TESTING LABORATORY
CERTIFICATE #4820.01

FCC PART 22H, PART 24E

MEASUREMENT AND TEST REPORT

For

Fennec Corp.

4F, No. 28, Ln. 50, Yixian Rd., Xinyi Disti., Taipei City, Taiwan

FCC ID:2AUYEFW001

Report Type:	**Product Type:**
Original Report	Fennec Watch One

Report Number:	RDG191101002-00C
Report Date:	2019-12-24
Reviewed By:	Jerry Zhang EMC Manager Jerry Zhang
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Dongguan) No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 www.baclcorp.com.cn

TABLE OF CONTENTS

GENERAL INFORMATION **4**
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) 4
OBJECTIVE 4
RELATED SUBMITTAL(S)/GRANT(S) 4
TEST METHODOLOGY 4
MEASUREMENT UNCERTAINTY 5
TEST FACILITY 5
DECLARATIONS 5
SYSTEM TEST CONFIGURATION **6**
JUSTIFICATION 6
EQUIPMENT MODIFICATIONS 6
SUPPORT EQUIPMENT LIST AND DETAILS 6
CONFIGURATION OF TEST SETUP 6
BLOCK DIAGRAM OF TEST SETUP 7
SUMMARY OF TEST RESULTS **8**
FCC §1.1310 & §2.1093- RF EXPOSURE **9**
APPLICABLE STANDARD 9
TEST RESULT 9
FCC §2.1047 - MODULATION CHARACTERISTIC **10**
FCC § 2.1046, § 22.913 (A) & § 24.232 (C) - RF OUTPUT POWER **11**
APPLICABLE STANDARD 11
TEST PROCEDURE 11
TEST EQUIPMENT LIST AND DETAILS 15
TEST DATA 15
FCC §2.1049, §22.917, §22.905 & §24.238 - OCCUPIED BANDWIDTH **19**
APPLICABLE STANDARD 19
TEST PROCEDURE 19
TEST EQUIPMENT LIST AND DETAILS 19
TEST DATA 20
FCC §2.1051, §22.917(A) & §24.238(A) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS **26**
APPLICABLE STANDARD 26
TEST PROCEDURE 26
TEST EQUIPMENT LIST AND DETAILS 26
TEST DATA 26
FCC §2.1053, §22.917 & §24.238 - SPURIOUS RADIATED EMISSIONS **31**
APPLICABLE STANDARD 31
TEST PROCEDURE 31
TEST EQUIPMENT LIST AND DETAILS 32
TEST DATA 32
FCC §22.917(A) & §24.238(A)- BAND EDGES **35**
APPLICABLE STANDARD 35
TEST PROCEDURE 35
TEST EQUIPMENT LIST AND DETAILS 35
TEST DATA 35

FCC §2.1055, §22.355 & §24.235 - FREQUENCY STABILITY 46
APPLICABLE STANDARD 46
TEST PROCEDURE 46
TEST EQUIPMENT LIST AND DETAILS 47
TEST DATA 47

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:		Fennec Watch One
EUT Model:		FW001
Operation modes:		GSM Voice, GPRS/EDGE Data, WCDMA(R99 (Voice+Data), HSDPA/HSUPA)
Operation Frequency:		GSM 850: 824-849 MHz(TX); 869-894 MHz(RX) PCS 1900: 1850-1910 MHz(TX); 1930-1990 MHz(RX) WCDMA Band 2: 1850-1910 MHz(TX); 1930-1990 MHz(RX) WCDMA Band 5: 824-849 MHz(TX); 869-894 MHz(RX)
Maximum Output Power: (Conducted)		GSM 850 : 31.23dBm; PCS 1900: 28.57 dBm WCDMA Band 2: 22.67 dBm; WCDMA Band 5: 22.86 dBm
Modulation Type:		GMSK, QPSK, 16QAM
Rated Input Voltage:		DC 4.35V from battery or DC 5V from adapter
Adapter Information	**Model:**	KA06E-0501000US
	Input:	100-240Vac
	Output:	5Vdc 1A
Serial Number:		RDG191101002-RF-S3
EUT Received Date:		2019/11/4
EUT Received Status:		Good

Objective

This report is prepared on behalf of ***Fennec Corp.*** in accordance with: Part 2-Subpart J, Part 22-Subpart H, and Part 24-Subpart E of the Federal Communications Commission's rules.

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

Related Submittal(s)/Grant(s)

FCC Part 15C DSS submissions with FCC ID: 2AUYEFW001
FCC Part 15B JBP submissions with FCC ID: 2AUYEFW001
FCC Part 15C DTS submissions with FCC ID: 2AUYEFW001

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

Applicable Standards: TIA/EIA 603-D-2010.

All radiated and conducted emissions measurements were performed at Bay Area Compliance Laboratories Corp.(Dongguan).

Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.61dB
Unwanted Emissions, radiated	30MHz ~ 1GHz:5.85 dB 1G~26.5GHz: 5.23 dB
Unwanted Emissions, conducted	±1.5 dB
Temperature	±1℃
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%

Note: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218, the FCC Designation No. : CN1220.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0022.

Declarations

BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol "△ ". Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

This report cannot be reproduced except in full, without prior written approval of the Company.

This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

This report must not be used by the customer to claim product certification, approval, or endorsement by A2LA, or any agency of the U.S. Government.

This report may contain data that are not covered by the accreditation scope and shall be marked with an asterisk "★".

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured for testing according to TIA/EIA-603-D 2010.

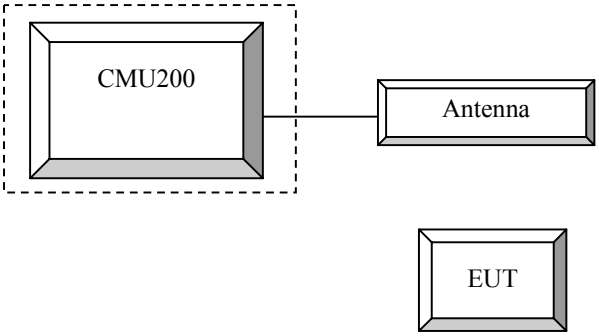
Equipment Modifications

No modification was made to the EUT.

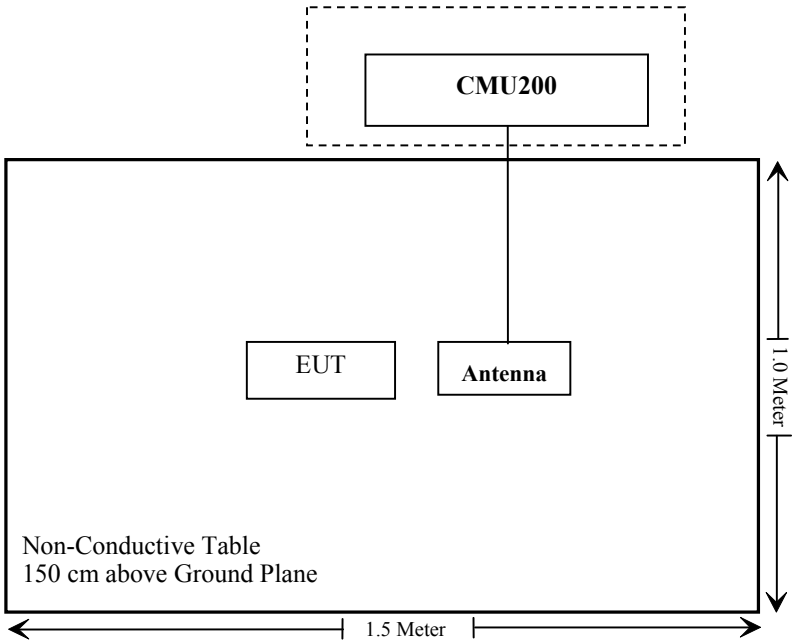
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
R&S	Universial Radio Communication Tester	CMU200	106 891
Un-Known	ANTENNA	Un-Known	Un-Known

Configuration of Test Setup



Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1310, §2.1093	RF Exposure	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)	Spurious Radiation Emissions	Compliance
§ 22.917 (a); § 24.238 (a)	Out of band emission, Band Edge	Compliance
§ 2.1055 § 22.355; § 24.235	Frequency stability vs. temperature Frequency stability vs. voltage	Compliance

FCC §1.1310 & §2.1093- RF EXPOSURE

Applicable Standard

FCC§1.1310 and §2.1093.

Test Result

Compliance, please refer to the SAR report: RDG191101002-20.

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.

According to §24.232 (d) Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

Test Procedure

GSM/GPRS/EGPRS

Function: Menu select > GSM Mobile Station > GSM 850/1900
Press Connection control to choose the different menus
Press RESET > choose all the reset all settings
Connection Press Signal Off to turn off the signal and change settings
Network Support > GSM + GPRS or GSM + EGSM
Main Service > Packet Data
Service selection > Test Mode A – Auto Slot Config. off
MS Signal Press Slot Config Bottom on the right twice to select and change the number of time slots and power setting
> Slot configuration > Uplink/Gamma
> 33 dBm for GPRS 850
> 30 dBm for GPRS 1900
> 27 dBm for EGPRS 850
> 26 dBm for EGPRS 1900
BS Signal Enter the same channel number for TCH channel (test channel) and BCCH channel
Frequency Offset > + 0 Hz
Mode > BCCH and TCH
BCCH Level > -85 dBm (May need to adjust if link is not stable)
BCCH Channel > choose desire test channel [Enter the same channel number for TCH channel (test channel) and BCCH channel]

Channel Type > Off
P0 > 4 dB
Slot Config > Unchanged (if already set under MS signal)
TCH > choose desired test channel
Hopping > Off
Main Timeslot > 3
Network Coding Scheme > CS4 (GPRS) and MCS5 (EGPRS)

Bit Stream > 2E9-1 PSR Bit Stream
AF/RF Enter appropriate offsets for Ext. Att. Output and Ext. Att. Input
Connection Press Signal on to turn on the signal and change settings

WCDMA-Release 99

The following tests were conducted according to the test requirements outlines in section 5.2 of the 3GPP TS34.121-1 specification. The EUT has a nominal maximum output power of 24dBm (+1.7/-3.7).

WCDMA General Settings	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	βc / βd	8/15

WCDMA HSDPA

The following tests were conducted according to the test requirements outlines in section 5.2 of the 3GPP TS34.121-1 specification.

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subset	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	Power Control Algorithm	Algorithm2			
	βc	2/15	12/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	βd (SF)	64			
	βc/ βd	2/15	12/15	15/8	15/4
	βhs	4/15	24/15	30/15	30/15
	MPR(dB)	0	0	0.5	0.5
HSDPA Specific Settings	DACK	8			
	DNAK	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback	4ms			
	CQI Repetition Factor	2			
	Ahs=βhs/ βc	30/15			

WCDMA HSUPA

The following tests were conducted according to the test requirements outlines in section 5.2 of the 3GPP TS34.121-1 specification.

	Mode	**HSUPA**	**HSUPA**	**HSUPA**	**HSUPA**	**HSUPA**
	Subset	**1**	**2**	**3**	**4**	**5**
WCDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2kbps RMC				
	HSDPA FRC	H-Set1				
	HSUPA Test	HSUPA Loopback				
	Power Control Algorithm	Algorithm2				
	βc	11/15	6/15	15/15	2/15	15/15
	βd	15/15	15/15	9/15	15/15	0
	βec	209/225	12/15	30/15	2/15	5/15
	βc/ βd	11/15	6/15	15/9	2/15	-
	βhs	22/15	12/15	30/15	4/15	5/15
	CM(dB)	1.0	3.0	2.0	3.0	1.0
	MPR(dB)	0	2	1	2	0
HSDPA Specific Settings	DACK	8				
	DNAK	8				
	DCQI	8				
	Ack-Nack repetition factor	3				
	CQI Feedback	4ms				
	CQI Repetition Factor	2				
	Ahs=βhs/ βc	30/15				
HSUPA Specific Settings	DE-DPCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	21
	ETFCI	75	67	92	71	81
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E_FCls	E-TFCI 11 E E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO23 E-TFCI 75 E-TFCI PO26 E-TFCI 81 E-TFCI PO 27		E-TFCI 11 E-TFCI PO4 E-TFCI 92 E-TFCI PO 18	E-TFCI 11 E E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO23 E-TFCI 75 E-TFCI PO26 E-TFCI 81 E-TFCI PO 27	

HSPA+

The following tests were conducted according to the test requirements in Table C.11.1.4 of 3GPP TS 34.121-1

Sub-test	β_c (Note3)	β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (2xSF2) (Note 4)	β_{ed} (2xSF4) (Note 4)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 4)	E-TFCI (Note 5)	E-TFCI (boost)
1	1	0	30/15	30/15	$\beta_{ed}1$: 30/15 $\beta_{ed}2$: 30/15	$\beta_{ed}3$: 24/15 $\beta_{ed}4$: 24/15	3.5	2.5	14	105	105

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c .
Note 2: CM = 3.5 and the MPR is based on the relative CM difference, MPR = MAX(CM-1,0).
Note 3: DPDCH is not configured, therefore the β_c is set to 1 and β_d = 0 by default.
Note 4: β_{ed} can not be set directly; it is set by Absolute Grant Value.
Note 5: All the sub-tests require the UE to transmit 2SF2+2SF4 16QAM EDCH and they apply for UE using E-DPDCH category 7. E-DCH TTI is set to 2ms TTI and E-DCH table index = 2. To support these E-DCH configurations DPDCH is not allocated. The UE is signalled to use the extrapolation algorithm.

DC-HSDPA

The following tests were conducted according to the test requirements in Table C.8.1.12 of 3GPP TS 34.121-1

Table C.8.1.12: Fixed Reference Channel H-Set 12

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK

Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table.
Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESR3	102453	2019-06-26	2020-06-26
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
EMCO	Adjustable Dipole Antenna	3121C	9109-753	N/A	N/A
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-1400-01	2019-05-06	2020-05-06
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-02	2019-09-05	2020-09-05
Agilent	Signal Generator	E8247C	MY43321350	2018-12-10	2019-12-10
Agilent	Spectrum Analyzer	E4440A	SG43360054	2019-05-09	2020-05-09
TDK RF	Horn Antenna	HRN-0118	130 084	2018-10-12	2021-10-12
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-02	2019-09-05	2020-09-05
R&S	Universal Radio Communication Tester	CMU200	106 891	2018-12-14	2019-12-14
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	N/A

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

Test Data

Environmental Conditions

Temperature:	27℃
Relative Humidity:	45%
ATM Pressure:	101.2kPa
Tester:	Blake Yang
Test Date:	2019-11-05

Test Result: Compliance

Conducted Output Power

Cellular Band & PCS Band

Band	Channel No.	Conducted Peak Output Power (dBm)							
		GPRS 1 TX Slot	GPRS 2 TX Slots	GPRS 3 TX Slots	GPRS 4 TX Slots	EDGE 1TX slot	EDGE 2TX slots	EDGE 3TX slots	EDGE 4TX slots
Cellular	128	32.4	32.11	31.25	29.08	27.14	25.94	23.87	22.36
	190	32.5	32.34	31.32	29.14	27.19	26.01	24.06	22.51
	251	32.5	32.41	31.37	29.19	27.23	26.11	24.21	22.68
PCS	512	27.8	27.76	26.81	24.85	24.52	23.74	21.55	20.38
	661	28.2	28.18	27.22	25.11	24.83	23.85	21.74	20.47
	810	29.1	29.04	28.05	26.09	25.78	24.62	22.35	21.24

WCDMA Band II

Mode	3GPP Sub Test	Low Channel		Middle Channel		High Channel	
		Ave. Power (dBm)	PAR (dB)	Ave. Power (dBm)	PAR (dB)	Ave. Power (dBm)	PAR (dB)
Rel 99	1	20.65	3.08	21.05	3.12	21.83	3.12
HSDPA	1	19.85	3.48	20.11	4.20	20.67	4.28
	2	19.81	3.60	20.34	3.76	20.63	4.49
	3	19.79	3.20	19.66	4.30	20.49	4.34
	4	19.35	3.73	20.44	3.85	20.84	4.17
HSUPA	1	19.94	4.08	20.24	4.24	20.75	4.04
	2	19.74	4.51	20.66	4.70	20.62	3.63
	3	20.31	3.95	20.28	4.19	20.41	3.83
	4	20.26	4.16	19.94	3.99	20.48	4.16
	5	19.51	3.91	20.17	3.78	21.20	4.10
DC-HSDPA	1	19.92	3.65	20.09	4.52	20.81	3.78
	2	20.02	4.37	20.35	4.66	21.04	3.99
	3	19.88	3.99	20.34	3.97	20.76	3.80
	4	20.07	3.75	19.86	4.66	20.92	4.43
HSPA+ (16QAM)	1	19.93	4.14	20.00	3.94	20.28	3.07

WCDMA Band V

Mode	3GPP Sub Test	Low Channel		Middle Channel		High Channel	
		Ave. Power (dBm)	PAR (dB)	Ave. Power (dBm)	PAR (dB)	Ave. Power (dBm)	PAR (dB)
Rel 99	1	22.91	2.68	22.78	3.20	22.89	2.76
HSDPA	1	21.94	3.84	21.68	4.24	21.87	4.04
	2	21.71	3.36	21.48	3.96	21.65	3.90
	3	21.61	3.57	21.94	4.18	22.25	4.12
	4	22.03	3.51	21.22	3.78	22.34	4.49
HSUPA	1	21.85	4.12	21.62	3.84	21.76	4.48
	2	22.25	3.84	21.66	3.90	21.81	4.75
	3	22.01	3.67	21.70	3.34	21.48	4.55
	4	21.83	3.67	21.75	3.57	21.28	4.74
	5	22.09	4.28	22.04	4.28	21.40	4.36
DC-HSDPA	1	21.85	4.09	21.51	3.39	21.48	4.22
	2	21.74	4.18	21.23	3.72	21.26	4.11
	3	22.19	4.00	22.01	3.80	21.38	4.44
	4	21.79	3.84	21.51	3.87	21.79	4.65
HSPA+ (16QAM)	1	21.36	3.77	21.38	4.04	21.62	4.59

ERP & EIRP

Part 22H

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBµV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
GSM 850 Middle Channel								
836.60	H	97.39	23.16	0.00	0.50	22.66	38.45	15.79
836.60	V	86.80	15.54	0.00	0.50	15.04	38.45	23.41
EGPRS 850 Middle Channel								
836.60	H	94.71	20.48	0.00	0.50	19.98	38.45	18.47
836.60	V	83.57	12.31	0.00	0.50	11.81	38.45	26.64
WCDMA Band 5 Middle Channel								
836.60	H	87.36	13.13	0.00	0.50	12.63	38.45	25.82
836.60	V	85.58	14.32	0.00	0.50	13.82	38.45	24.63

Part 24E

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBµV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
WCDMA R99 Band 2 middle channel								
1880.00	H	88.36	15.75	11.66	2.66	24.75	33.00	8.25
1880.00	V	85.70	13.23	11.66	2.66	22.23	33.00	10.77
EGPRS 1900 Middle Channel								
1880.00	H	86.69	14.08	11.66	2.66	23.08	33.00	9.92
1880.00	V	85.67	13.20	11.66	2.66	22.20	33.00	10.80
WCDMA R99 Band 5 middle channel								
1880.00	H	72.75	0.14	11.66	2.66	9.14	33.00	23.86
1880.00	V	79.27	6.80	11.66	2.66	15.80	33.00	17.20

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

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

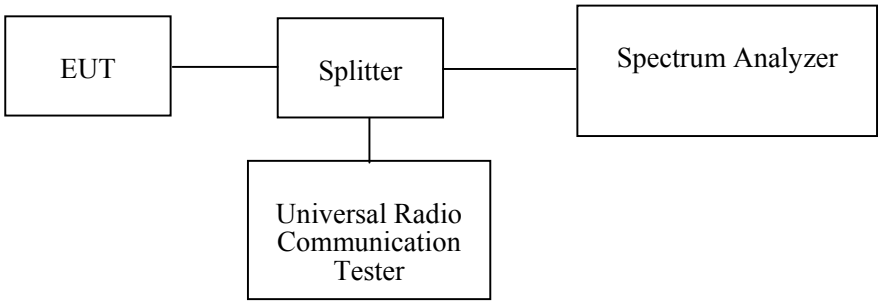
Applicable Standard

FCC §2.1049, §22.917, §22.905, §24.238

Test Procedure

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

The 26 dB & 99% bandwidth was recorded.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2018-12-10	2019-12-10
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41005011	Each time	/
Unknown	Coaxial Cable	C-SJ00-0010	C0010/03	Each time	/
E-Microwave	Two-way Spliter	ODP-1-6-2S	OE0120142	Each time	/

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

Test Data

Environmental Conditions

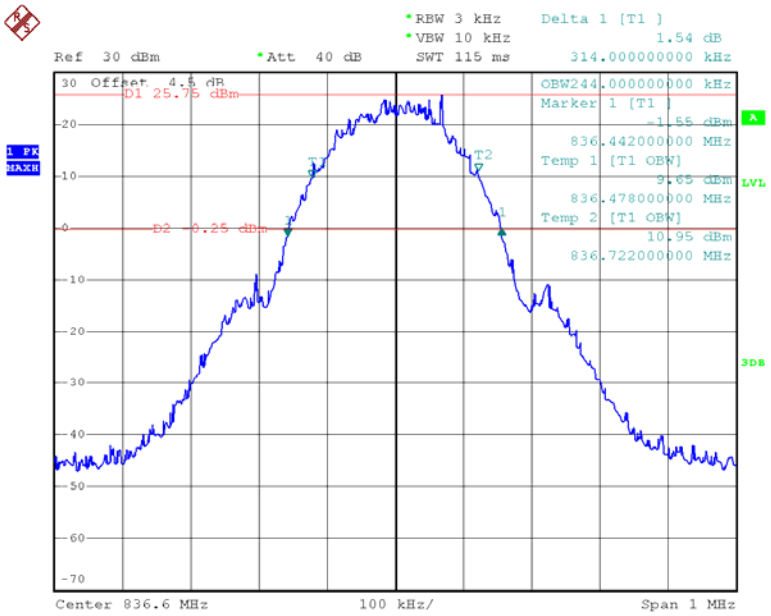
Temperature:	27℃
Relative Humidity:	45%
ATM Pressure:	101.2kPa
Tester:	Blake Yang
Test Date:	2019-11-05

Test Mode: Transmitting

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

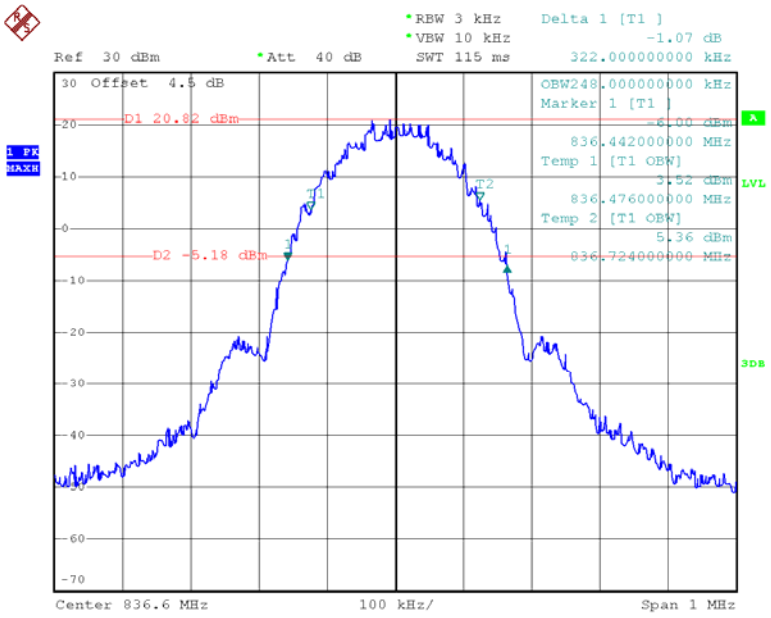
Band	Test Channel	Mode	99% Occupied Bandwidth (MHz)	26 dB Occupied Bandwidth (MHz)
Cellular	Middle	GSM	0.244	0.314
		EDGE	0.248	0.322
PCS		GSM	0.250	0.320
		EDGE	0.252	0.318
WCDMA Band 2		Rel 99	4.160	4.720
		HSDPA	4.180	4.720
		HSUPA	4.180	4.720
WCDMA Band 5		Rel 99	4.180	4.700
		HSDPA	4.180	4.720
		HSUPA	4.740	4.180

GSM Cellular 850



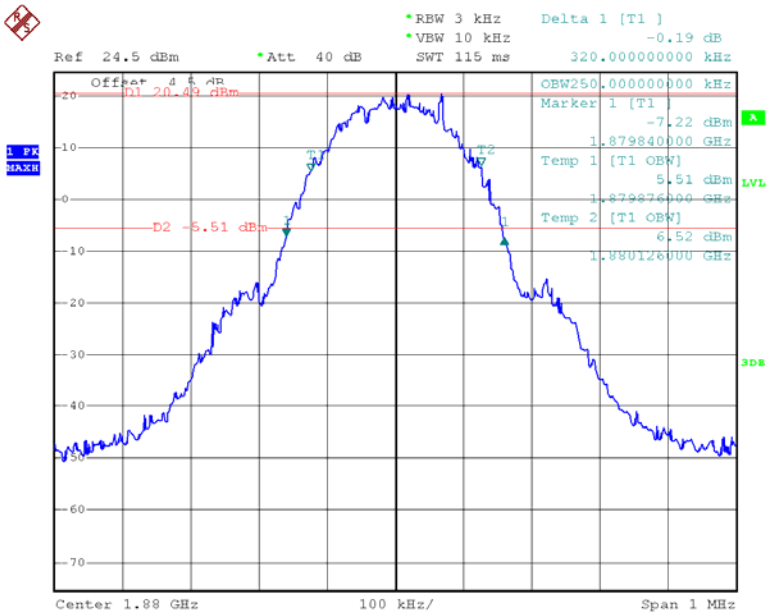
Date: 5.NOV.2019 21:54:07

EDGE Cellular 850



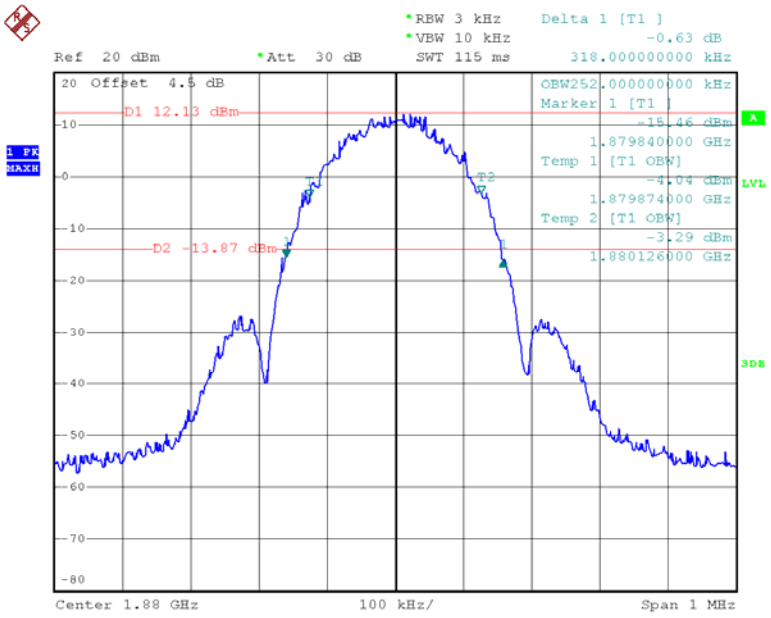
Date: 5.NOV.2019 22:00:56

GSM PCS 1900



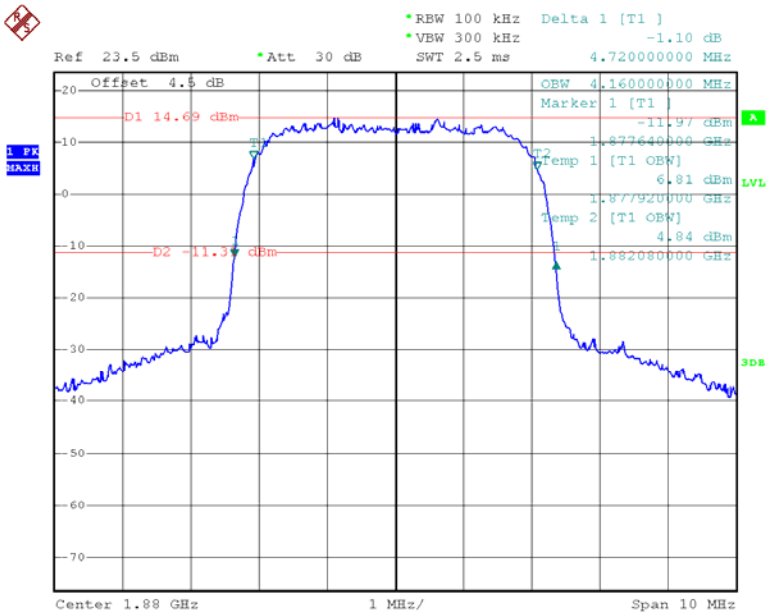
Date: 5.NOV.2019 22:16:07

EDGE PCS1900



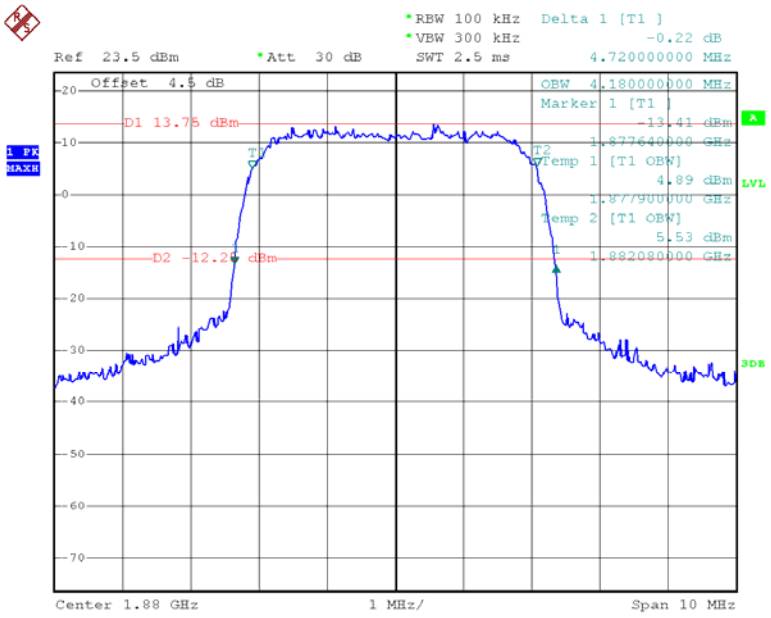
Date: 5.NOV.2019 22:12:28

Band 2 REL99



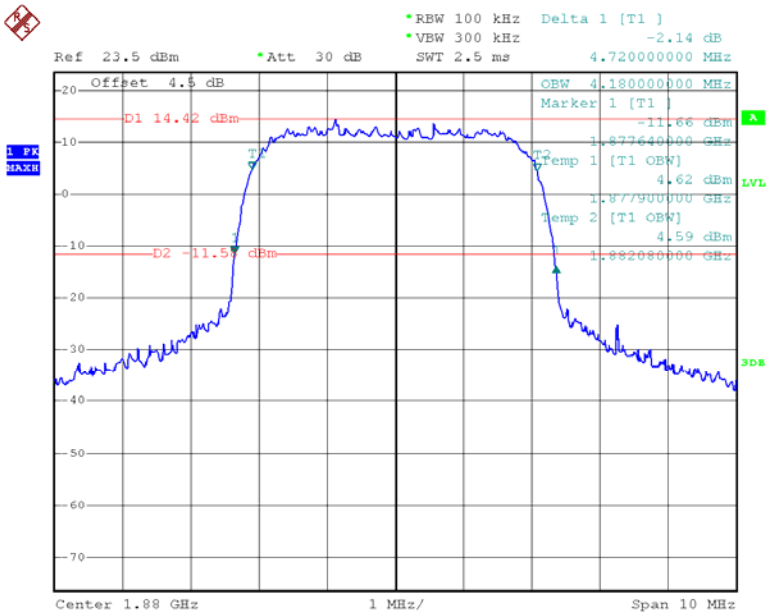
Date: 5.NOV.2019 21:12:45

Band 2 HSDPA



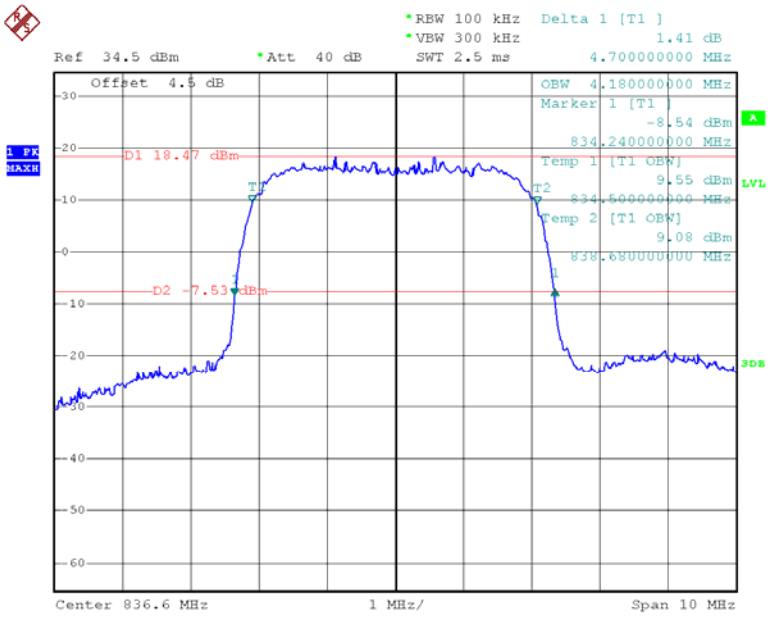
Date: 5.NOV.2019 21:11:28

Band 2 HSDPA



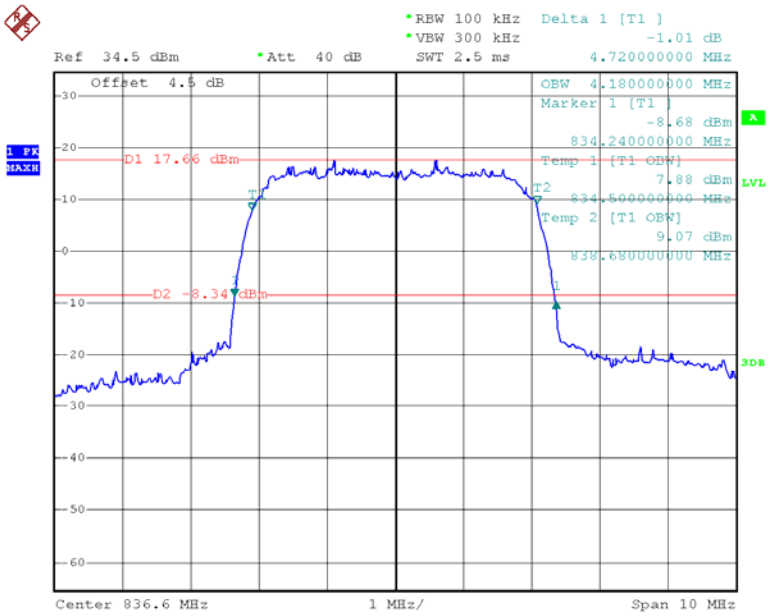
Date: 5.NOV.2019 21:09:51

Band 5 REL99



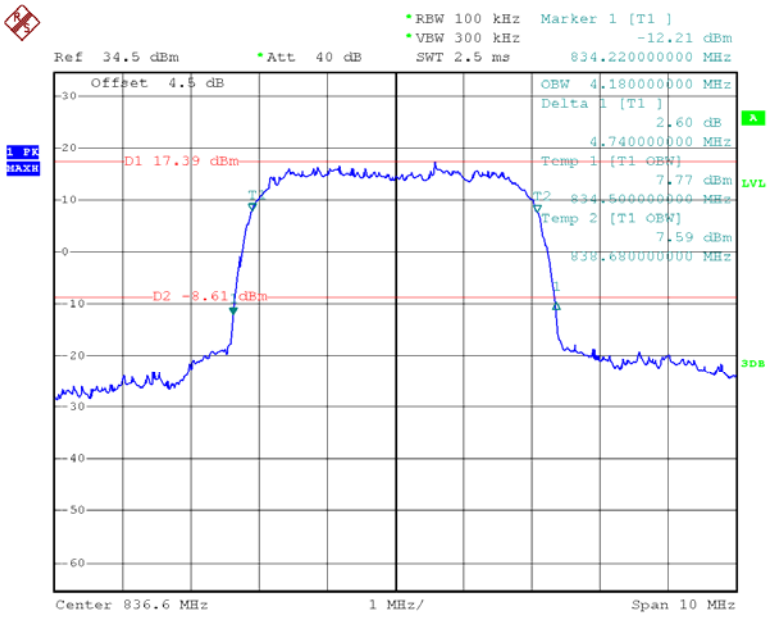
Date: 5.NOV.2019 21:20:01

Band 5 HSDPA



Date: 5.NOV.2019 21:34:35

Band 5 HSDPA



Date: 5.NOV.2019 21:36:04

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

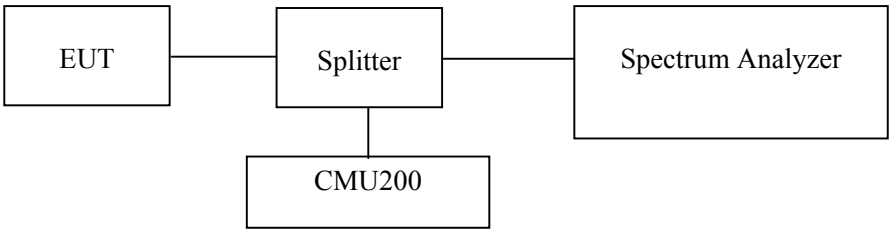
Applicable Standard

FCC §2.1051, §22.917(a) , §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. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2018-12-10	2019-12-10
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41005011	Each time	/
Unknown	Coaxial Cable	C-SJ00-0010	C0010/03	Each time	/
E-Microwave	Two-way Spliter	ODP-1-6-2S	OE0120142	Each time	/

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

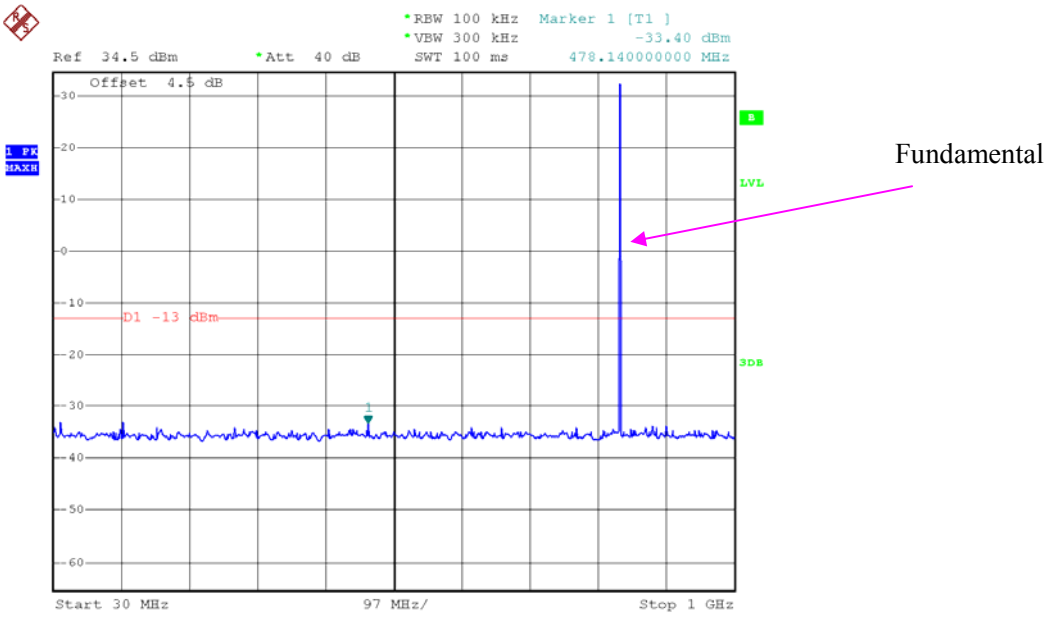
Test Data

Environmental Conditions

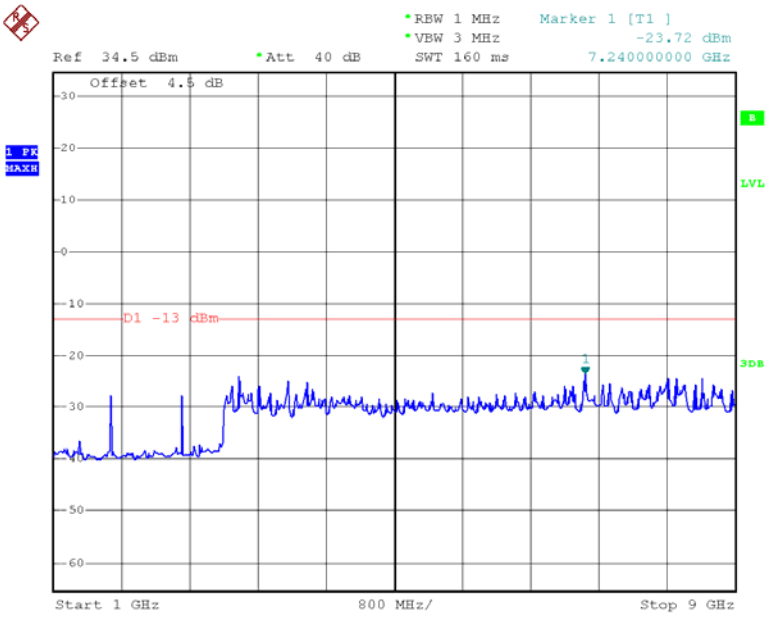
Temperature:	27℃
Relative Humidity:	45%
ATM Pressure:	101.2kPa
Tester:	Blake Yang
Test Date:	2019-11-05

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

GSM 850 Middle Channel

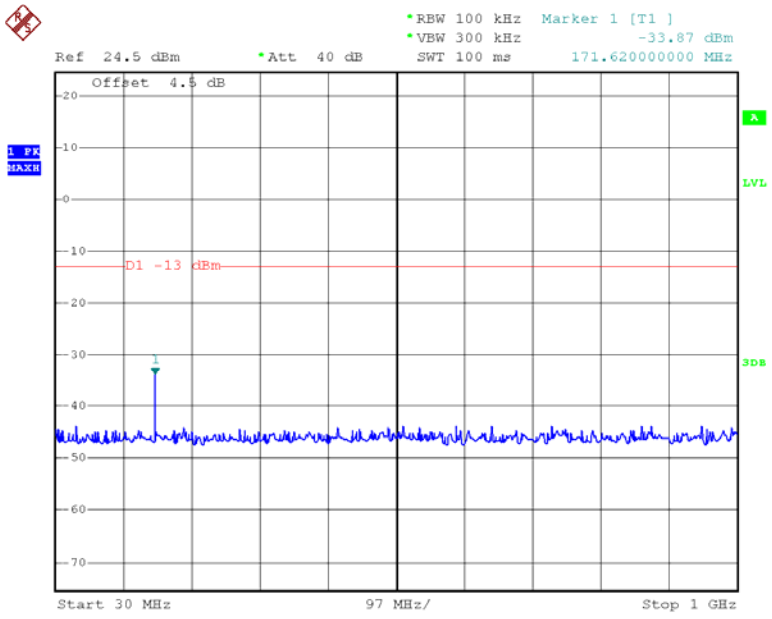


Date: 5.NOV.2019 21:55:23

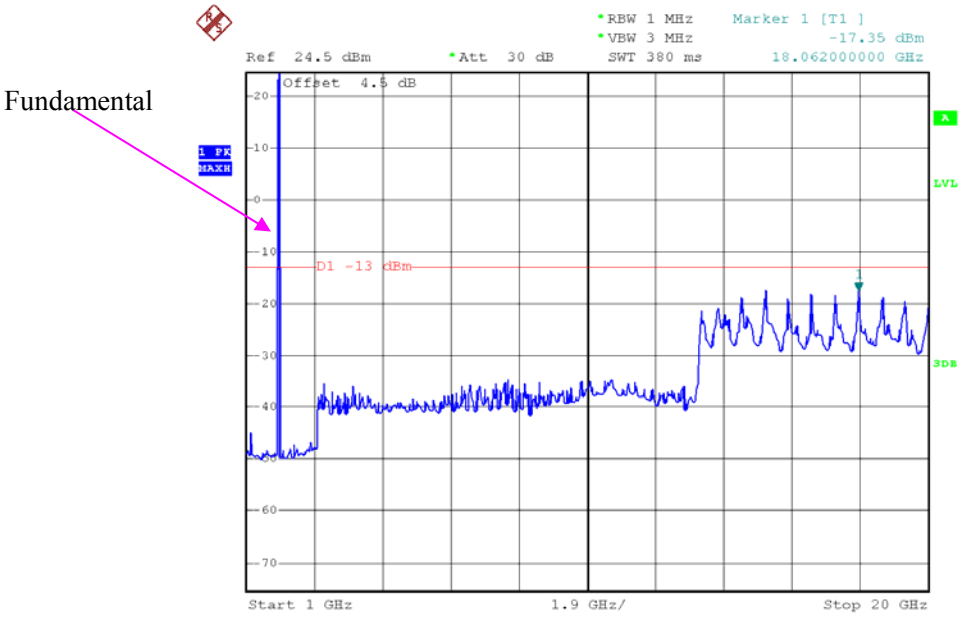


Date: 5.NOV.2019 21:55:54

GSM1900 Middle Channel

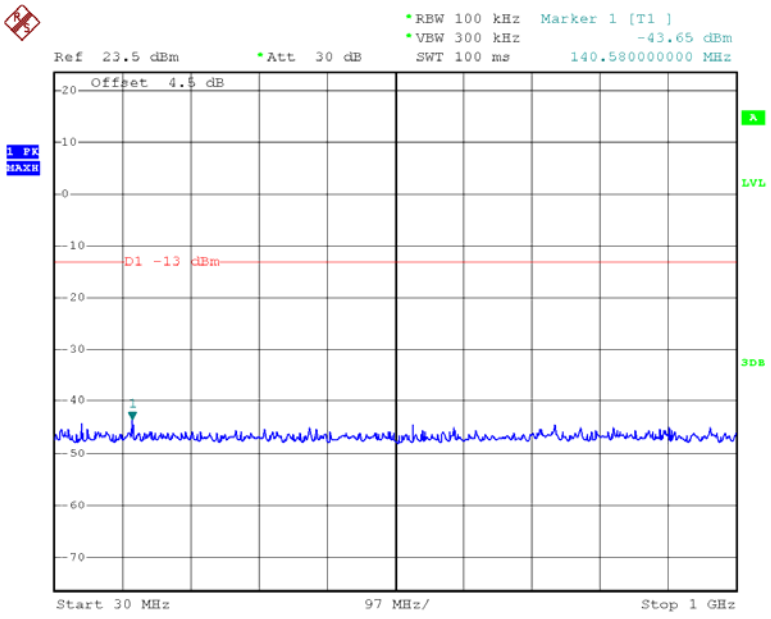


Date: 5.NOV.2019 22:18:50



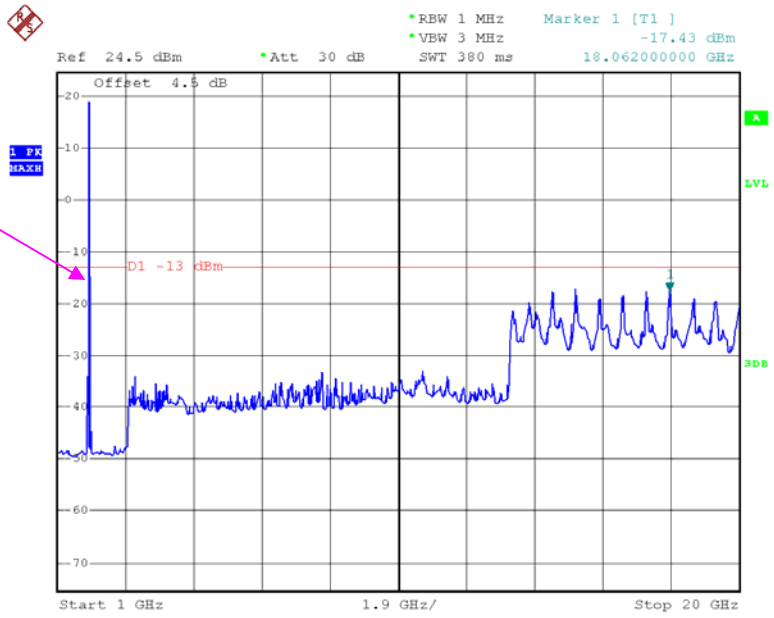
Date: 5.NOV.2019 22:19:22

Band 2 REL99



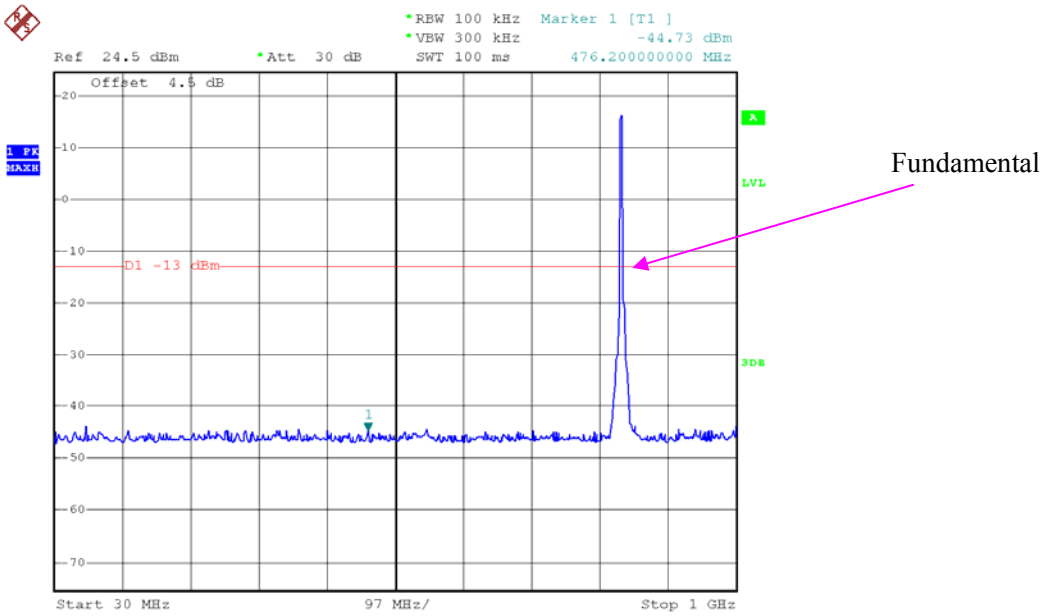
Date: 5.NOV.2019 21:13:40

Fundamental

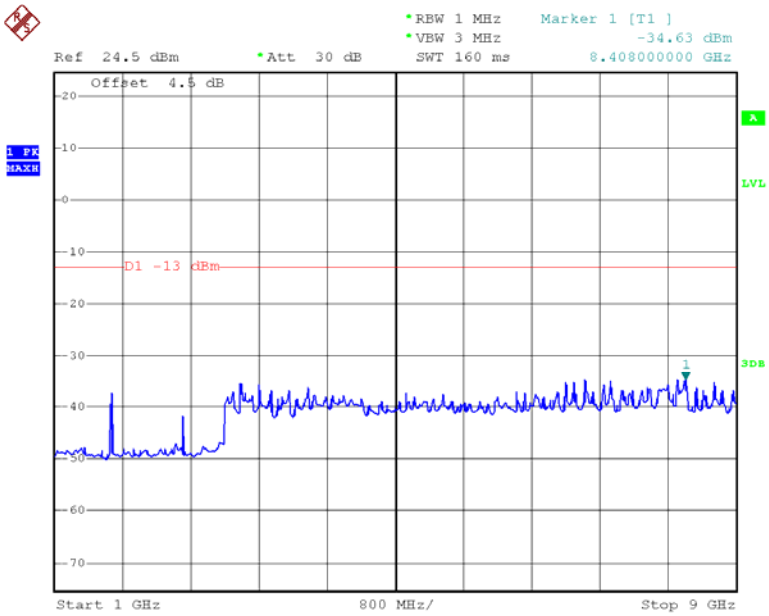


Date: 5.NOV.2019 21:14:42

Band 5 REL99



Date: 5.NOV.2019 21:17:30



Date: 5.NOV.2019 21:17:02

FCC §2.1053, §22.917 & §24.238 - SPURIOUS RADIATED EMISSIONS

Applicable Standard

FCC § 2.1053, §22.917, § 24.238

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 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 (TXpwr in Watts/0.001) – the absolute level

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESR3	102453	2019-06-26	2020-06-26
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
EMCO	Adjustable Dipole Antenna	3121C	9109-753	N/A	N/A
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-1400-01	2019-05-06	2020-05-06
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-02	2019-09-05	2020-09-05
HP	Amplifier	8447D	2727A05902	2019-09-05	2020-09-05
Sinoscite	Band-stop filter	BSF824-862MS-1438-001	1438001	2019-06-16	2020-06-16
Agilent	Spectrum Analyzer	E4440A	SG43360054	2019-05-09	2020-05-09
TDK RF	Horn Antenna	HRN-0118	130 084	2018-10-12	2021-10-12
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-02	2019-09-05	2020-09-05
MITEQ	Amplifier	AFS42-00101800-25-S-42	2001271	2019-09-05	2020-09-05
Sinoscite	Band-stop filter	BSF1850-1910MS-0935V2	0935V2	2019-06-16	2020-06-16
Agilent	Signal Generator	E8247C	MY43321350	2019-12-10	2020-12-10
Ducommun Technolagies	Horn Antenna	ARH-4223-02	1007726-01 1304	2019-11-18	2022-11-18
Ducommun Technolagies	Horn Antenna	ARH-4223-02	1007726-02 1304	2019-11-18	2022-11-18
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2019-06-27	2020-06-27

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

Test Data

Environmental Conditions

Test Items	Radiation Below 1GHz	Radiation Above 1GHz
Temperature:	23.9 °C	23.6 °C
Relative Humidity:	38%	37%
ATM Pressure:	102.1 kPa	101.9 kPa
Tester:	Neil Liao	Lucy Lu
Test Date:	2019-12-09	2019-12-12

Test Result: Compliance.

EUT Operation Mode: Transmitting

Cellular Band (PART 22H)

30 MHz-10 GHz:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBµV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
GSM850 Middle Channel, Frequency:836.600 MHz								
1673.200	H	58.58	-55.63	10.6	0.73	-45.8	-13.0	32.8
1673.200	V	55.63	-59.18	10.6	0.73	-49.3	-13.0	36.3
2509.800	H	56.19	-56.83	13.1	1.25	-45.0	-13.0	32.0
2509.800	V	53.41	-59.64	13.1	1.25	-47.8	-13.0	34.8
3346.400	H	55.45	-55.21	13.8	1.61	-43.0	-13.0	30.0
3346.400	V	51.69	-59.02	13.8	1.61	-46.8	-13.0	33.8
499.480	H	37.26	-68.16	0.0	0.35	-68.5	-13.0	55.5
499.480	V	38.62	-64.11	0.0	0.35	-64.5	-13.0	51.5
WCDMA Band 5 Middle Channel, Frequency:836.600 MHz								
1673.200	H	44.42	-69.79	10.6	0.73	-59.9	-13.0	46.9
1673.200	V	45.70	-69.11	10.6	0.73	-59.2	-13.0	46.2
2509.800	H	37.64	-75.38	13.1	1.25	-63.5	-13.0	50.5
2509.800	V	37.25	-75.8	13.1	1.25	-63.9	-13.0	50.9
3346.400	H	35.22	-75.44	13.8	1.61	-63.2	-13.0	50.2
3346.400	V	35.16	-75.55	13.8	1.61	-63.3	-13.0	50.3
701.240	H	37.44	-63.43	0.0	0.38	-63.8	-13.0	50.8
701.240	V	40.86	-56.64	0.0	0.38	-57.0	-13.0	44.0

PCS Band (PART 24E)

30 MHz-20 GHz:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
GSM1900, Middle Channel:1880.000 MHz								
3760.000	H	45.21	-63.59	13.8	1.63	-51.5	-13.0	38.5
3760.000	V	46.55	-62.12	13.8	1.63	-50.0	-13.0	37.0
5640.000	H	59.11	-46.92	14.0	1.31	-34.2	-13.0	21.2
5640.000	V	54.56	-51.36	14.0	1.31	-38.7	-13.0	25.7
499.480	H	37.15	-68.27	0.0	0.35	-68.6	-13.0	55.6
499.480	V	38.42	-64.31	0.0	0.35	-64.7	-13.0	51.7
WCDMA Band 2, Middle Channel:1880.000 MHz								
3760.000	H	38.79	-70.01	13.8	1.63	-57.9	-13.0	44.9
3760.000	V	41.75	-66.92	13.8	1.63	-54.8	-13.0	41.8
5640.000	H	38.15	-67.88	14.0	1.31	-55.2	-13.0	42.2
5640.000	V	40.24	-65.67	14.0	1.31	-53.0	-13.0	40.0
701.240	H	37.59	-63.28	0.0	0.38	-63.7	-13.0	50.7
701.240	V	41.23	-56.27	0.0	0.38	-56.7	-13.0	43.7

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

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

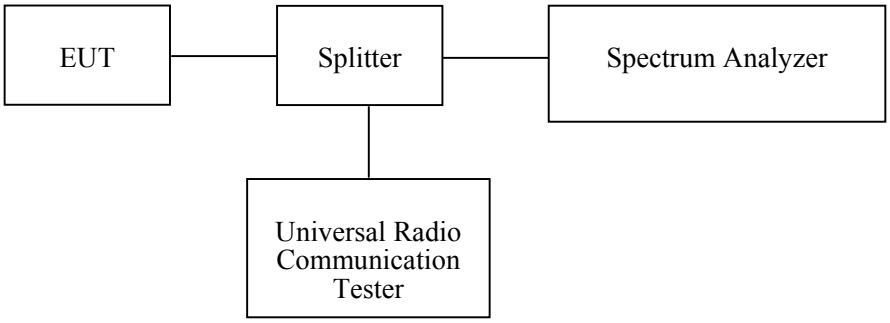
Applicable Standard

FCC § 2.1053, §22.917, § 24.238.

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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2018-12-10	2019-12-10
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41005011	Each time	/
Unknown	Coaxial Cable	C-SJ00-0010	C0010/03	Each time	/
E-Microwave	Two-way Spliter	ODP-1-6-2S	OE0120142	Each time	/

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

Test Data

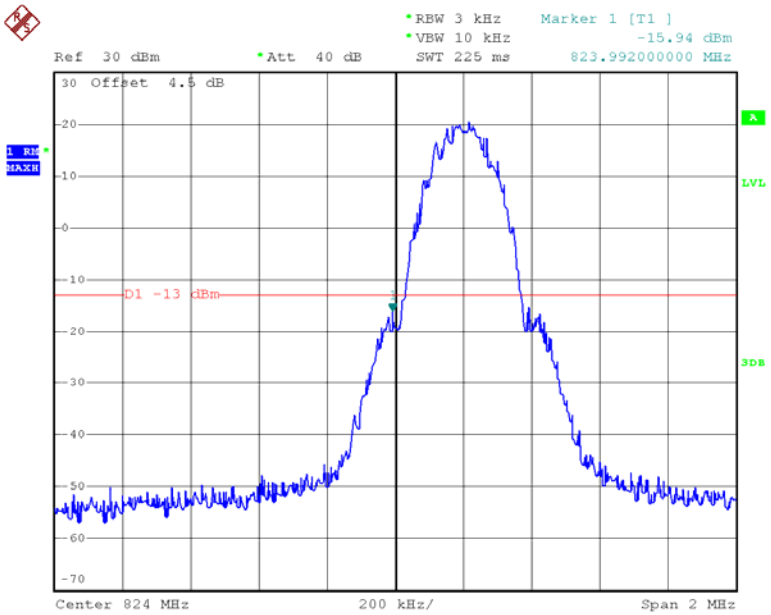
Environmental Conditions

Temperature:	27℃
Relative Humidity:	45%
ATM Pressure:	101.2kPa
Tester:	Blake Yang
Test Date:	2019-11-05

Test Mode: Transmitting

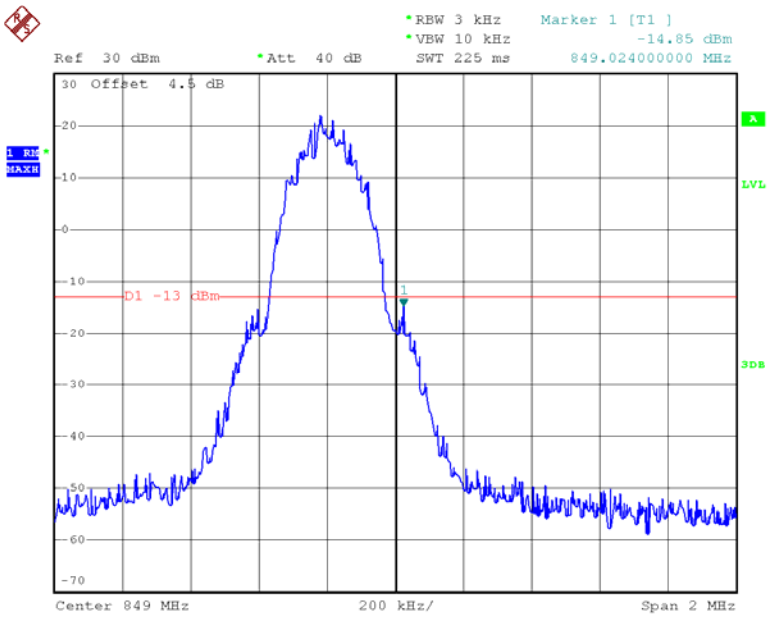
Test Result: Compliance. Please refer to the following plots.

GSM 850, Left Band Edge



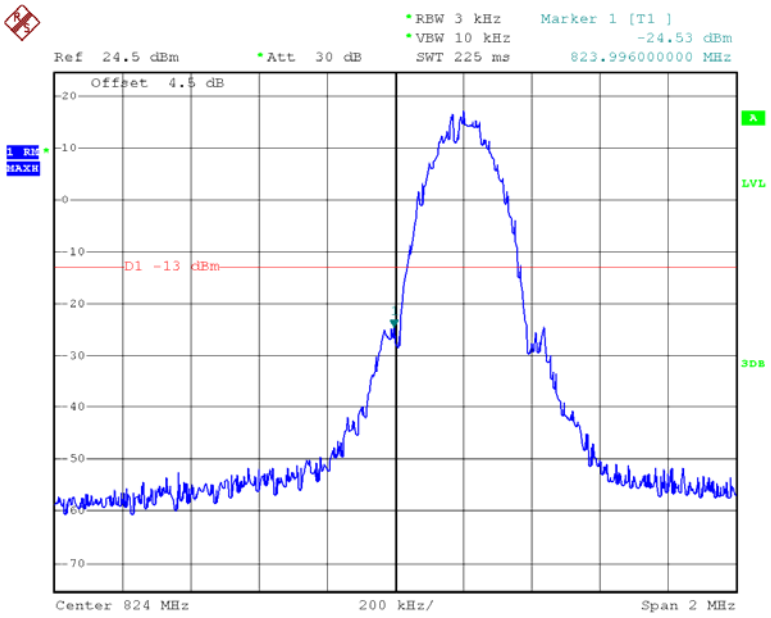
Date: 5.NOV.2019 21:50:35

GSM 850, Right Band Edge



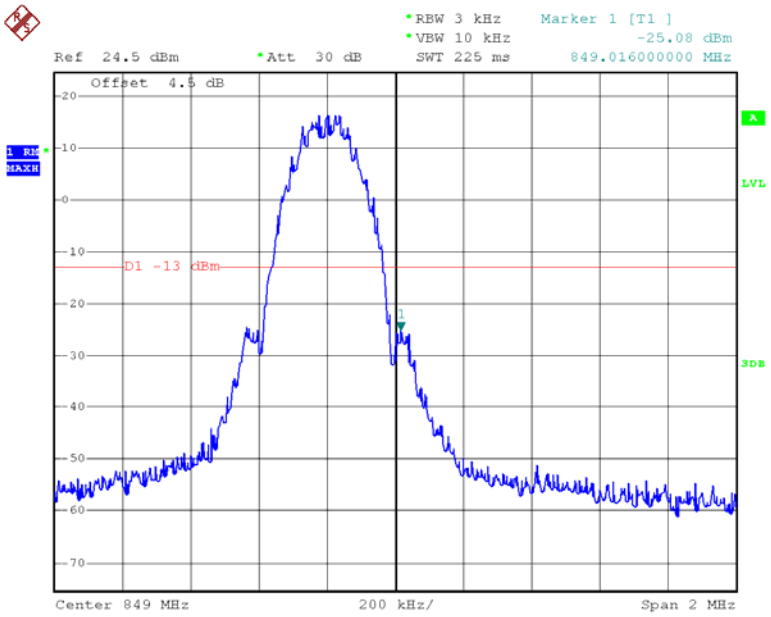
Date: 5.NOV.2019 21:52:09

EDGE 850, Left Band Edge



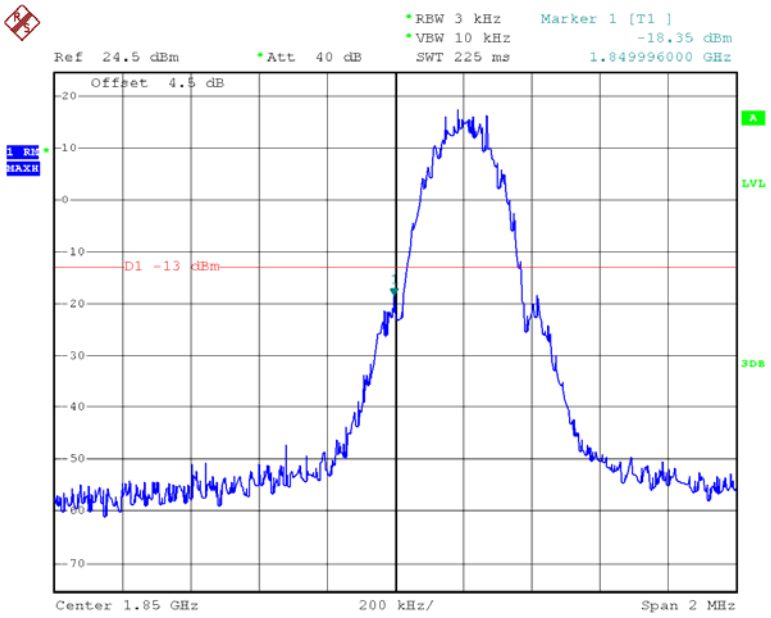
Date: 5.NOV.2019 22:04:10

EDGE 850 Right Band Edge



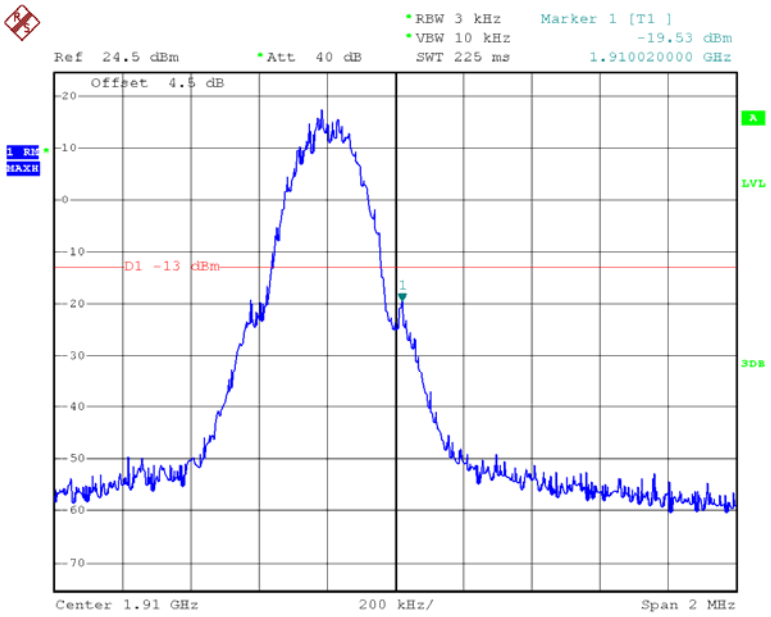
Date: 5.NOV.2019 22:05:01

GSM 1900, Left Band Edge



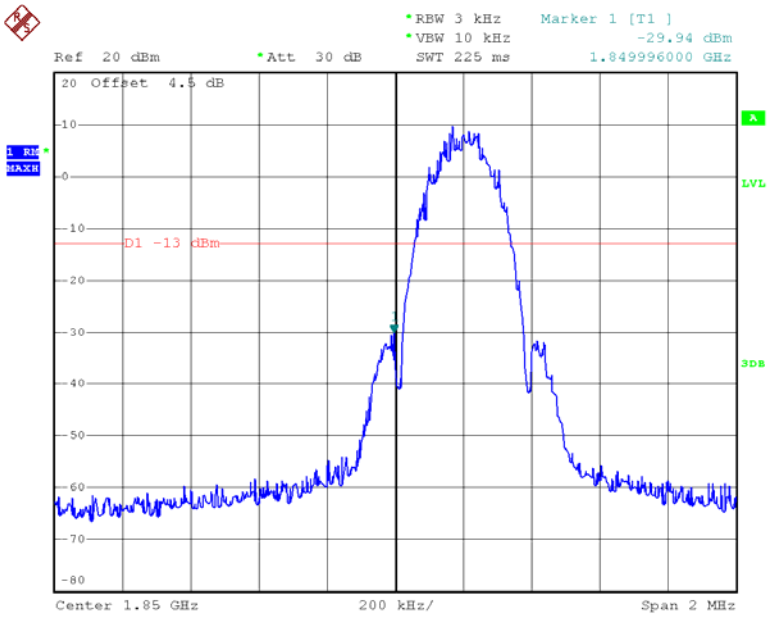
Date: 5.NOV.2019 22:17:08

GSM 1900, Right Band Edge



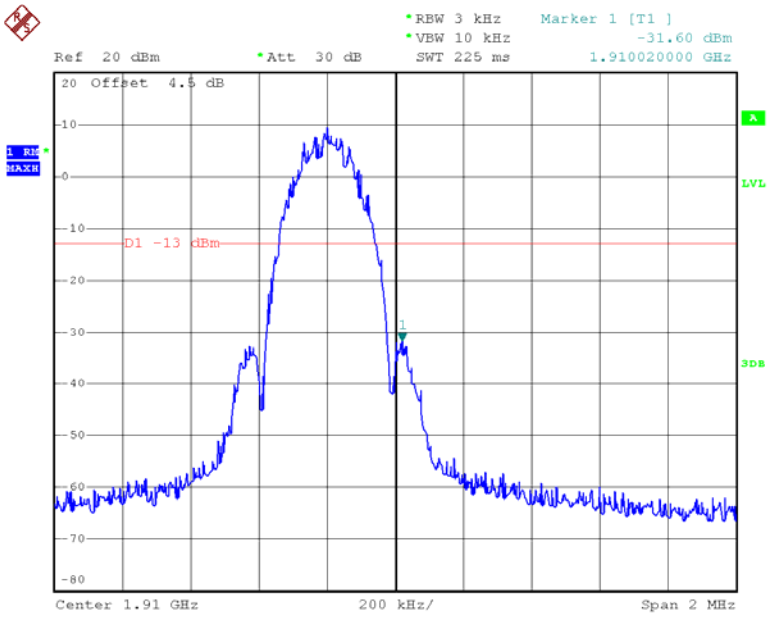
Date: 5.NOV.2019 22:17:48

EDGE 1900, Left Band Edge



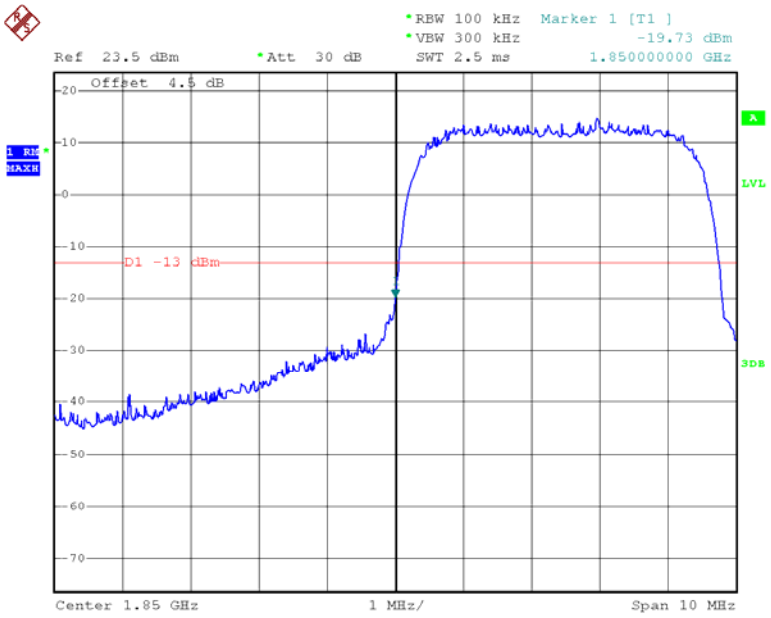
Date: 5.NOV.2019 22:09:33

EDGE 1900, Right Band Edge



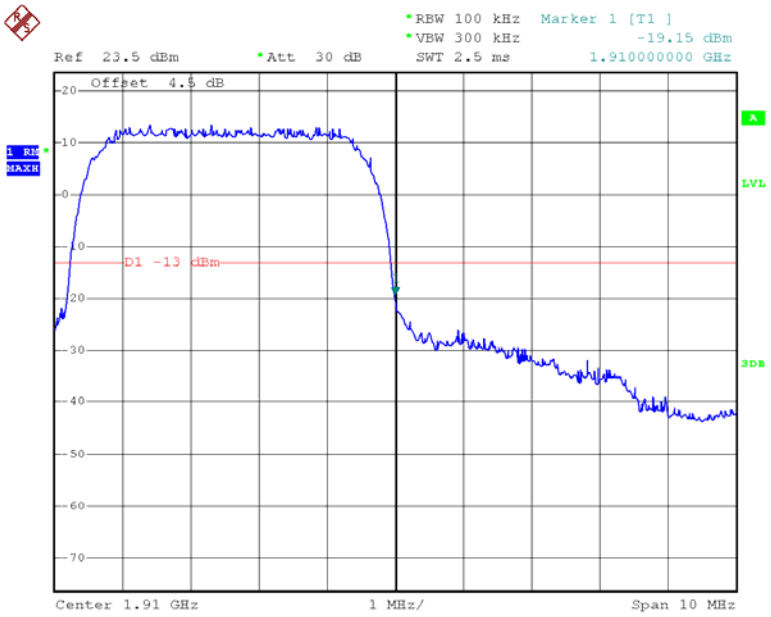
Date: 5.NOV.2019 22:08:28

WCDMA Band 2 REL99, Left Band Edge



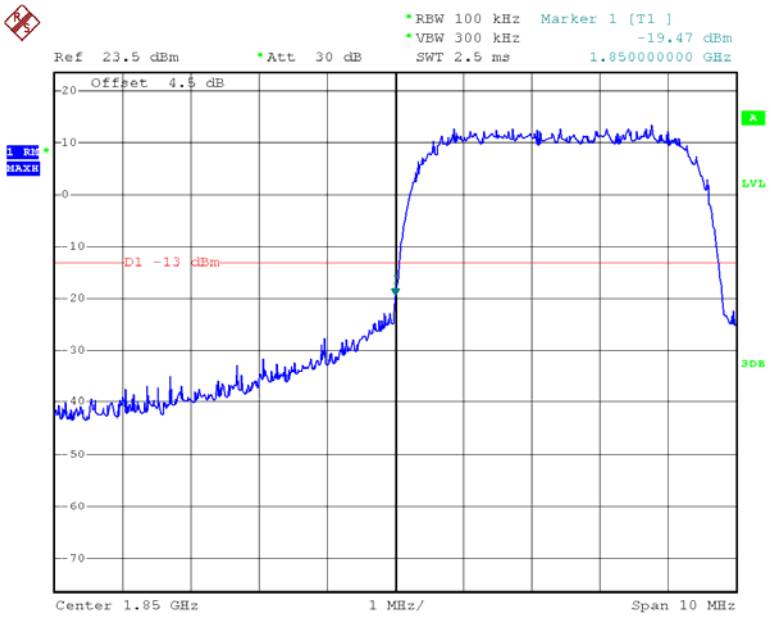
Date: 5.NOV.2019 20:59:23

WCDMA Band 2 REL99, Right Band Edge



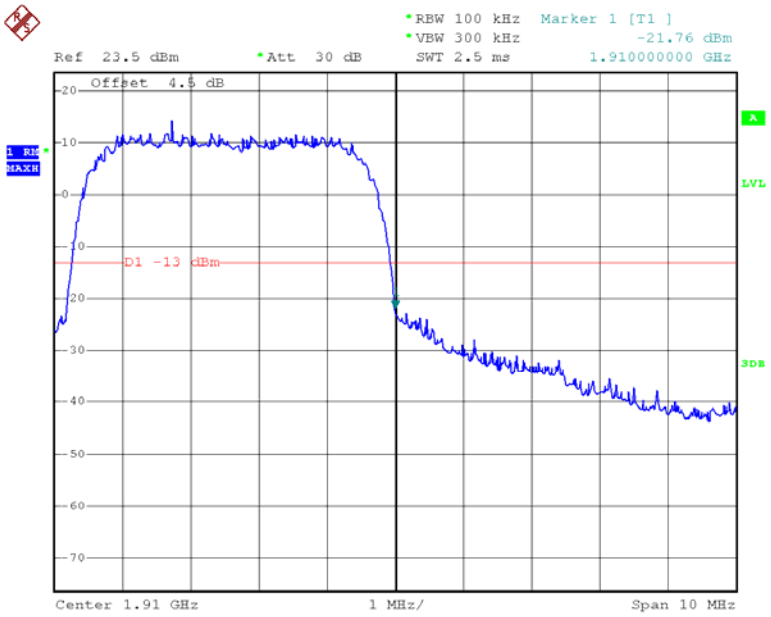
Date: 5.NOV.2019 20:58:36

WCDMA Band 2 HSDPA, Left Band Edge



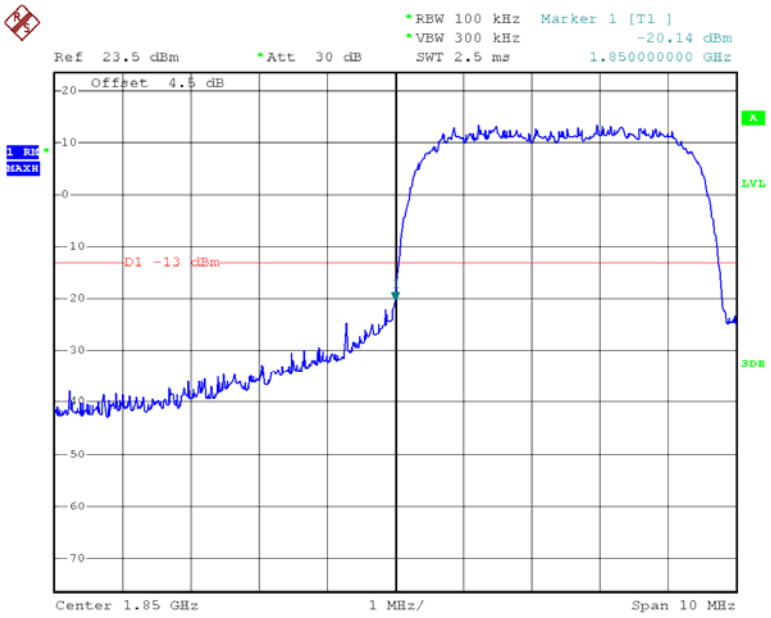
Date: 5.NOV.2019 20:59:56

WCDMA Band 2 HSDPA, Right Band Edge



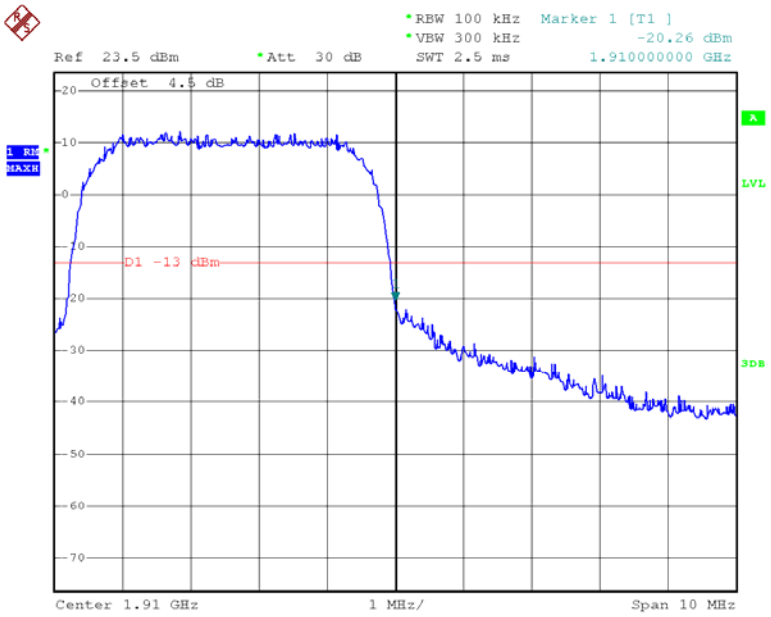
Date: 5.NOV.2019 21:01:35

WCDMA Band 2 HSDPA, Left Band Edge



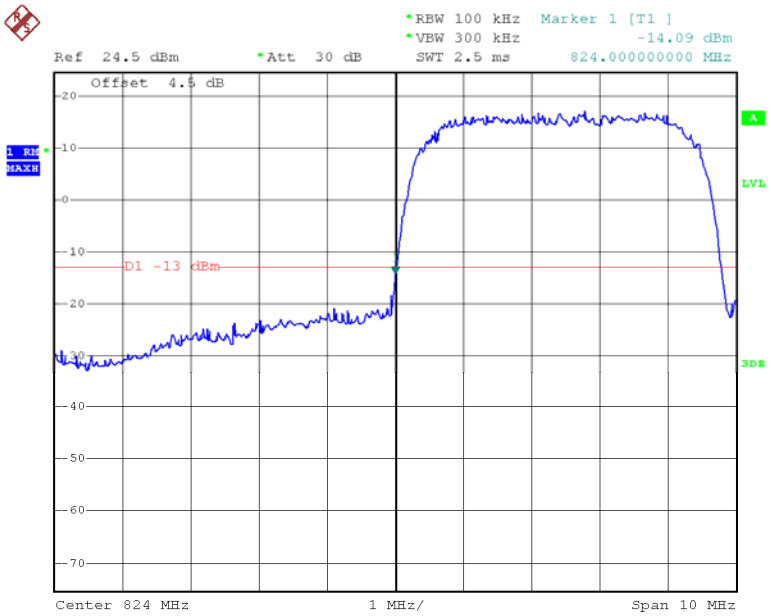
Date: 5.NOV.2019 21:06:45

WCDMA Band 2 HSDPA, Right Band Edge



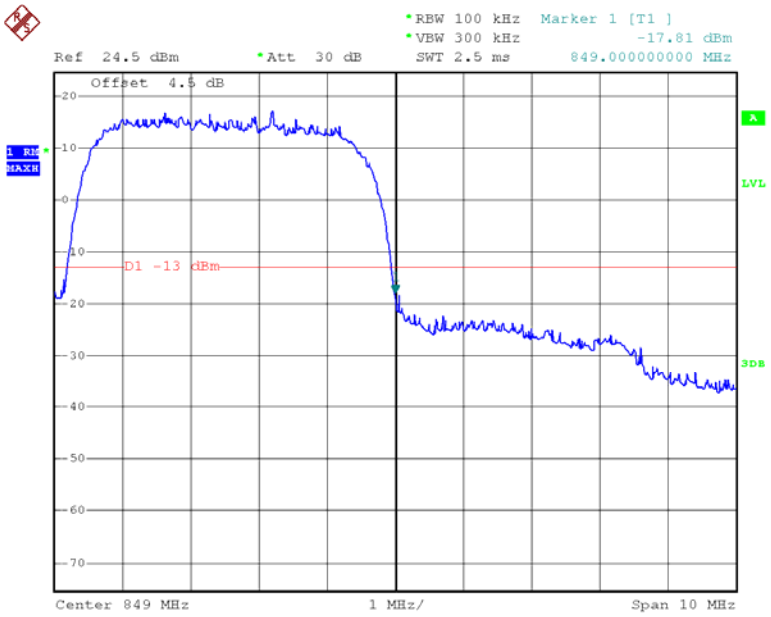
Date: 5.NOV.2019 21:07:16

WCDMA Band 5 REL99, Left Band Edge



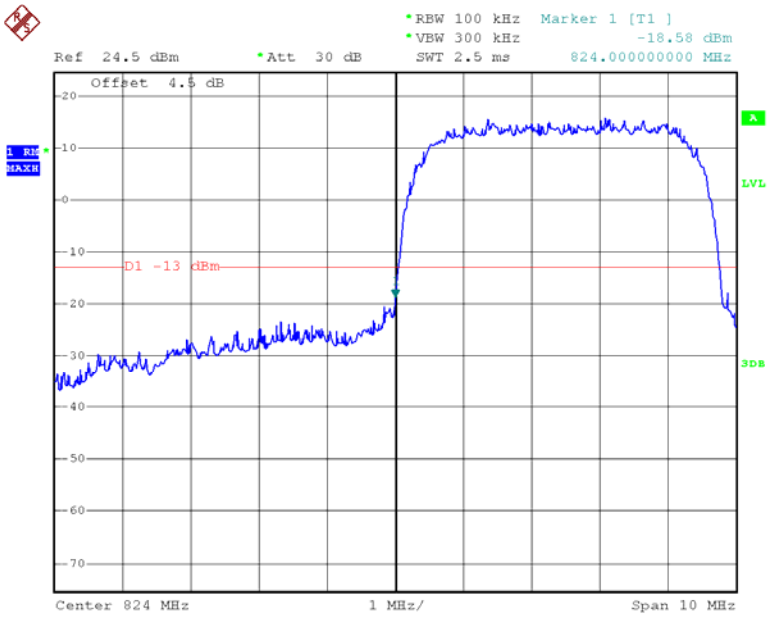
Date: 5.NOV.2019 21:23:01

WCDMA Band 5 REL99, Right Band Edge



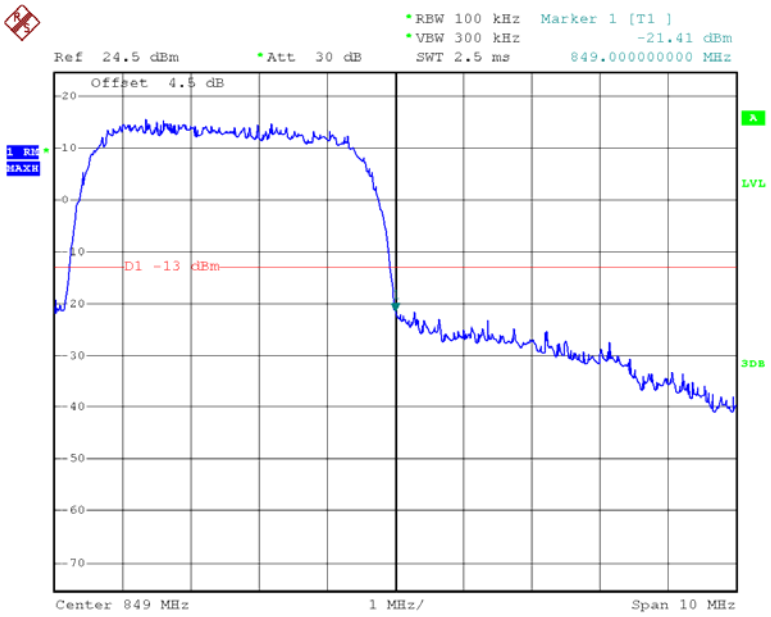
Date: 5.NOV.2019 21:23:42

WCDMA Band 5 HSDPA, Left Band Edge



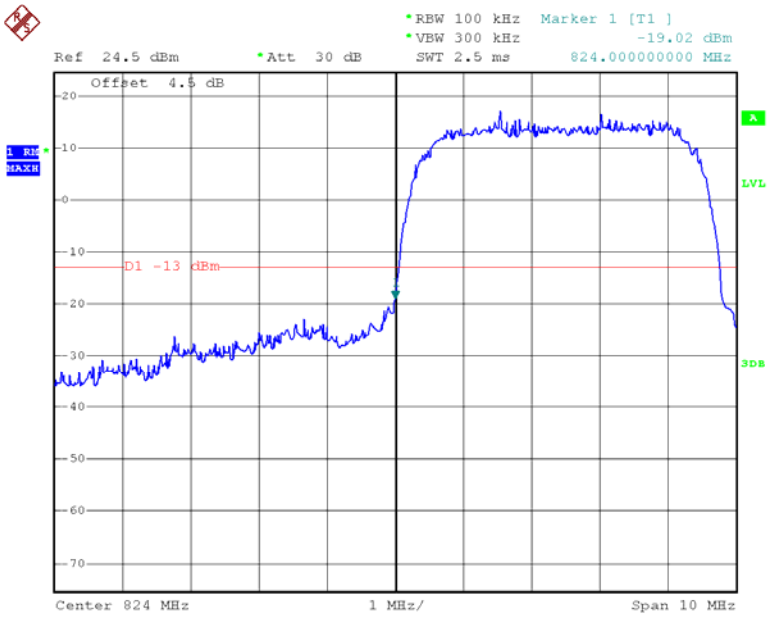
Date: 5.NOV.2019 21:31:01

WCDMA Band 5 HSDPA, Right Band Edge



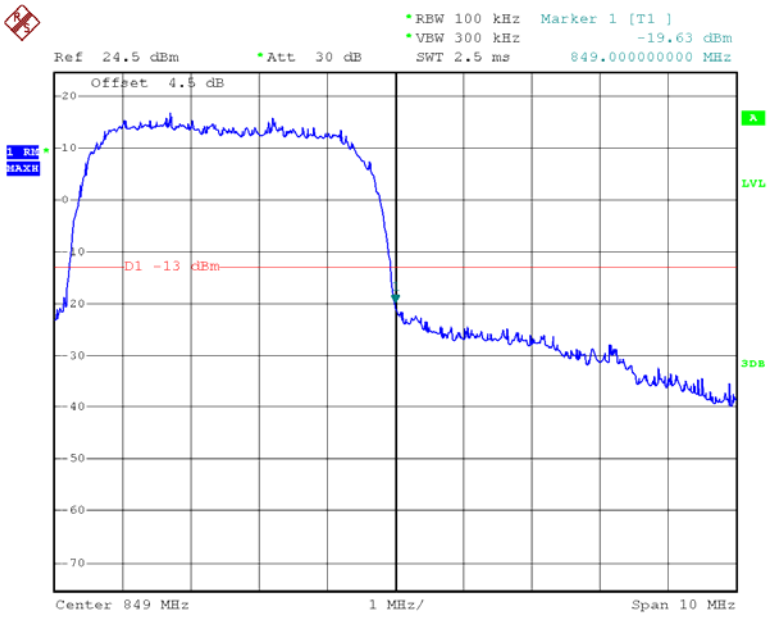
Date: 5.NOV.2019 21:30:36

WCDMA Band 5 HSDPA, Left Band Edge



Date: 5.NOV.2019 21:41:13

WCDMA Band 5 HSDPA, Right Band Edge



Date: 5.NOV.2019 21:40:49

FCC §2.1055, §22.355 & §24.235 - FREQUENCY STABILITY

Applicable Standard

FCC § 2.1055 (a), § 2.1055 (d), §22.355, §24.235

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

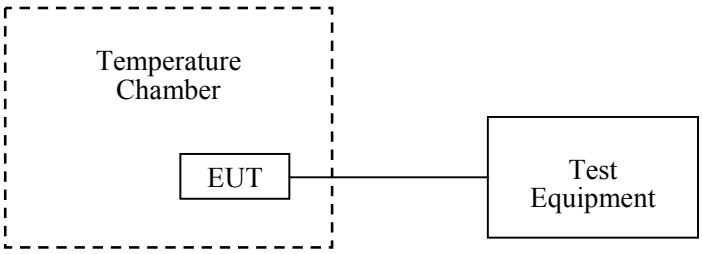
According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

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 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: An external variable DC power supply was connected to the battery terminals of the equipment under test. The voltage was set from 85% to 115% of the nominal value and was then decreased until the transmitter light no longer illuminated; i.e., the battery end point. The output frequency was recorded for each battery voltage.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41005011	Each time	/
Unknown	Coaxial Cable	C-SJ00-0010	C0010/03	Each time	/
E-Microwave	Blocking Control	EMDCB-00036	0E01201048	Each time	/
E-Microwave	Coaxial Attenuators	EMCA10-5RN-6	OE01203239	Each time	/
R&S	Universal Radio Communication Tester	CMU200	106 891	2019-09-12	2020-09-12
ESPEC	Constant temperature and humidity Tester	ESX-4CA	018 463	2019-03-26	2020-03-26
UNI-T	Multimeter	UT39A	M130199938	2019-07-23	2020-07-23
Pro instrument	DC Power Supply	pps3300	3300012	N/A	N/A

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

Test Data

Environmental Conditions

Temperature:	27℃
Relative Humidity:	45%
ATM Pressure:	101.2kPa
Tester:	Blake Yang
Test Date:	2019-11-05

Test Result: Compliance.

Cellular Band

GMSK, Middle Channel, f_c = 836.6 MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Limit
℃	V_{DC}	Hz	ppm	ppm
-30	3.8	-4	-0.00478	2.5
-20		-6	-0.00717	
-10		-3	-0.00359	
0		-5	-0.00598	
10		-7	-0.00837	
20		-5	-0.00598	
30		-8	-0.00956	
40		-4	-0.00478	
50		-6	-0.00717	
20	3.6	-3	-0.00359	
20	4.35	-7	-0.00837	

EGPRS 850, Middle Channel, f_c = 836.6 MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Limit
℃	V_{DC}	Hz	ppm	ppm
-30	3.8	-6	-0.00717	2.5
-20		-5	-0.00598	
-10		-4	-0.00478	
0		-2	-0.00239	
10		-7	-0.00837	
20		-5	-0.00598	
30		-3	-0.00359	
40		-6	-0.00717	
50		-5	-0.00598	
20	3.6	-4	-0.00478	
20	4.35	-8	-0.00956	

WCDMA Band 5 Rel 99, Middle Channel, f_c = 836.6 MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Limit
℃	V_{DC}	Hz	ppm	ppm
-30	3.8	4	0.00478	2.5
-20		6	0.00717	
-10		5	0.00598	
0		2	0.00239	
10		7	0.00837	
20		3	0.00359	
30		5	0.00598	
40		4	0.00478	
50		6	0.00717	
20	3.6	5	0.00598	
20	4.35	7	0.00837	

PCS Band

PCS1900, Middle Channel, f_c = 1880.0 MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Results
℃	V_{DC}	Hz	ppm	
-30	3.8	-20	-0.01064	Pass
-20		-23	-0.01223	
-10		-21	-0.01117	
0		-25	-0.01330	
10		-28	-0.01489	
20		-26	-0.01383	
30		-27	-0.01436	
40		-20	-0.01064	
50		-21	-0.01117	
20	3.6	-24	-0.01277	
20	4.35	-23	-0.01223	

EGPRS 1900, Middle Channel, f_c = 1880.0 MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Results
℃	V_{DC}	Hz	ppm	
-30	3.8	-16	-0.00851	Pass
-20		-25	-0.01330	
-10		-18	-0.00957	
0		-17	-0.00904	
10		-26	-0.01383	
20		-24	-0.01277	
30		-24	-0.01277	
40		-18	-0.00957	
50		-21	-0.01117	
20	3.6	-23	-0.01223	
20	4.35	-18	-0.00957	

WCDMA Band 2 Rel 99, Middle Channel, f_c = 1880.0 MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Results
℃	V_{DC}	Hz	ppm	
-30	3.8	-26	-0.01383	Pass
-20		-25	-0.01330	
-10		-18	-0.00957	
0		-21	-0.01117	
10		-24	-0.01277	
20		-24	-0.01277	
30		-24	-0.01277	
40		-17	-0.00904	
50		-26	-0.01383	
20	3.6	-25	-0.01330	
20	4.35	-18	-0.00957	

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