36.80	-13	23.80
1673.20	58.14	112	2.1	V	-47.6	1.30	8.90	-40.00	-13	27.00
2509.80	57.20	295	1.1	H	-46.2	2.60	10.20	-38.60	-13	25.60
2509.80	56.05	194	1.6	V	-46.7	2.60	10.20	-39.10	-13	26.10
3346.40	60.66	69	1.2	H	-40.2	1.50	11.70	-30.00	-13	17.00
3346.40	58.32	59	1.8	V	-42.6	1.50	11.70	-32.40	-13	19.40
4183.00	60.57	313	1.4	H	-41.4	1.50	11.80	-31.10	-13	18.10
4183.00	57.48	20	1.2	V	-43.7	1.50	11.80	-33.40	-13	20.40
5019.60	53.51	8	1.2	H	-45.3	1.70	12.00	-35.00	-13	22.00
5019.60	51.17	316	1.2	V	-47.1	1.70	12.00	-36.80	-13	23.80
WCDMA Mode, Middle channel										
938.69	36.65	160	1.5	H	-63.9	1.37	0.0	-65.27	-13	52.27
938.69	37.77	144	1.1	V	-61.6	1.37	0.0	-62.97	-13	49.97
1673.20	48.74	189	2.1	H	-57.6	1.30	8.90	-50.00	-13	37.00
1673.20	46.38	31	2.2	V	-59.4	1.30	8.90	-51.80	-13	38.80
2509.80	49.25	67	2.1	H	-54.1	2.60	10.20	-46.50	-13	33.50
2509.80	48.12	161	1.3	V	-54.6	2.60	10.20	-47.00	-13	34.00
3346.40	45.56	109	2.2	H	-55.3	1.50	11.70	-45.10	-13	32.10
3346.40	43.25	159	1.5	V	-57.7	1.50	11.70	-47.50	-13	34.50

30 MHz ~ 20 GHz:

PCS Band (Part 24E)

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
GSM Mode, Middle channel										
943.69	36.93	122	1.8	H	-63.6	1.37	0.0	-64.97	-13	51.97
943.69	37.48	71	2.1	V	-61.9	1.37	0.0	-63.27	-13	50.27
3760.00	51.48	262	1.8	H	-50.6	1.50	11.80	-40.30	-13	27.30
3760.00	50.28	114	2.5	V	-51.3	1.50	11.80	-41.00	-13	28.00
5640.00	51.62	342	2.2	H	-46.0	1.70	12.40	-35.30	-13	22.30
5640.00	50.33	126	1.4	V	-46.9	1.70	12.40	-36.20	-13	23.20
9400.00	49.90	337	1.5	H	-45.4	2.20	11.50	-36.10	-13	23.10
9400.00	48.23	116	2.4	V	-47.3	2.20	11.50	-38.00	-13	25.00
WCDMA Mode, Middle channel										
938.69	36.27	140	2.2	H	-64.3	1.37	0.0	-65.67	-13	52.67
938.69	37.05	243	2.4	V	-62.3	1.37	0.0	-63.67	-13	50.67
3760.00	55.84	54	1.3	H	-46.2	1.50	11.80	-35.90	-13	22.90
3760.00	53.04	260	2.1	V	-48.5	1.50	11.80	-38.20	-13	25.20
5640.00	49.86	70	1.1	H	-49.8	1.70	12.40	-39.10	-13	26.10
5640.00	47.79	65	1.7	V	-51.6	1.70	12.40	-40.90	-13	27.90

Note:
1) Absolute Level = Substituted Level - Cable loss + Antenna Gain
2) Margin = Limit- Absolute Level
3) The unit of antenna gain is dBd for frequency below 1GHz and is dBi for frequency above 1GHz.

FCC § 22.917 (a); § 24.238 (a) - BAND EDGES

Applicable Standard

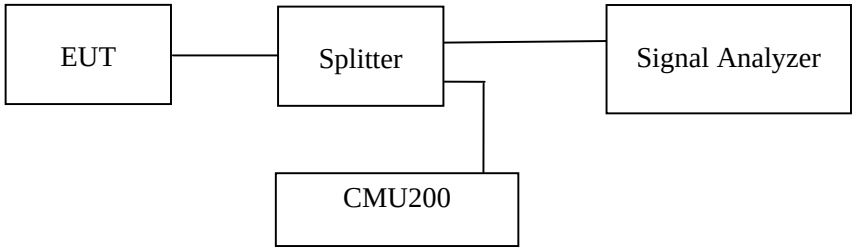
According to § 22.917(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

According to §24.238(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The center of the spectrum analyzer was set to block edge frequency



Test Data

Environmental Conditions

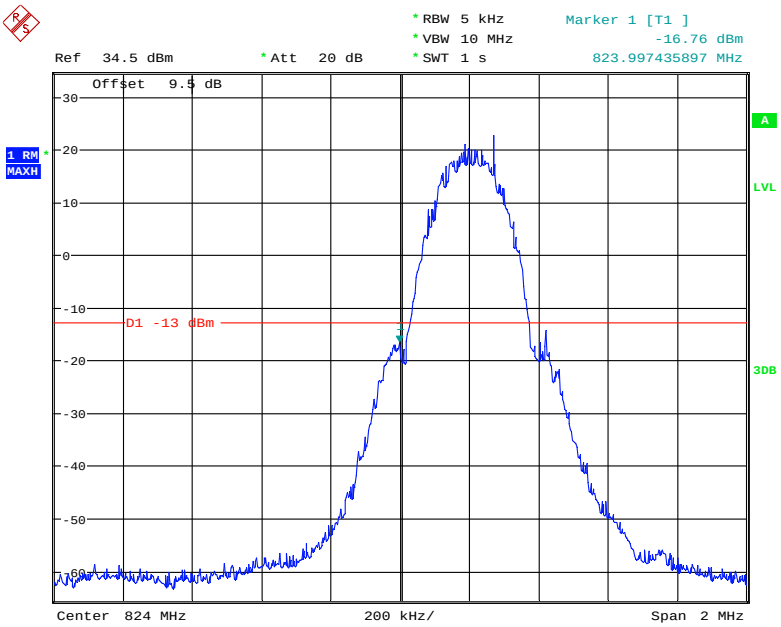
Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by George Zhong on 2019-08-25.

EUT operation mode: Transmitting

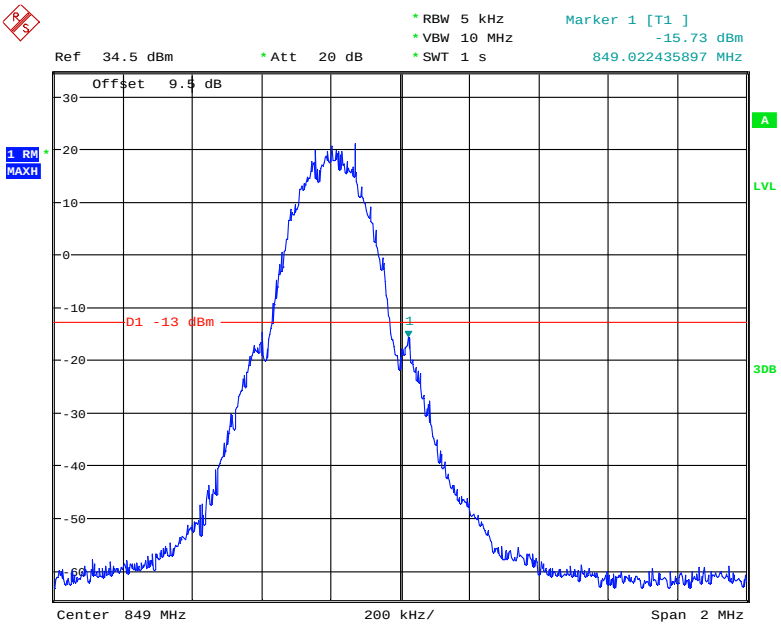
Test Result: Compliance. Please refer to the following plots.

Cellular Band, Left Band Edge for GSM (GMSK) Mode



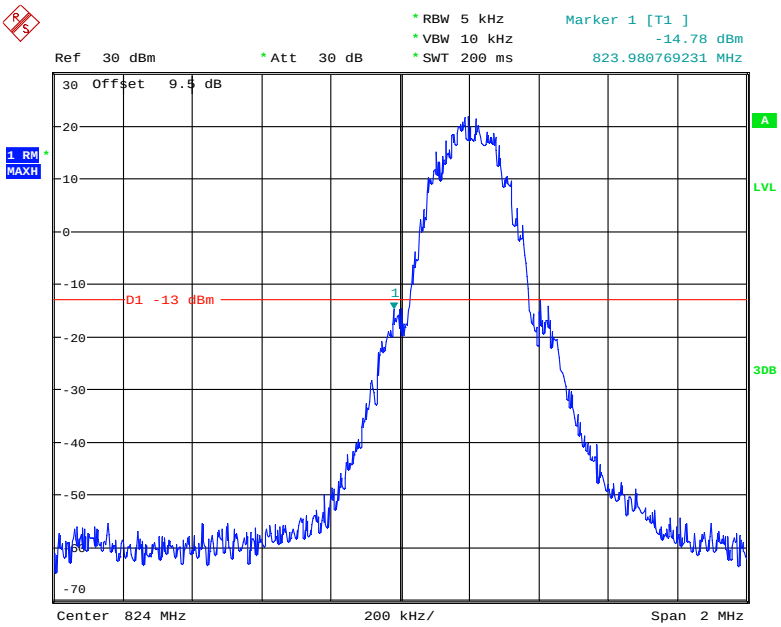
Date: 25.AUG.2019 13:42:59

Cellular Band, Right Band Edge for GSM (GMSK) Mode



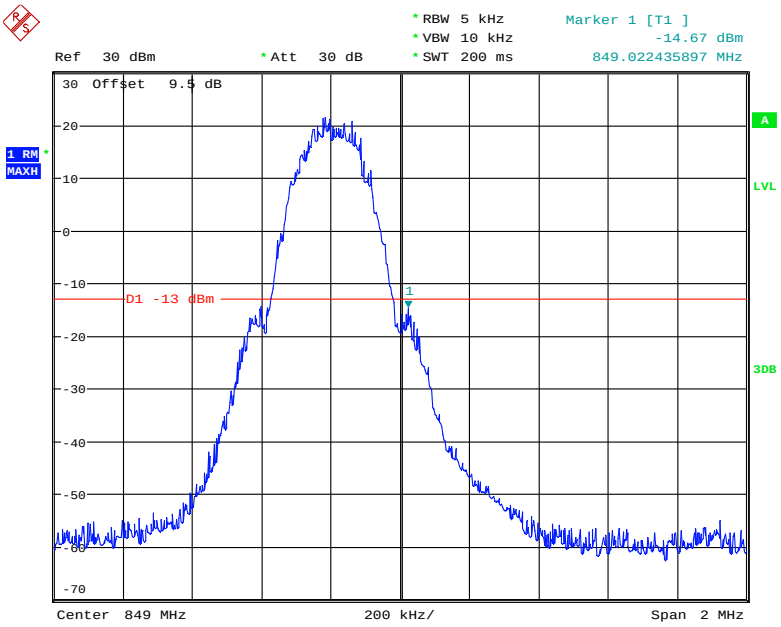
Date: 25.AUG.2019 13:41:27

Cellular Band, Left Band Edge for EDGE Mode



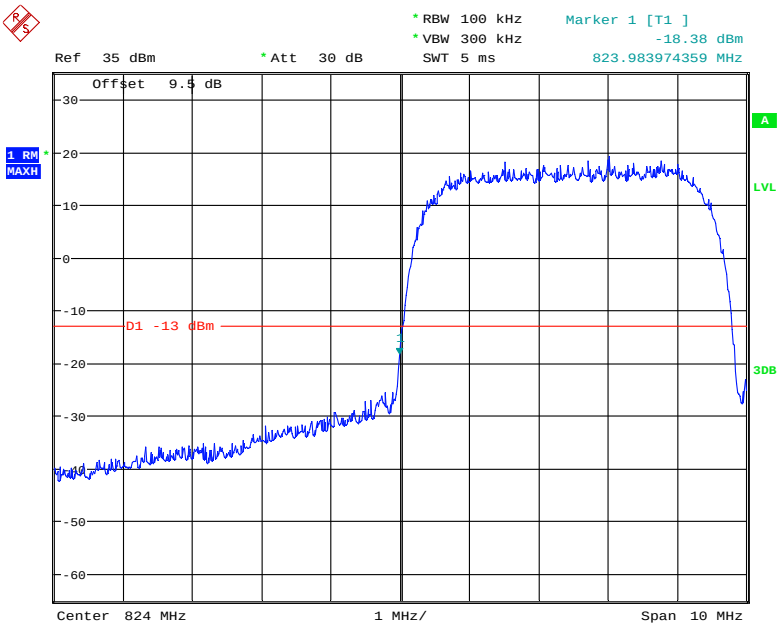
Date: 25.AUG.2019 13:58:58

Cellular Band, Right Band Edge for EDGE Mode



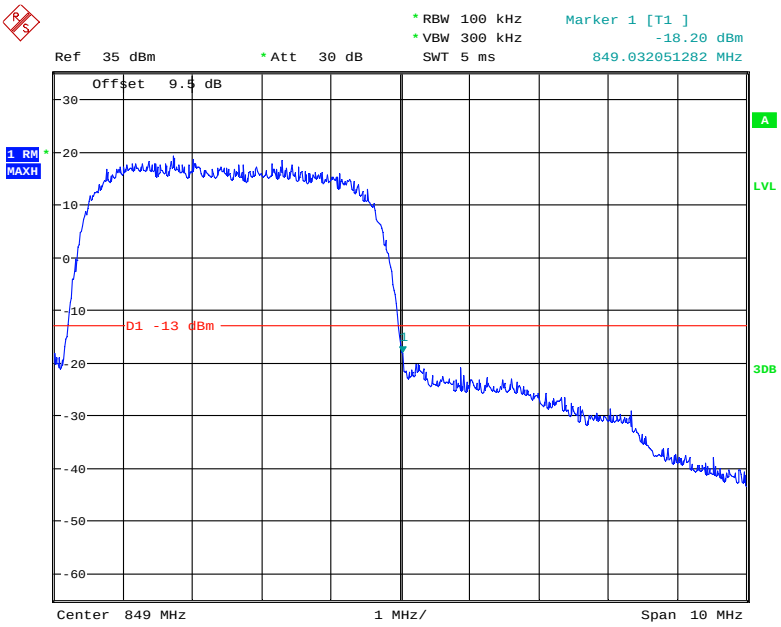
Date: 25.AUG.2019 14:00:01

Cellular Band, Left Band Edge for WCDMA (BPSK) Mode



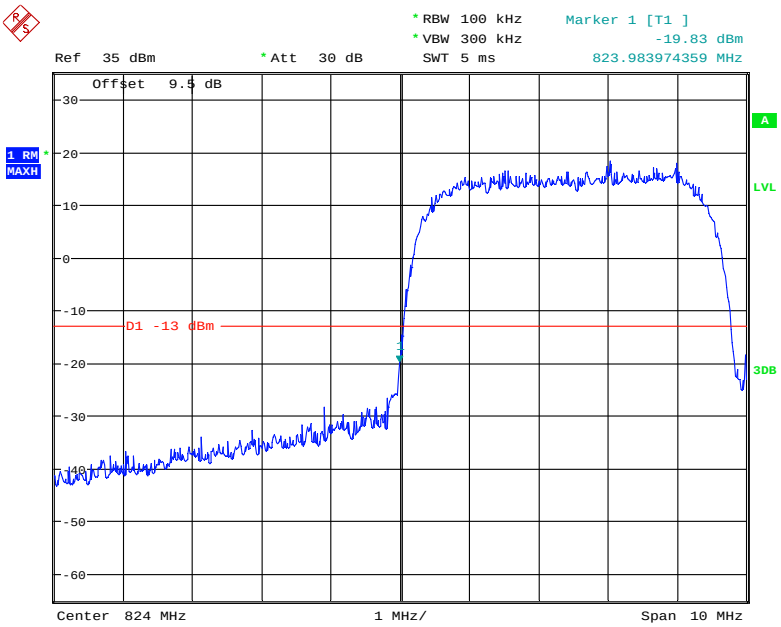
Date: 25.AUG.2019 15:14:03

Cellular Band, Right Band Edge for WCDMA (BPSK) Mode



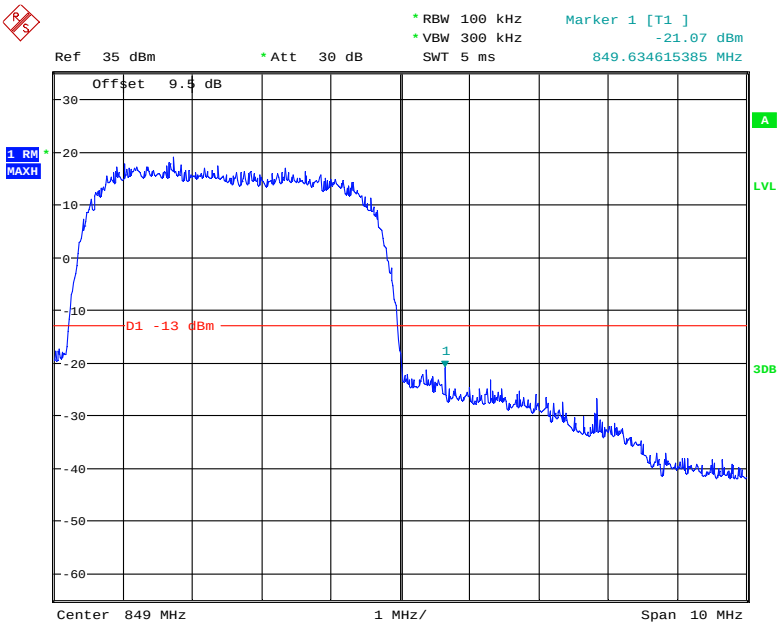
Date: 25.AUG.2019 15:14:36

Cellular Band, Left Band Edge for HSDPA (16QAM) Mode



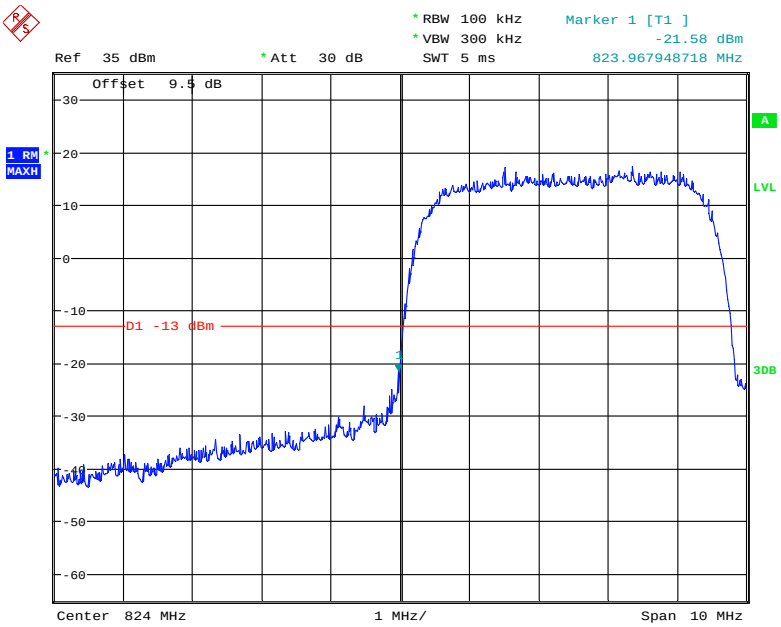
Date: 25.AUG.2019 15:19:32

Cellular Band, Right Band Edge for HSDPA (16QAM) Mode



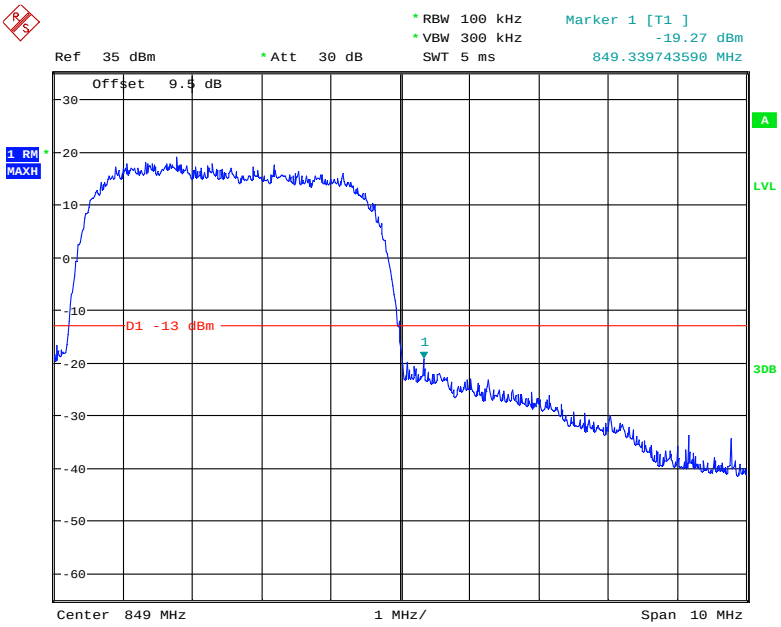
Date: 25.AUG.2019 15:20:14

Cellular Band, Left Band Edge for HSUPA (BPSK) Mode



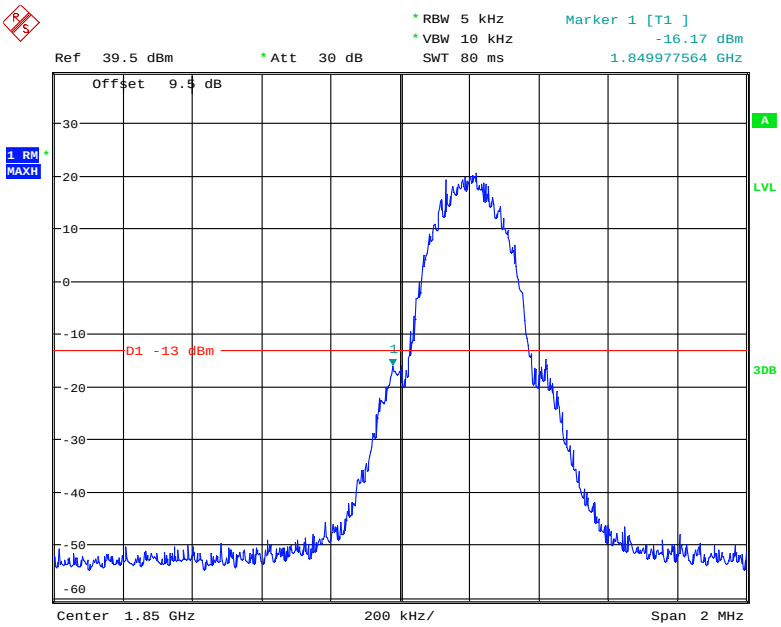
Date: 25.AUG.2019 15:23:08

Cellular Band, Right Band Edge for HSUPA (BPSK) Mode



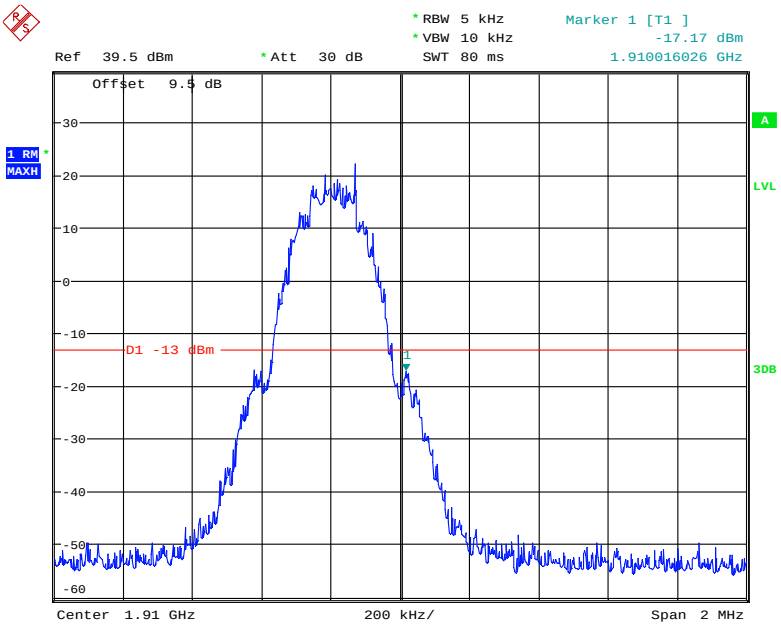
Date: 25.AUG.2019 15:22:21

PCS Band, Left Band Edge for GSM (GMSK) Mode



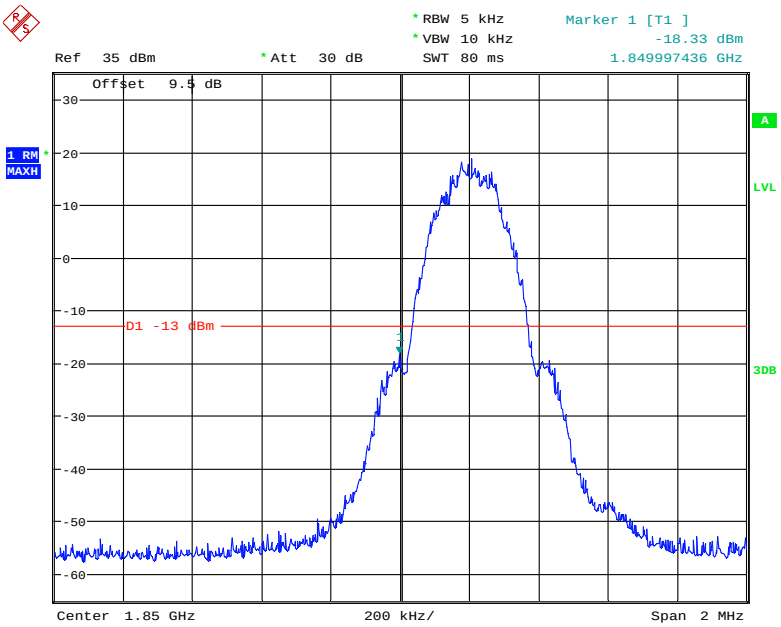
Date: 25.AUG.2019 13:55:09

PCS Band, Right Band Edge for GSM (GMSK) Mode



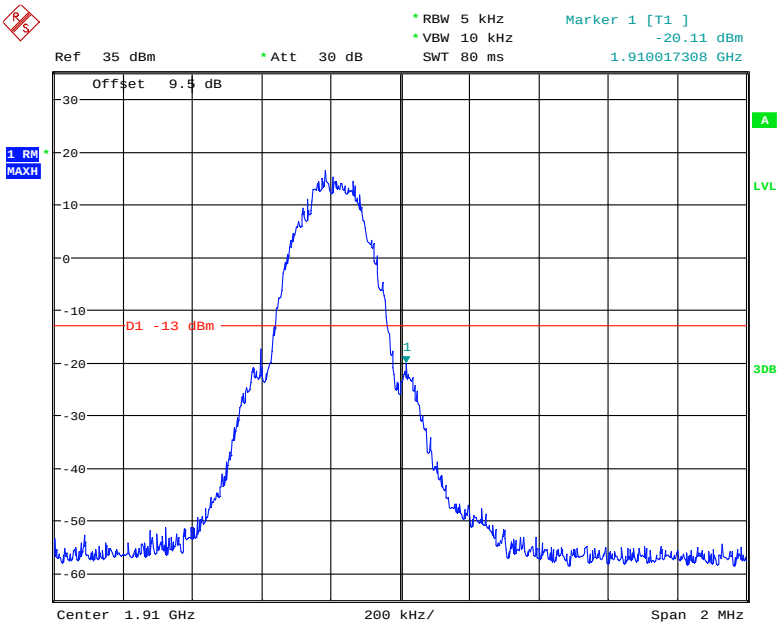
Date: 25.AUG.2019 13:55:42

PCS Band, Left Band Edge for EDGE Mode



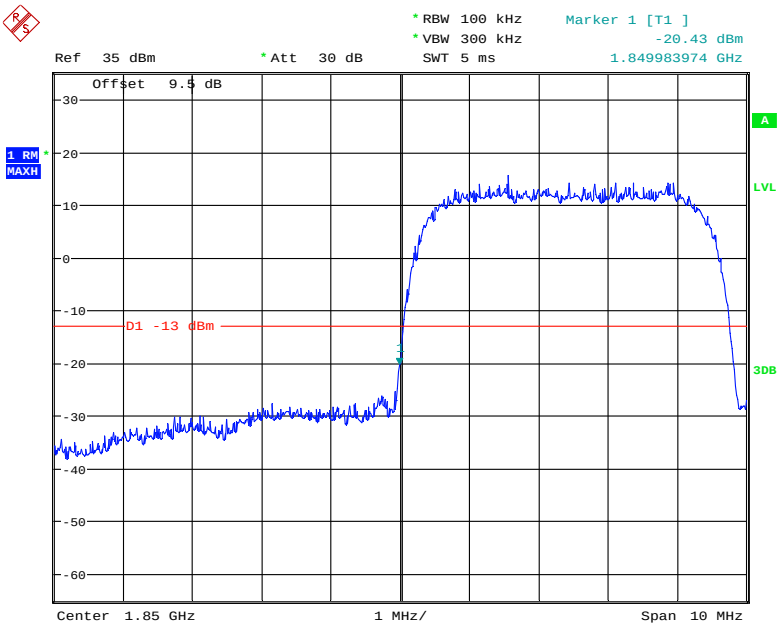
Date: 25.AUG.2019 14:08:17

PCS Band, Right Band Edge for EDGE Mode



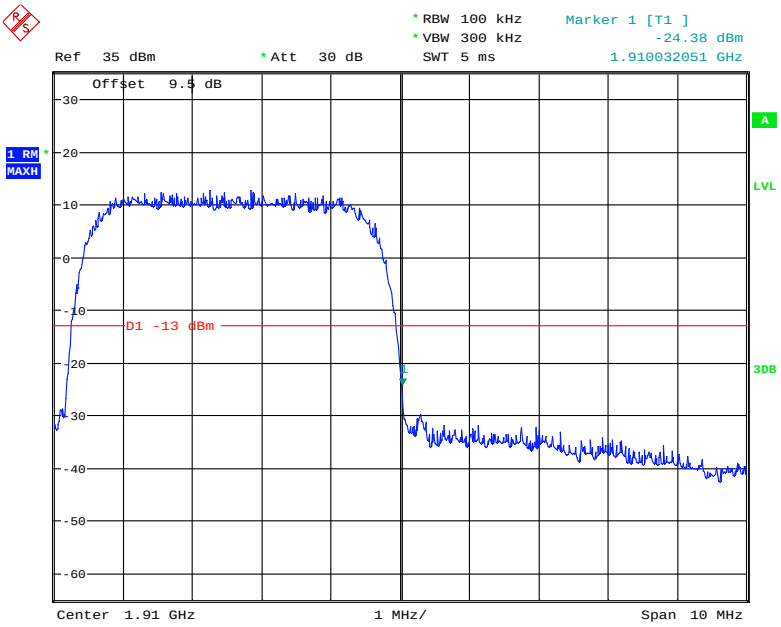
Date: 25.AUG.2019 14:09:15

PCS Band, Left Band Edge for WCDMA (BPSK) Mode



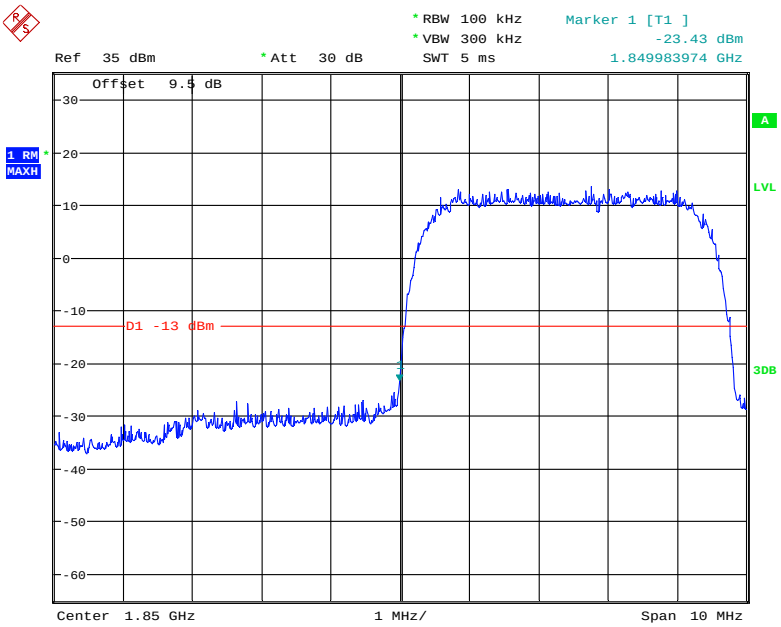
Date: 25.AUG.2019 15:04:20

PCS Band, Right Band Edge for WCDMA (BPSK) Mode



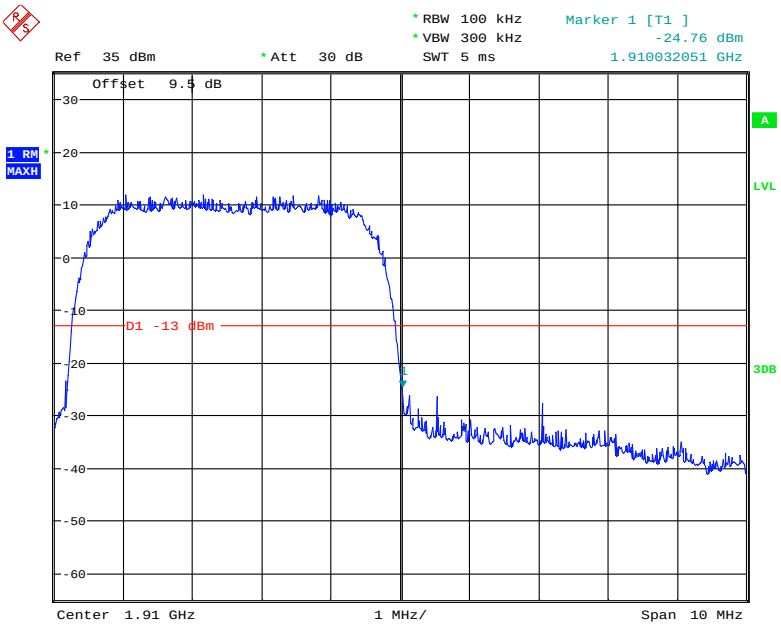
Date: 25.AUG.2019 15:03:45

PCS Band, Left Band Edge for HSDPA (16QAM) Mode



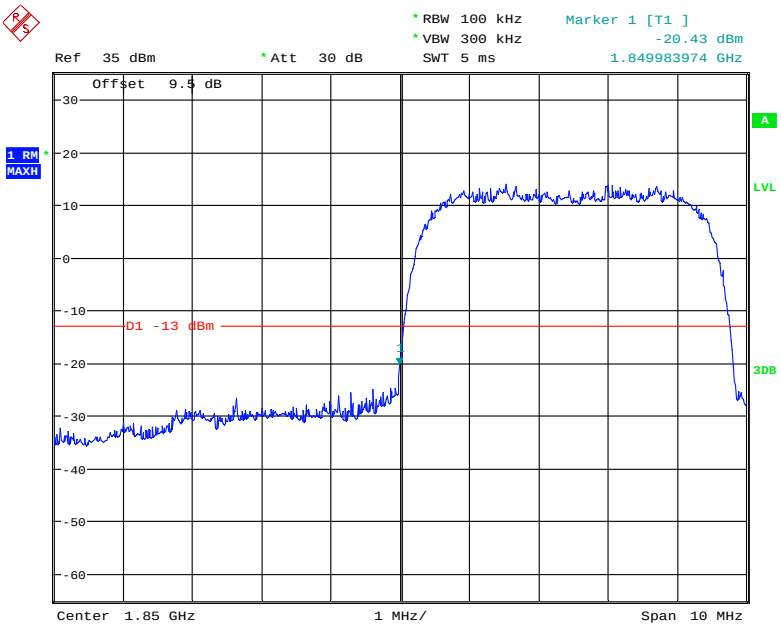
Date: 25.AUG.2019 14:38:42

PCS Band, Right Band Edge for HSDPA (16QAM) Mode



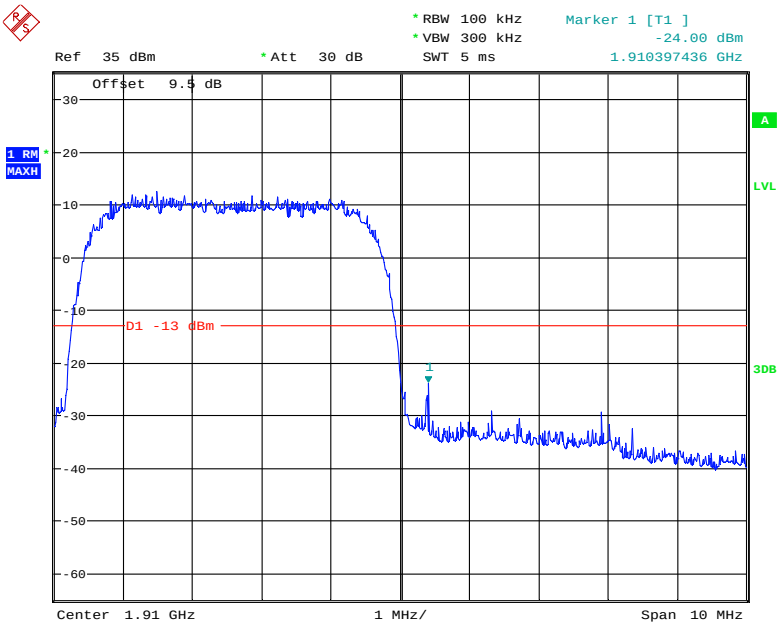
Date: 25.AUG.2019 14:39:27

PCS Band, Left Band Edge for HSUPA (BPSK) Mode



Date: 25.AUG.2019 14:26:23

PCS Band, Right Band Edge for HSUPA (BPSK) Mode



Date: 25.AUG.2019 14:28:47

FCC § 2.1055; § 22.355; § 24.235 - FREQUENCY STABILITY

Applicable Standard

FCC § 2.1055, §22.355 and §24.235.

According to FCC §2.1055, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

According to §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table below:

Frequency Tolerance for Transmitters in the Public Mobile Services

Frequency Range (MHz)	Base, fixed (ppm)	Mobile ≤ 3 watts (ppm)	Mobile > 3 watts (ppm)
25 to 50	20.0	20.0	50.0
50 to 450	5.0	5.0	50.0
450 to 512	2.5	5.0	5.0
821 to 896	1.5	2.5	2.5
928 to 929.	5.0	N/A	N/A
929 to 960.	1.5	N/A	N/A
2110 to 2220	10.0	N/A	N/A

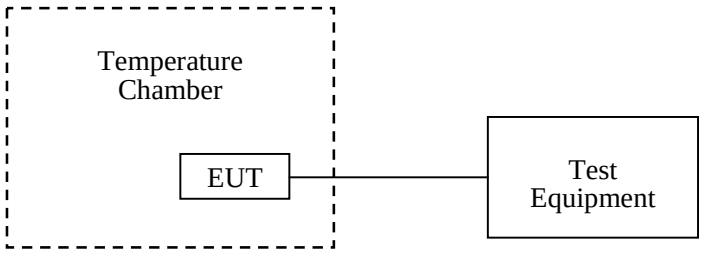
According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the communication test set.

Frequency Stability vs. Voltage: For hand carried, battery powered equipment; reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.



Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by George Zhong on 2019-08-28.

EUT operation mode: Transmitting

Test Result: Compliance. Please refer to the following tables.

Cellular Band (Part 22H)

GSM Mode

Middle Channel, f_o =836.6MHz				
Temperature (℃)	**Power Supplied (V_{DC})**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Limit (ppm)**
-30	3.85	4	0.004781	2.5
-20		3	0.003586	2.5
-10		1	0.001195	2.5
0		5	0.005977	2.5
10		7	0.008367	2.5
20		8	0.009563	2.5
30		1	0.001195	2.5
40		-2	-0.002391	2.5
50		2	0.002391	2.5
25	V min.= 3.5	-2	-0.002391	2.5
25	V max.= 4.2	5	0.005977	2.5

EDGE Mode

Middle Channel, f_o =836.6MHz				
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Limit (ppm)**
-30	3.85	5	0.005977	2.5
-20		3	0.003586	2.5
-10		4	0.004781	2.5
0		5	0.005877	2.5
10		9	0.010758	2.5
20		6	0.007172	2.5
30		5	0.005977	2.5
40		4	0.004781	2.5
50		8	0.009563	2.5
25	V min.= 3.5	8	0.009563	2.5
	V max.= 4.2	6	0.007172	2.5

WCDMA Mode

Middle Channel, f_o =836.6MHz				
Temperature (℃)	**Power Supplied (V_{DC})**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Limit (ppm)**
-30	3.85	8	0.009563	2.5
-20		3	0.003586	2.5
-10		1	0.001195	2.5
0		5	0.005977	2.5
10		-1	-0.001195	2.5
20		4	0.004781	2.5
30		1	0.001195	2.5
40		-2	-0.002391	2.5
50		4	0.004781	2.5
25	V min.= 3.5	-2	-0.002391	2.5
25	V max.= 4.2	3	0.003586	2.5

PCS Band (Part 24E)

GSM Mode

Middle Channel, f_o =1880.0 MHz				
Temperature (℃)	**Power Supplied (V_{DC})**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Result**
-30	3.85	5	0.002660	pass
-20		4	0.002128	pass
-10		2	0.001064	pass
0		7	0.003723	pass
10		-2	-0.001064	pass
20		4	0.002128	pass
30		8	0.004255	pass
40		-1	-0.000532	pass
50		3	0.001596	pass
25	V min.= 3.5	4	0.002128	pass
25	V max.= 4.2	5	0.002660	pass

EDGE Mode

Middle Channel, f_o =1880.0 MHz				
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Limit (ppm)**
-30	3.85	-1	-0.000532	pass
-20		3	0.001596	pass
-10		6	0.003191	pass
0		4	0.002128	pass
10		6	0.003191	pass
20		-2	-0.001064	pass
30		5	0.002660	pass
40		6	0.003191	pass
50		4	0.002128	pass
25	V min.= 3.5	2	0.001064	pass
	V max.= 4.2	-1	-0.000532	pass

WCDMA Mode

Middle Channel, f_o =1880.0 MHz				
Temperature (℃)	**Power Supplied (V_{DC})**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Result**
-30	3.85	5	0.002660	pass
-20		-2	-0.001064	pass
-10		2	0.001064	pass
0		3	0.001596	pass
10		-2	-0.001064	pass
20		4	0.002128	pass
30		8	0.004255	pass
40		-1	-0.000532	pass
50		3	0.001596	pass
25	V min.= 3.5	1	0.000532	pass
25	V max.= 4.2	5	0.002660	pass

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