TESTING LABORATORY
CERTIFICATE #4820.01

FCC PART 22H, PART 24E

MEASUREMENT AND TEST REPORT

For

CLC HONG KONG LIMITED

1011A, 10/F., Harbour Centre Tower 1, No.1 Hok Cheung St., Hung Hom, Kowloon, Hong Kong

FCC ID: 2AG4WZ407

Report Type:	**Product Type:**
Original Report	Axe 4

Report Number: RDG171213009-00D

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

	EUT Name:	Axe 4
	EUT Model:	Z407
	FCC ID:	2AG4WZ407
	Rated Input Voltage:	DC3.7V from Battery or DC 5V from adapter
Adapter Information	**Model:**	PMC43
	Input:	AC100-240V~ 50/60Hz 0.15A
	Output:	5.0V , 1.0A
	External Dimension:	Length (12.4 cm)*Width (6.5 cm)*High (1.0 cm)
	Serial Number:	171213009
	EUT Received Date:	2017.12.13

Objective

This report is prepared on behalf of ***CLC HONG KONG LIMITED*** 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: 2AG4WZ407.
FCC Part 15C DTS submissions with FCC ID: 2AG4WZ407.
FCC Part 15B JBP submissions with FCC ID: 2AG4WZ407.

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, Part 22 Subpart H, Part 24 Subpart E.

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

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

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 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. : 897218,the FCC Designation No. : CN1220.

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

SYSTEM TEST CONFIGURATION

Justification

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

The test items were performed with the EUT operating at testing mode.

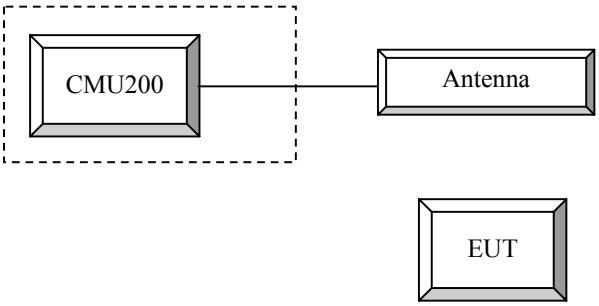
Equipment Modifications

No modification was made to the EUT.

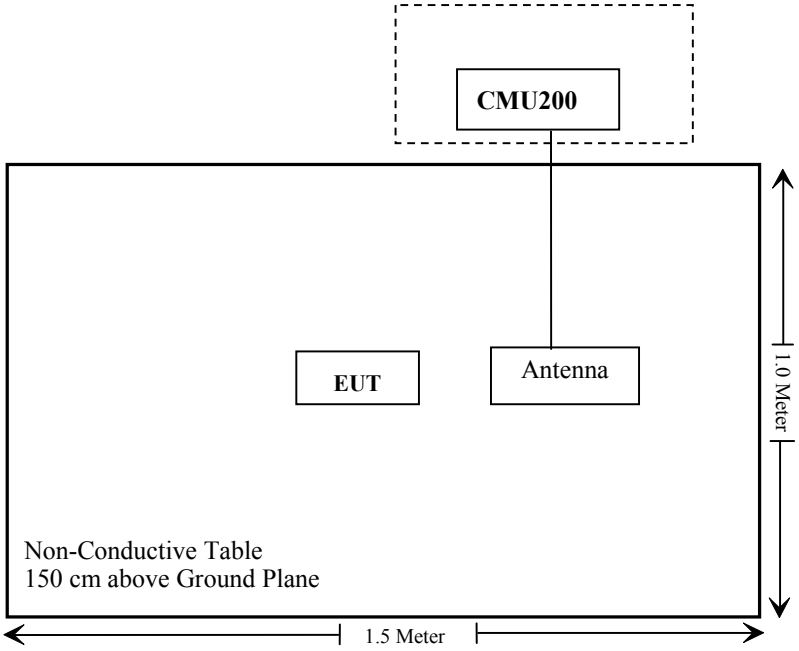
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
R&S	Universial Radio Communication Tester	CMU200	109038

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)	Field Strength of Spurious Radiation	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

Compliant, please refer to the SAR report: RDG171213009-20.

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.

Radiated method:

ANSI/TIA-603-D section 2.2.17

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2017-12-11	2018-12-11
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
Agilent	Spectrum Analyzer	E4440A	SG43360054	2017-12-08	2018-12-08
HP	Signal Generator	1026	320408	2017-12-14	2018-12-14
EMCO	Adjustable Dipole Antenna	3121C	9109-753	N/A	N/A
TDK RF	Horn Antenna	HRN-0118	130 084	2016-01-05	2019-01-04
N/A	Coaxial Cable	C-NJNJ-50	C-0400-01	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-NJNJ-50	C-0075-01	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-NJNJ-50	C-1000-01	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-SJSJ-50	C-0800-01	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-SJ00-0010	C0010/02	Each time	N/A
R&S	Universal Radio Communication Tester	CMU200	109 038	2017-07-21	2018-07-21

*** 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:	20~23.2°C
Relative Humidity:	34~40 %
ATM Pressure:	101.5 kPa

The testing was performed by Harry Yang on 2017-12-17~2017-12-19.

Conducted Output Power

Cellular Band (Part 22H) & PCS Band (Part 24E)

Band	Channel No.	Peak Conducted Output Power (dBm)				
		GSM	GPRS 1 TX Slot	GPRS 2 TX Slot	GPRS 3 TX Slot	GPRS 4 TX Slot
Cellular	128	30.50	30.59	28.77	27.15	25.38
	190	30.40	30.50	28.58	26.87	25.11
	251	30.20	30.38	28.35	26.56	24.81
PCS	512	28.10	28.01	25.37	23.89	21.89
	661	28.20	28.19	25.75	24.32	22.39
	810	28.30	28.24	25.81	24.41	22.47

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	22.07	3.20	21.93	3.12	22.23	2.92
HSDPA	1	20.87	3.72	21.50	4.00	21.83	3.80
	2	20.81	3.82	21.31	4.05	22.03	3.97
	3	21.09	3.98	21.58	3.65	22.09	3.96
	4	20.76	3.54	21.20	4.08	22.03	3.83
HSUPA	1	20.88	5.96	21.34	5.52	21.67	5.04
	2	21.06	6.13	21.33	5.18	21.34	4.71
	3	20.88	5.59	21.06	5.42	21.34	4.99
	4	20.63	5.99	21.10	5.33	21.50	4.86
	5	20.72	6.18	21.02	5.69	21.30	5.25
DC-HSDPA	1	20.74	6.26	21.04	5.24	21.88	5.2
	2	21.14	5.56	21.00	5.36	21.80	4.73
	3	20.50	6.04	21.37	5.56	21.38	5.29
	4	21.04	5.61	21.45	5.68	21.74	5.25
HSPA+	1	21.04	6.07	21.26	5.34	21.37	4.87

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	22.32	3.00	22.01	2.88	22.19	2.80
HSDPA	1	20.79	4.16	21.57	3.24	20.97	3.36
	2	20.81	3.86	21.28	3.19	21.24	3.29
	3	20.49	3.88	21.80	3.00	20.64	2.97
	4	20.50	4.44	21.20	3.22	21.15	2.97
HSUPA	1	22.23	5.52	22.8	4.48	22.07	4.44
	2	22.47	5.22	22.95	4.48	21.97	4.41
	3	22.44	5.44	22.50	4.72	21.68	4.06
	4	22.25	5.58	22.85	4.53	22.36	4.43
	5	21.87	5.29	22.62	4.44	21.98	4.09
DC-HSDPA	1	20.77	5.67	21.33	4.34	21.02	4.39
	2	20.29	5.25	20.80	4.42	20.68	4.51
	3	19.73	5.35	21.49	4.40	20.69	4.11
	4	20.61	5.16	20.86	4.14	20.41	4.74
HSPA+	1	20.15	5.50	20.86	4.15	20.39	4.63

Peak-to-average ratio (PAR)<13dB

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								
836.600	H	93.87	18.9	0.0	1	17.9	38.5	20.6
836.600	V	103.08	31.3	0.0	1	30.3	38.5	8.2
WCDMA Band V Middle Channel								
836.600	H	88.82	13.9	0.0	1	12.9	38.5	25.6
836.600	V	97.06	25.3	0.0	1	24.3	38.5	14.2

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)			
PCS 1900 Middle Channel								
1880.000	H	91.16	18.2	11.1	1.6	27.7	33.0	5.3
1880.000	V	90.97	17.8	11.1	1.6	27.3	33.0	5.7
WCDMA Band II Middle Channel								
1880.000	H	87.23	14.3	11.1	1.6	23.8	33.0	9.2
1880.000	V	85.63	12.5	11.1	1.6	22.0	33.0	11.0

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

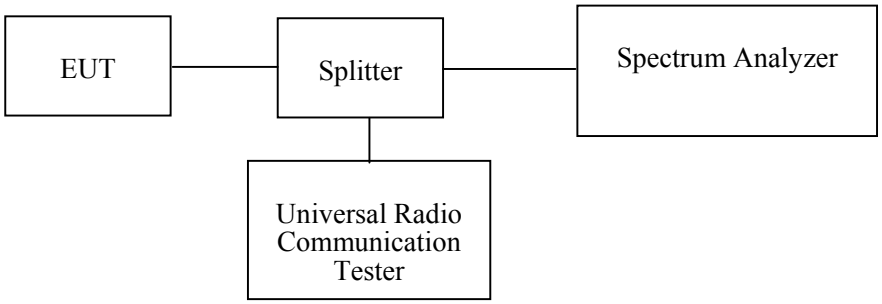
Applicable Standard

FCC §2.1049, §22.917 and §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	2017-12-08	2018-12-08
R&S	Universal Radio Communication Tester	CMU200	109 038	2017-07-18	2018-07-18
Unknown	Coaxial Cable	0.1m	C-1	Each Time	/
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	Each Time	/
Pasternack	RF Coaxial Cable	0.5m	C-5	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:	23.1°C
Relative Humidity:	41 %
ATM Pressure:	102 kPa

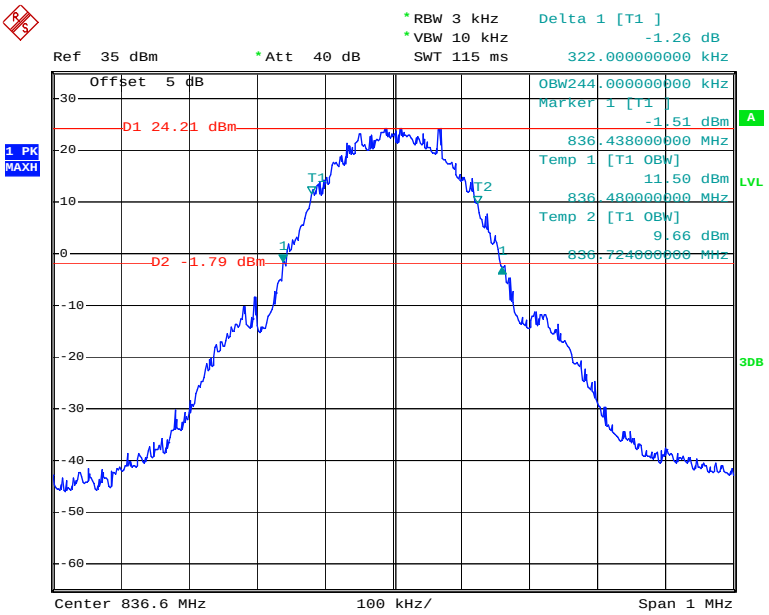
The testing was performed by Harry Yang on 2017-12-16.

Test Mode: Transmitting

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

Band	Test Channel	Mode	99% Occupied Bandwidth (kHz)	26 dB Occupied Bandwidth (kHz)
Cellular	M	GSM	244	322
PCS		GSM	246	316
WCDMA Band II		Rel 99	4120	4680
		HSDPA	4120	4680
		HSUPA	4100	4700
WCDMA Band V		Rel 99	4120	4680
		HSDPA	4100	4680
		HSUPA	4160	4780

GMSK 850 Cellular Band



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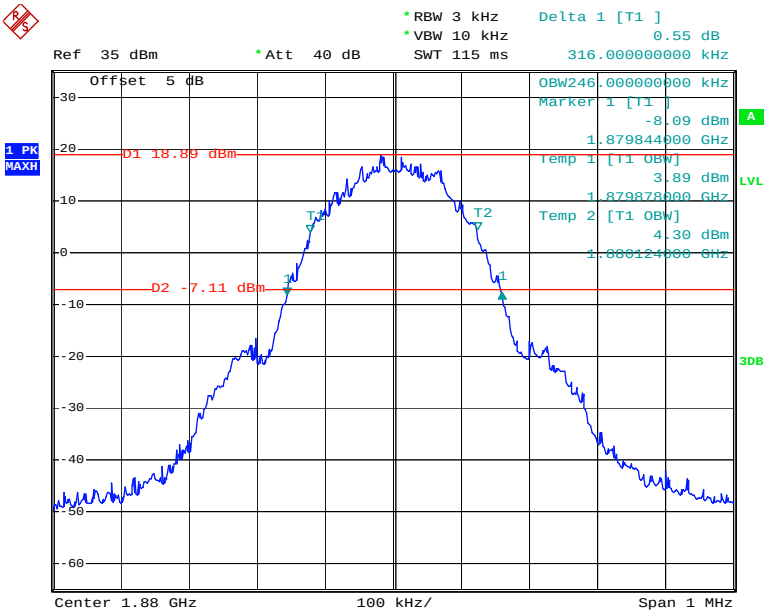
GMSK PCS Band



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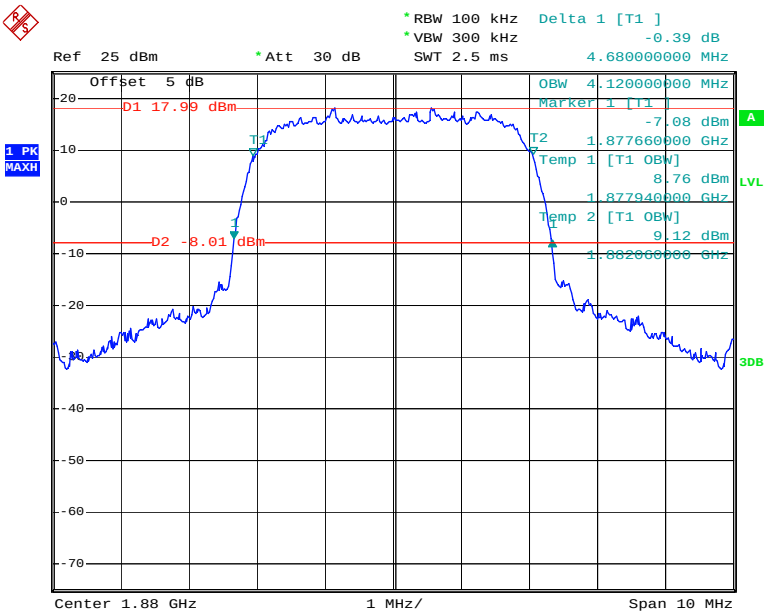
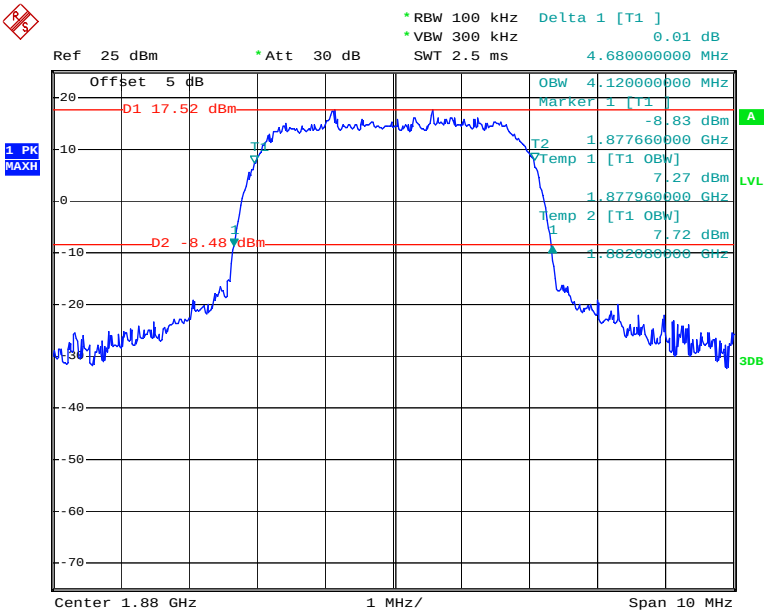
REL99 Band II



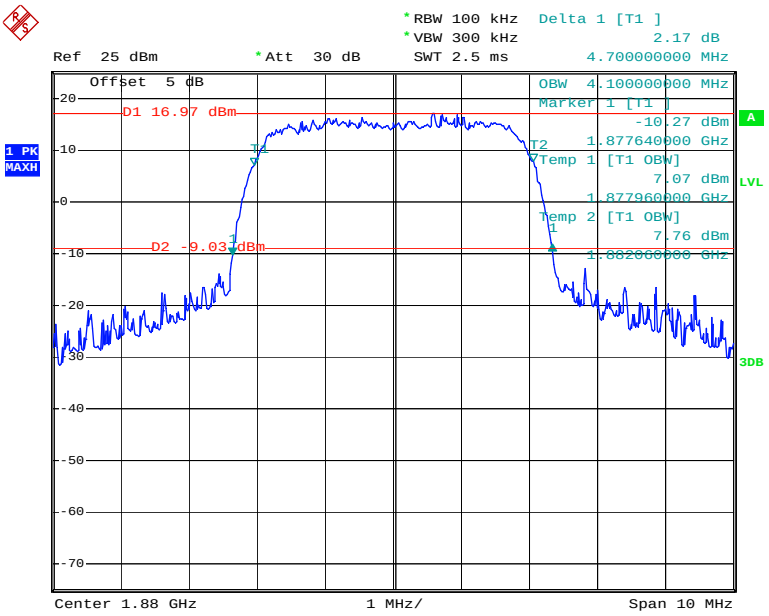
Date: 16.DEC.2017 11:44:24

HSDPA Band II



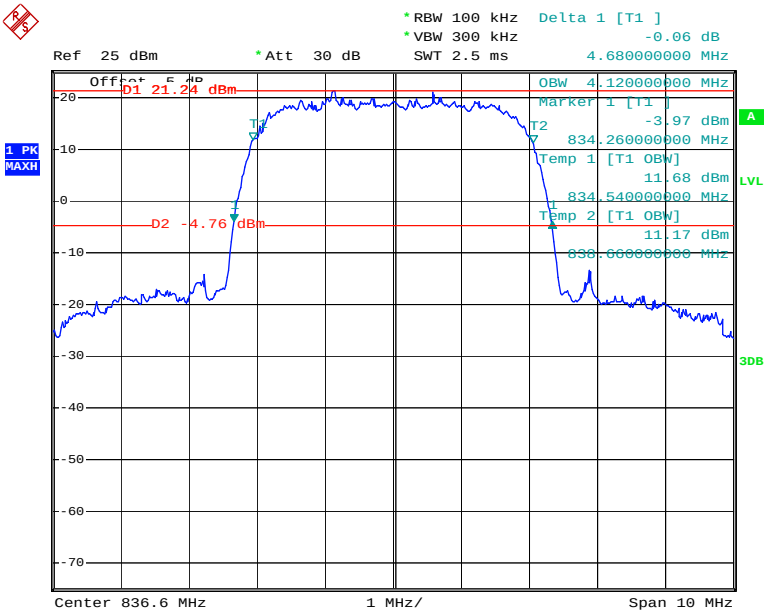
Date: 16.DEC.2017 11:47:15

HSUPA Band II



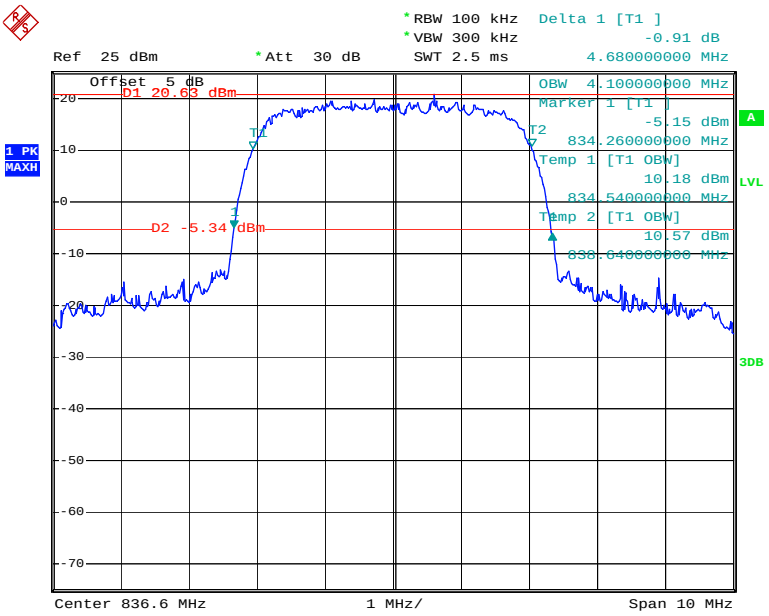
Date: 16.DEC.2017 11:46:01

REL99 Band V



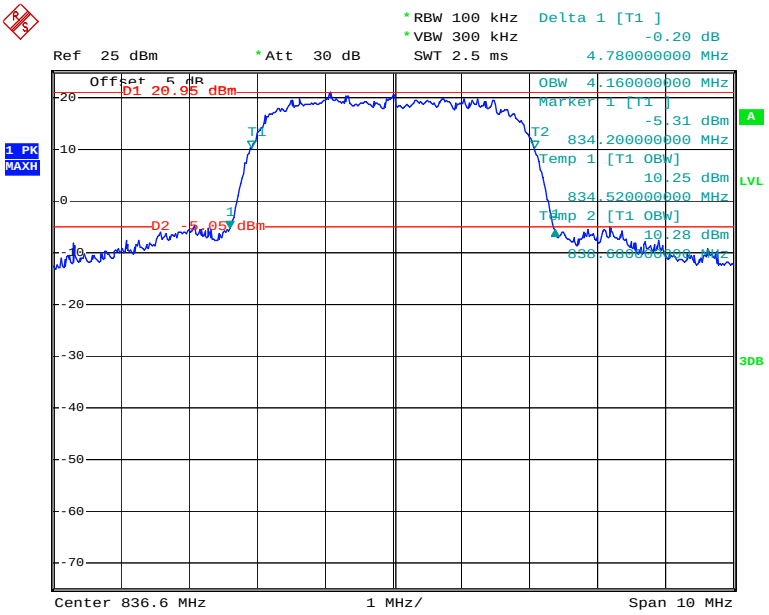
Date: 16.DEC.2017 13:29:36

HSDPA Band V



Date: 16.DEC.2017 13:30:55

HSUPA Band V



Date: 16.DEC.2017 13:33:10

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

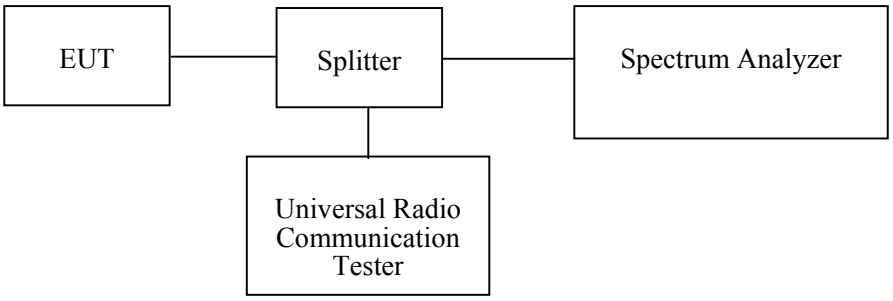
Applicable Standard

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. 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	2017-12-08	2018-12-08
R&S	Universal Radio Communication Tester	CMU200	109 038	2017-07-18	2018-07-18
Unknown	Coaxial Cable	C-SJ00-0010	C0010/02	Each Time	/
Pasternack	RF Coaxial Cable	0.5m	C-5	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

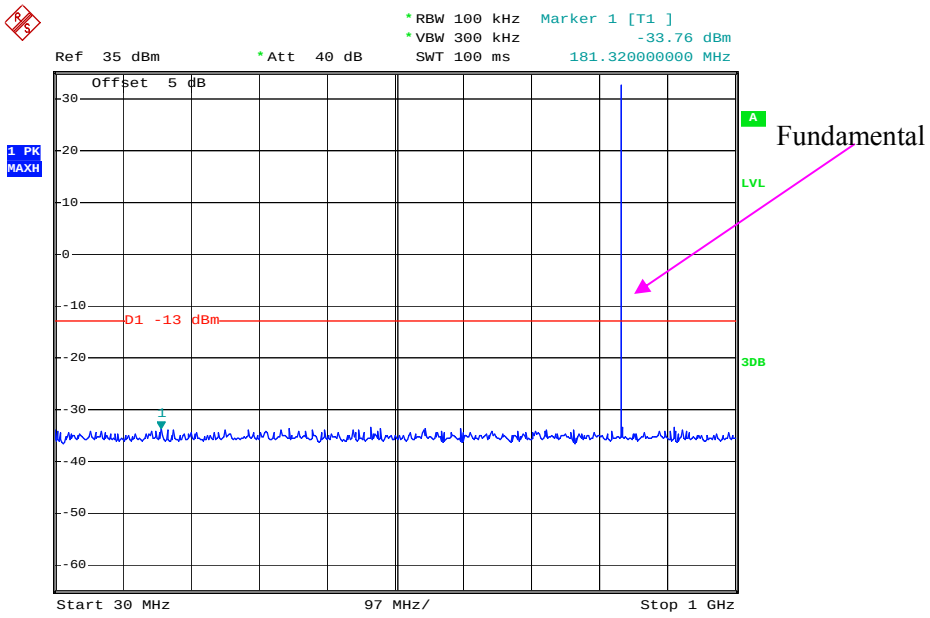
Environmental Conditions

Temperature:	23.1~26.4 °C
Relative Humidity:	41~60 %
ATM Pressure:	100.8~102 kPa

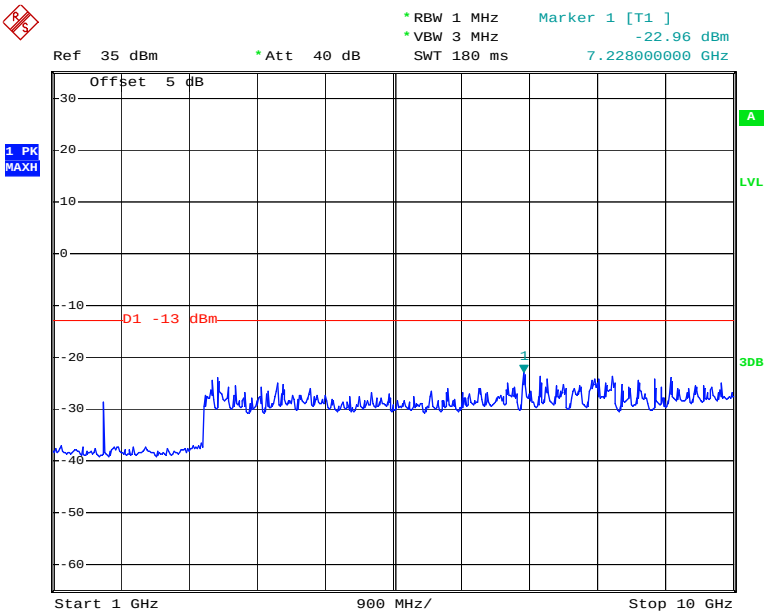
The testing was performed by Harry Yang on 2017-12-16~2018-03-20.

Please refer to the following plots.

GSM850_Middle Channel

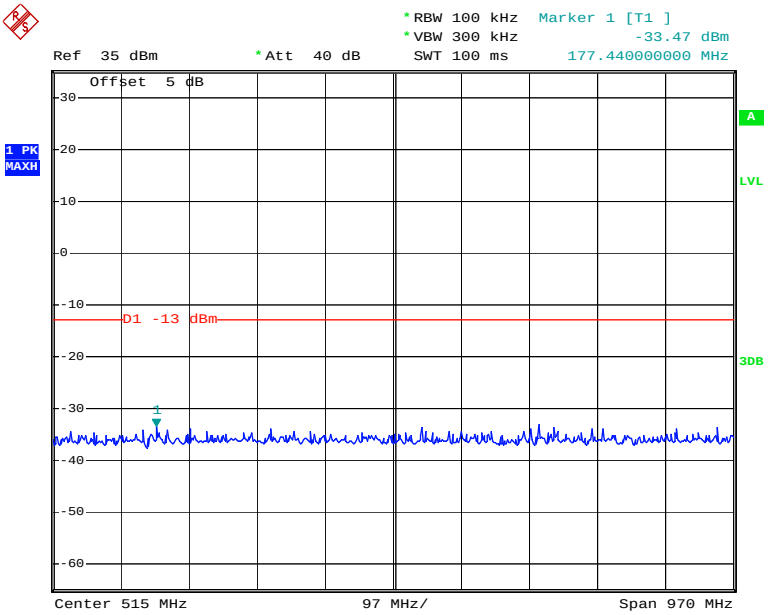


Date: 16.DEC.2017 11:38:36



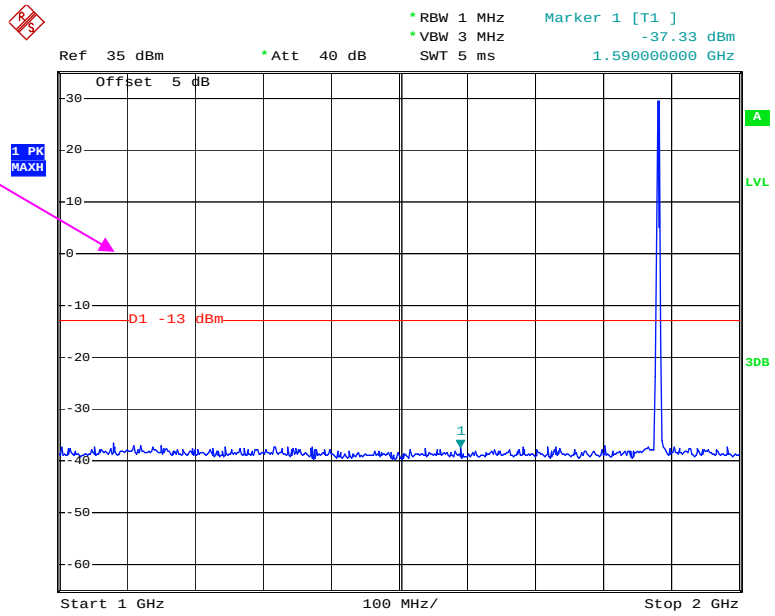
Date: 16.DEC.2017 11:39:02

PCS 1900_ Middle Channel

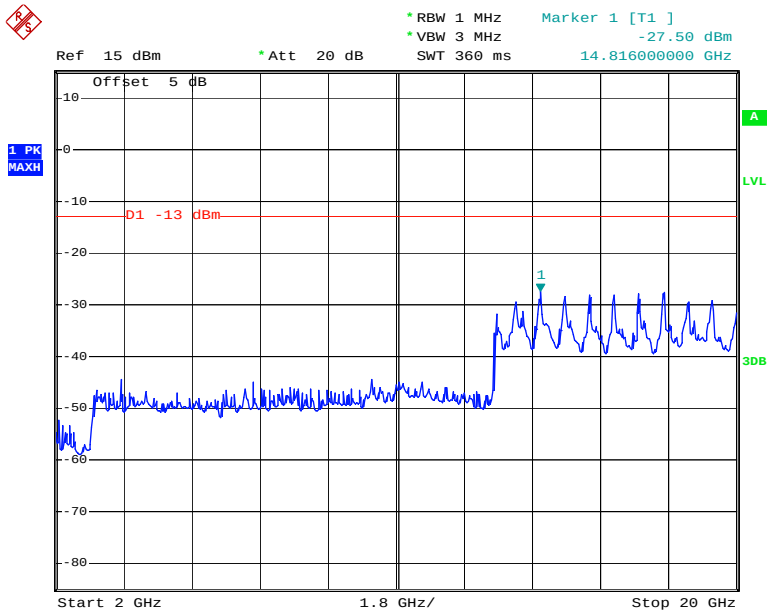


Date: 16.DEC.2017 11:18:28

Fundamental

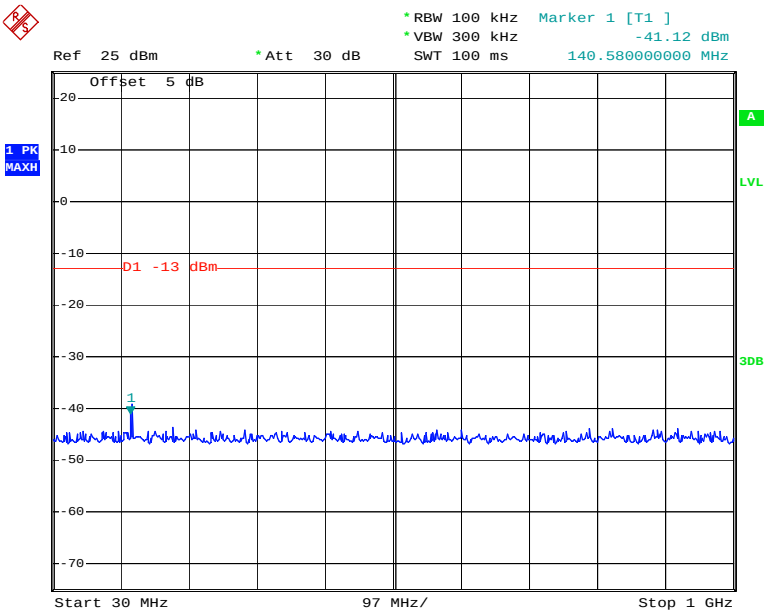


Date: 20.MAR.2018 17:09:37



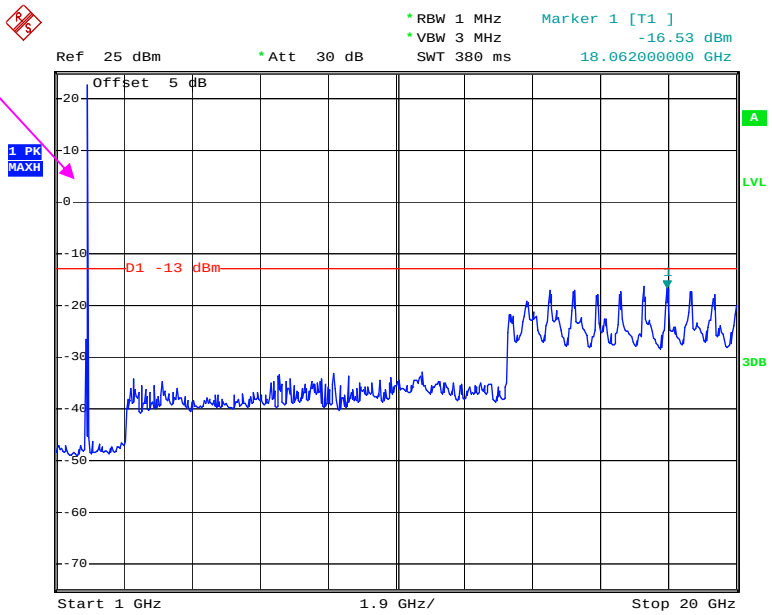
Date: 20.MAR.2018 17:10:04

REL99 Band II_ Middle Channel



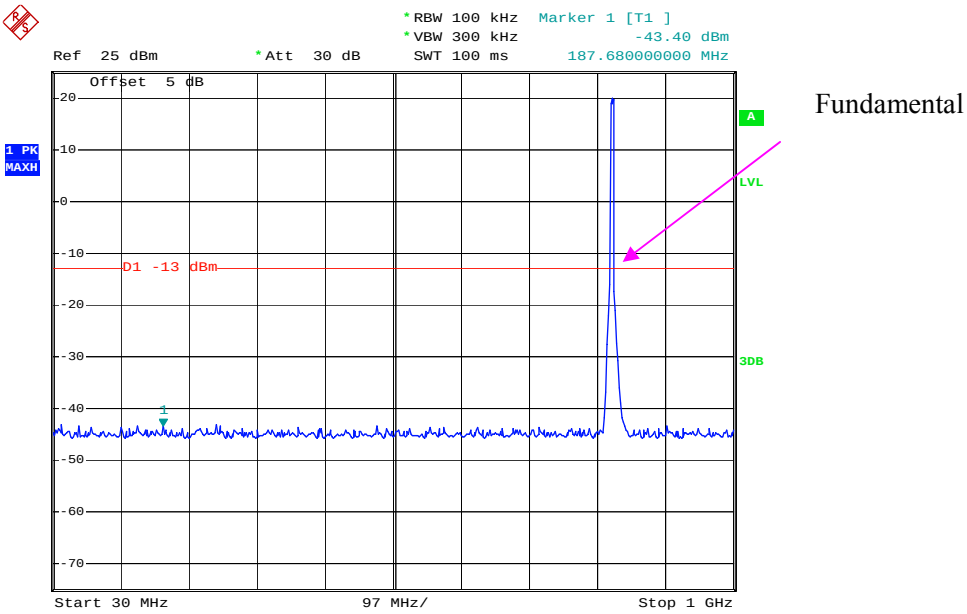
Date: 16.DEC.2017 11:43:02

Fundamental



Date: 16.DEC.2017 11:42:30

REL99 Band V_ Middle Channel



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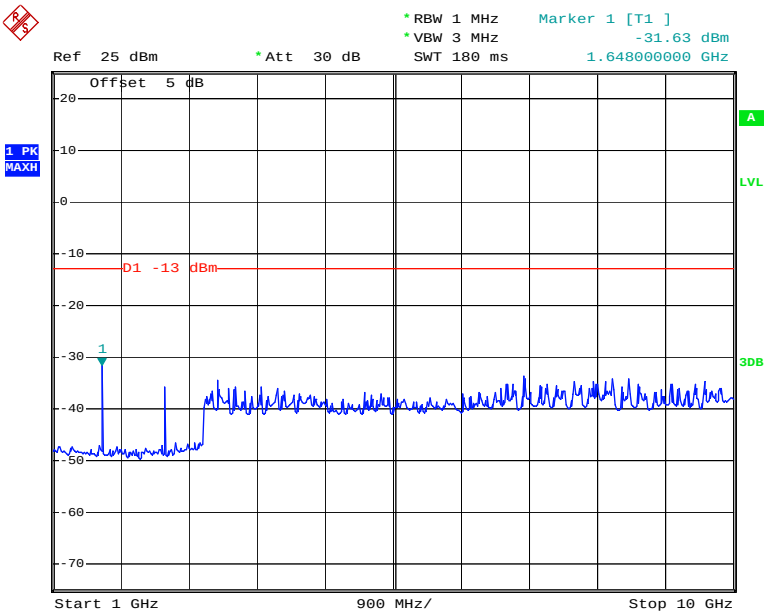


Date: 16.DEC.2017 13:26:03

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

Applicable Standard

FCC § 2.1053, §22.917 and § 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
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
R&S	EMI Test Receiver	ESCI	100224	2017-12-11	2018-12-11
HP	Amplifier	8447D	2727A05902	2017-09-05	2018-09-05
Agilent	Spectrum Analyzer	E4440A	SG43360054	2017-12-08	2018-12-08
ETS-Lindgren	Horn Antenna	3115	000 527 35	2016-01-05	2019-01-04
MITEQ	Amplifier	AFS42-00101800-25-S-42	2001271	2017-09-05	2018-09-05
Ducommun Technolagies	Horn Antenna	ARH-4223-02	1007726-01 1304	2016-11-18	2019-11-18
Ducommun Technolagies	Horn Antenna	ARH-4223-02	1007726-02 1304	2016-11-18	2019-11-18
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2017-06-27	2018-06-27
N/A	Coaxial Cable	C-NJNJ-50	C-0400-01	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-NJNJ-50	C-0075-01	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-NJNJ-50	C-1000-01	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-SJSJ-50	C-0800-01	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-2.4J2.4J-50	C-0700-02	2017-06-27	2018-06-27
HP	Signal Generator	1026	320408	2017-12-08	2018-12-08
EMCO	Adjustable Dipole Antenna	3121C	9109-753	N/A	N/A
TDK RF	Horn Antenna	HRN-0118	130 084	2016-01-05	2019-01-04

*** 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:	20~23.2 °C
Relative Humidity:	34~40 %
ATM Pressure:	101.5 kPa

The testing was performed by Harry Yang on 2017-12-17~2017-12-19.

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, Frequency:836.600 MHz								
276.000	H	43.24	-65.7	0.0	0.5	-66.2	-13.0	53.2
276.000	V	45.62	-65.6	0.0	0.5	-66.1	-13.0	53.1
1673.200	H	45.34	-57.4	10.5	1.5	-48.4	-13.0	35.4
1673.200	V	43.22	-59.4	10.5	1.5	-50.4	-13.0	37.4
2509.800	H	43.24	-57.5	12.2	1.8	-47.1	-13.0	34.1
2509.800	V	41.18	-61	12.2	1.8	-50.6	-13.0	37.6
2912.000	H	44.73	-55.2	12.4	1.9	-44.7	-13.0	31.7
2912.000	V	43.54	-56.5	12.4	1.9	-46.0	-13.0	33.0
WCDMA Band V R99,Frequency:836.600 MHz								
358.000	H	42.67	-63.7	0.0	0.6	-64.3	-13.0	51.3
358.000	V	45.06	-63.9	0.0	0.6	-64.5	-13.0	51.5
1673.200	H	46.24	-56.5	10.5	1.5	-47.5	-13.0	34.5
1673.200	V	44.92	-57.7	10.5	1.5	-48.7	-13.0	35.7
2509.800	H	45.37	-55.4	12.2	1.8	-45.0	-13.0	32.0
2509.800	V	43.26	-58.9	12.2	1.8	-48.5	-13.0	35.5
2964.000	H	45.11	-54.7	12.4	1.9	-44.2	-13.0	31.2
2964.000	V	43.35	-56.4	12.4	1.9	-45.9	-13.0	32.9

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, Frequency:1880.000 MHz								
483.000	H	44.38	-59.9	0.0	0.7	-60.6	-13.0	47.6
483.000	V	45.73	-61.7	0.0	0.7	-62.4	-13.0	49.4
3760.000	H	67.28	-30.4	12.3	2.1	-20.2	-13.0	7.2
3760.000	V	65.45	-32	12.3	2.1	-21.8	-13.0	8.8
5640.000	H	45.53	-46.9	13.0	2.4	-36.3	-13.0	23.3
5640.000	V	43.12	-49.6	13.0	2.4	-39.0	-13.0	26.0
5815.000	H	44.31	-47.6	13.2	2.4	-36.8	-13.0	23.8
5815.000	V	41.16	-50.9	13.2	2.4	-40.1	-13.0	27.1
WCDMA Band II, R99, Frequency:1880.000 MHz								
407.000	H	42.71	-62.1	0.0	0.6	-62.7	-13.0	49.7
407.000	V	44.57	-63.5	0.0	0.6	-64.1	-13.0	51.1
3760.000	H	61.24	-36.5	12.3	2.1	-26.3	-13.0	13.3
3760.000	V	60.06	-37.4	12.3	2.1	-27.2	-13.0	14.2
5640.000	H	45.62	-46.8	13.0	2.4	-36.2	-13.0	23.2
5640.000	V	43.25	-49.4	13.0	2.4	-38.8	-13.0	25.8
8234.000	H	43.56	-43.4	12.9	2.6	-33.1	-13.0	20.1
8234.000	V	41.12	-46.4	12.9	2.6	-36.1	-13.0	23.1

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

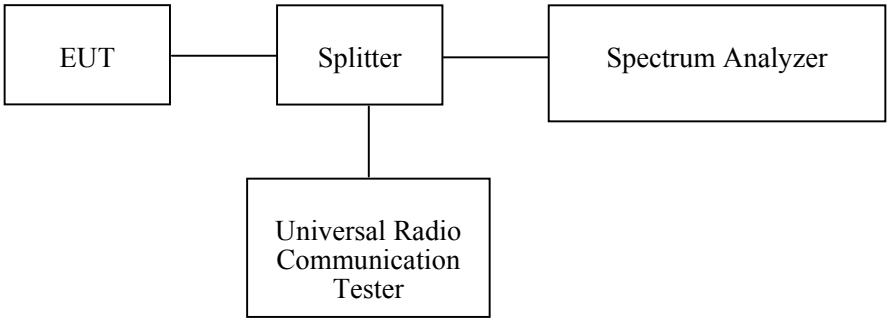
According to § 22.917(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2017-12-08	2018-12-08
R&S	Universal Radio Communication Tester	CMU200	109 038	2017-07-18	2018-07-18
Unknown	Coaxial Cable	C-SJ00-0010	C0010/02	Each Time	/
Pasternack	RF Coaxial Cable	0.5m	C-5	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

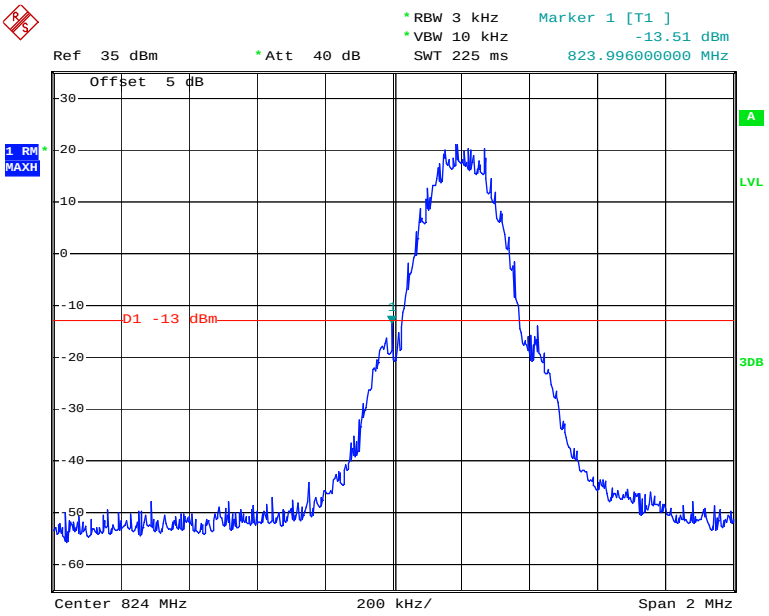
Temperature:	23.1°C
Relative Humidity:	41%
ATM Pressure:	102 kPa

The testing was performed by Harry Yang on 2017-12-16.

Test Mode: Transmitting

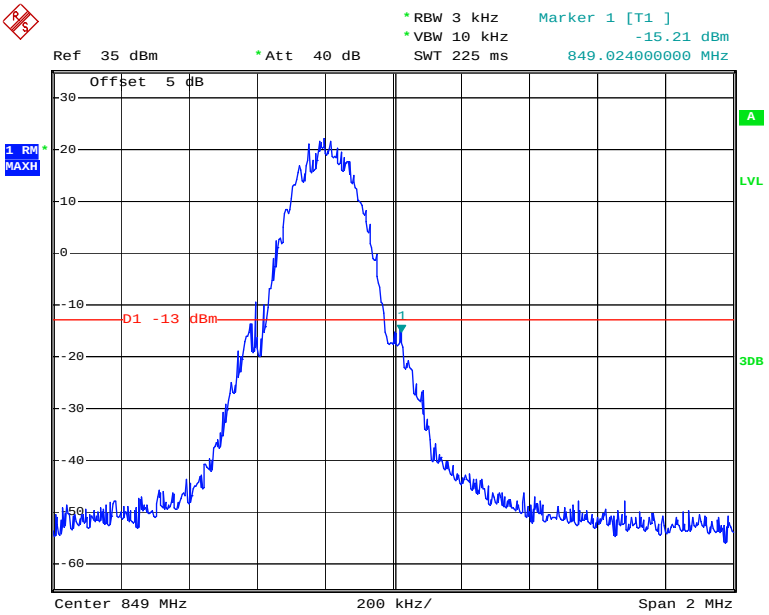
Test Result: Compliant. Please refer to the following plots.

GSM 850, Left Band Edge



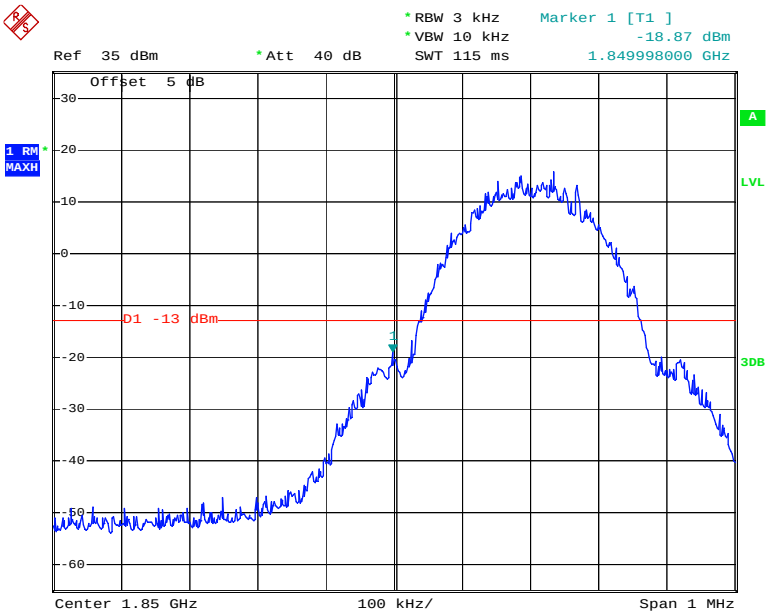
Date: 16.DEC.2017 11:34:25

GSM 850, Right Band Edge



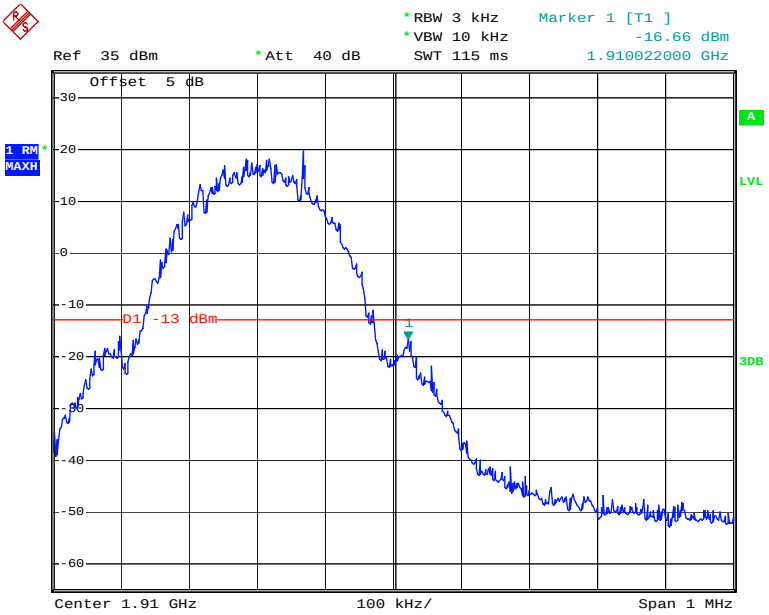
Date: 16.DEC.2017 11:35:45

PCS 1900, Left Band Edge



Date: 16.DEC.2017 11:26:42

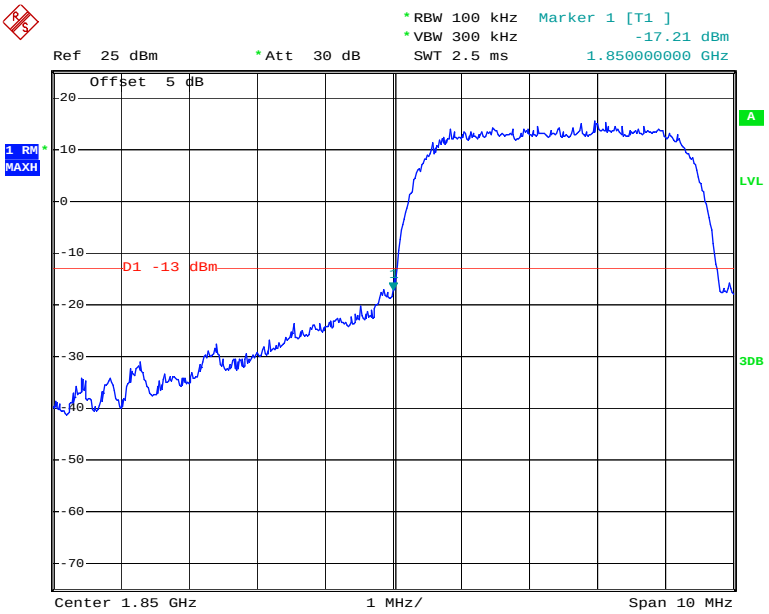
PCS 1900, Right Band Edge



Date: 16.DEC.2017 11:28:04

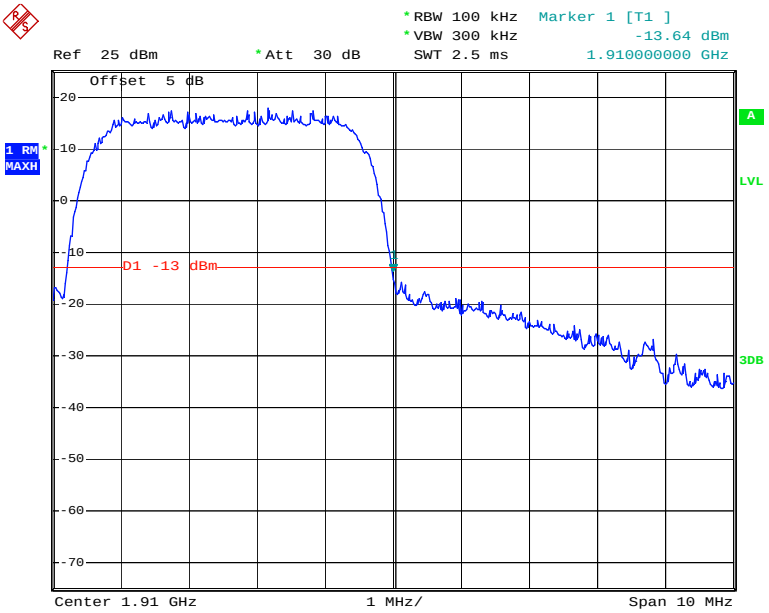
WCDMA Band II:

REL99 Band II, Left Band Edge



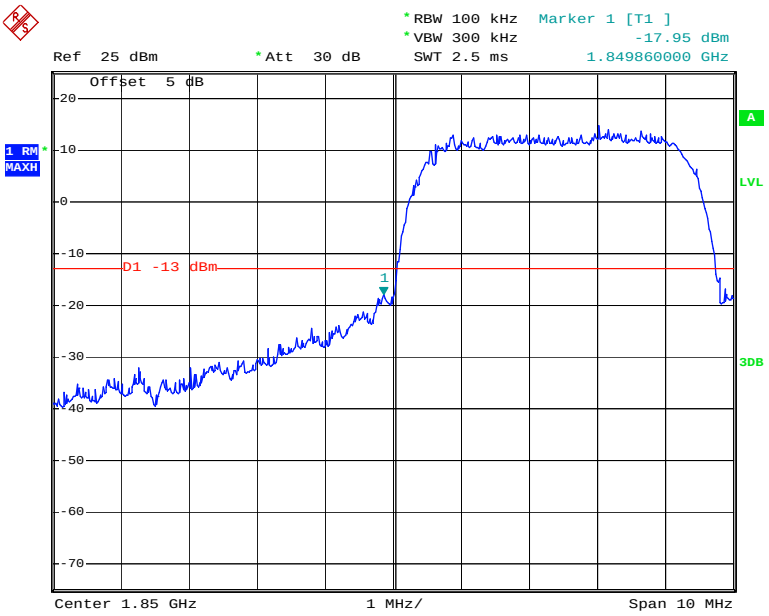
Date: 16.DEC.2017 11:54:14

REL99 Band II, Right Band Edge



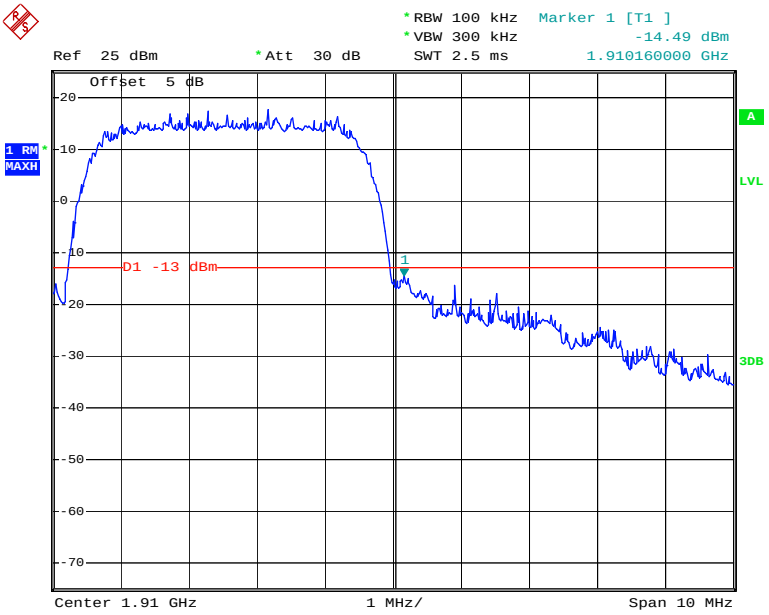
Date: 16.DEC.2017 11:54:49

HSDPA Band II, Left Band Edge



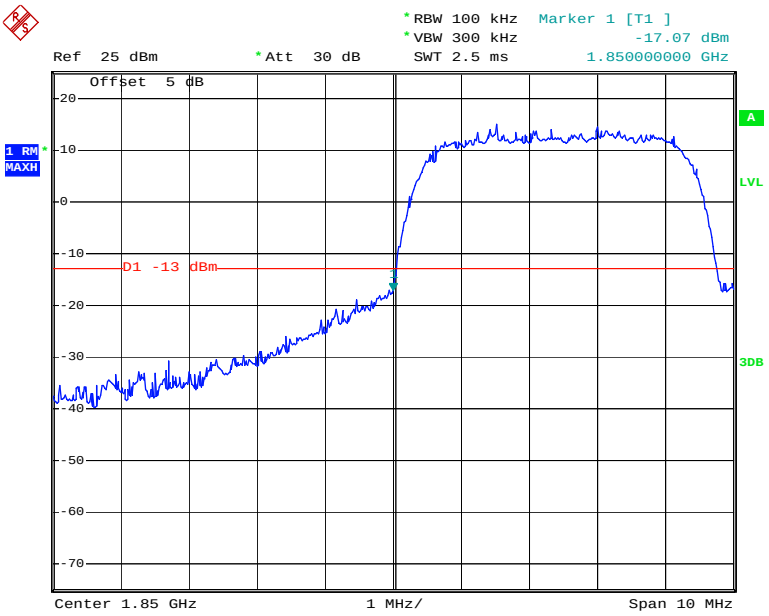
Date: 16.DEC.2017 11:49:02

HSDPA Band II, Right Band Edge



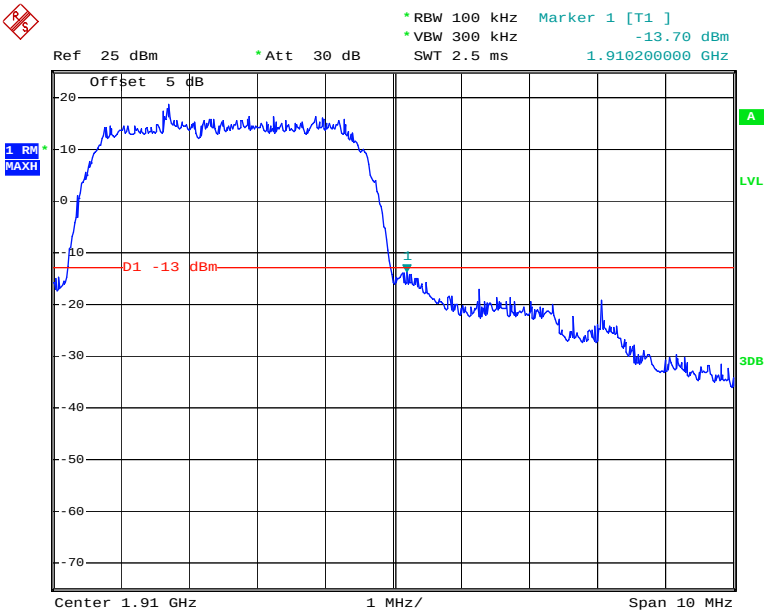
Date: 16.DEC.2017 11:50:27

HSUPA Band II, Left Band Edge



Date: 16.DEC.2017 11:53:29

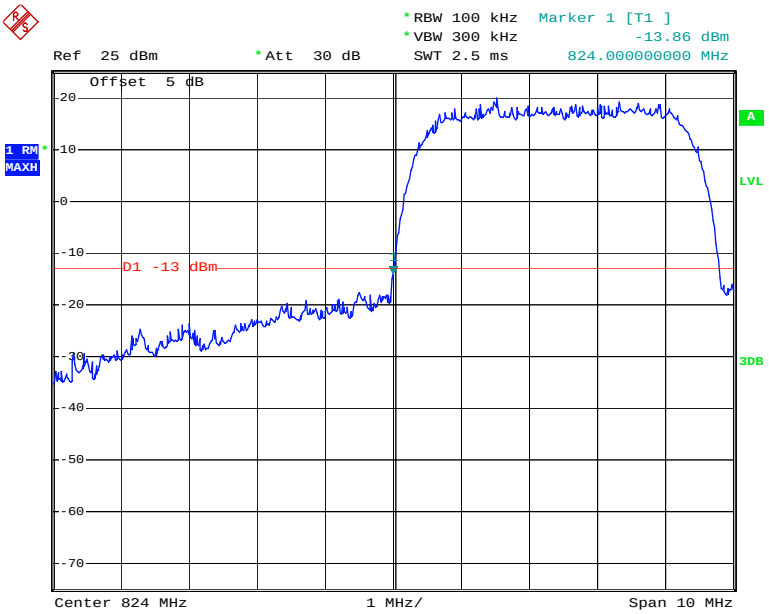
HSUPA Band II, Right Band Edge



Date: 16.DEC.2017 11:52:00

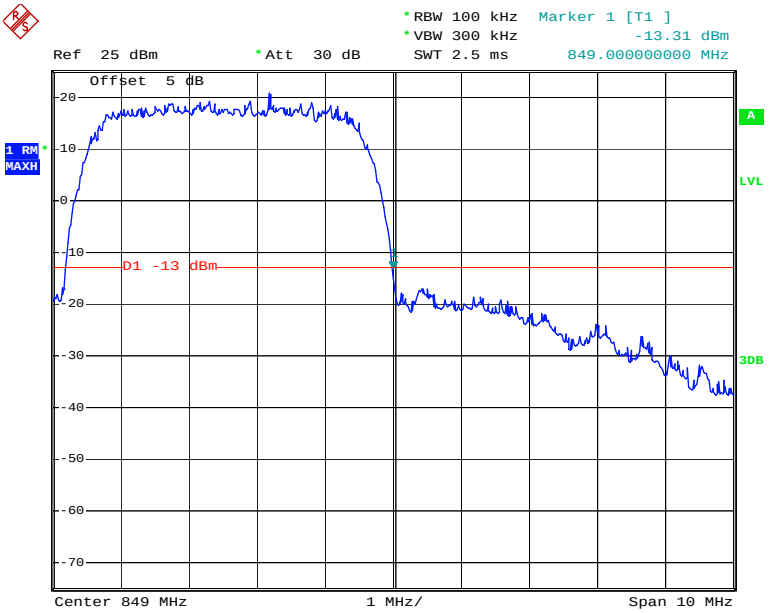
WCDMA Band V

REL99 Band V, Left Band Edge



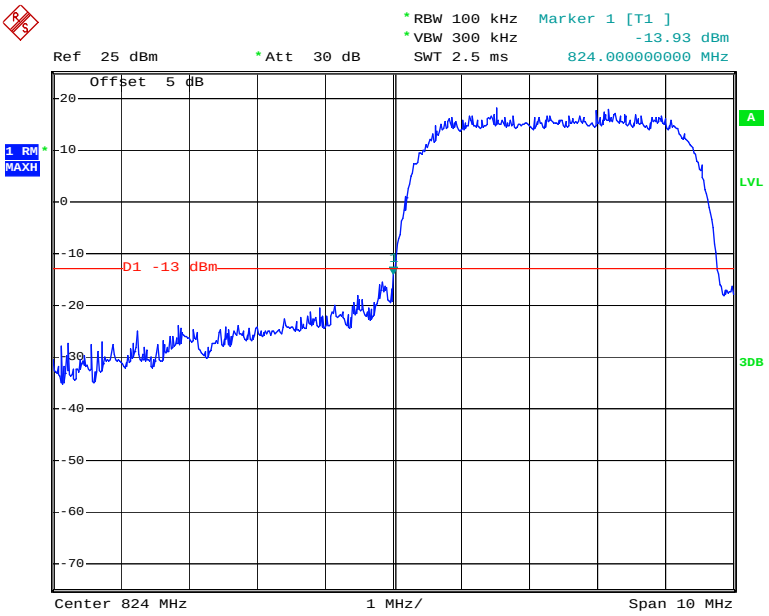
Date: 16.DEC.2017 13:03:36

REL99 Band V Right Band Edge



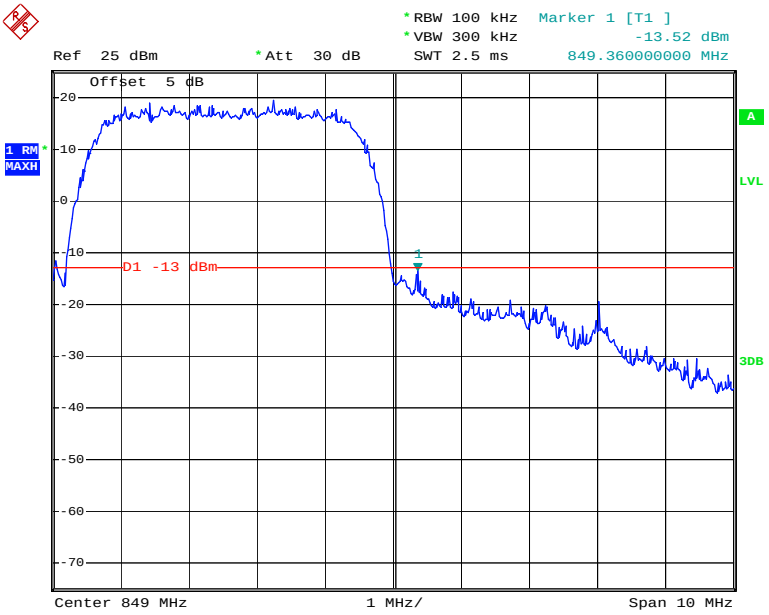
Date: 16.DEC.2017 13:03:57

HSDPA Band V, Left Band Edge



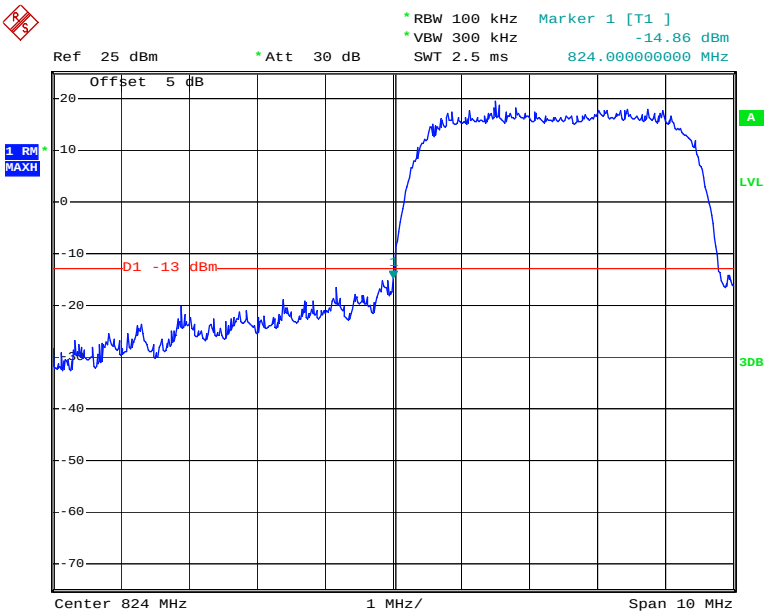
Date: 16.DEC.2017 13:08:28

HSDPA Band V, Right Band Edge



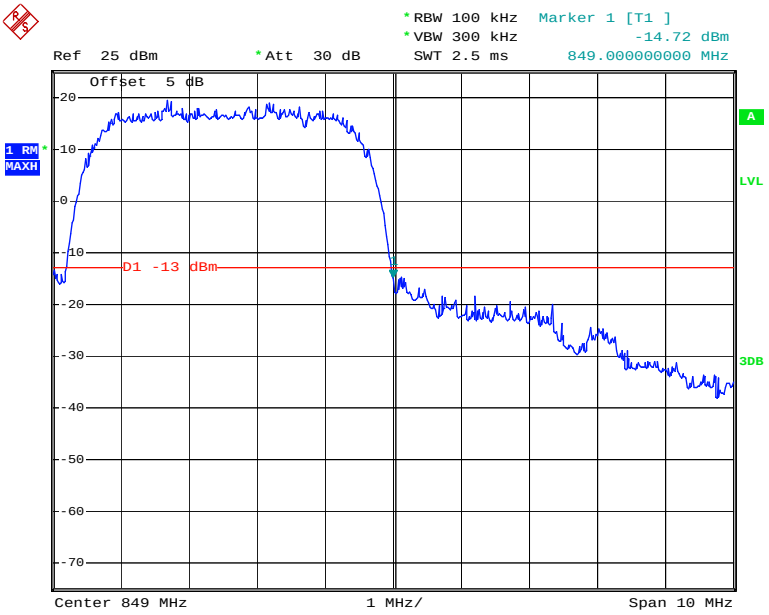
Date: 16.DEC.2017 13:07:56

HSUPA Band V, Left Band Edge



Date: 16.DEC.2017 13:23:39

HSUPA Band V, Right Band Edge



Date: 16.DEC.2017 13:22:51

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

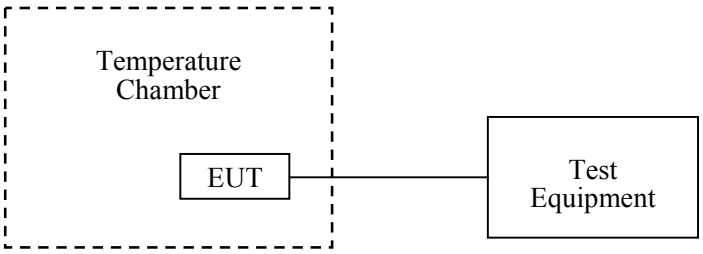
According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

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 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: 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
Dongzhixu	High Temperature Test Chamber	DP1000	201105083-4	2017-08-28	2018-08-28
R&S	Universal Radio Communication Tester	CMU200	109 038	2017-07-18	2018-07-18
UNI-T	Multimeter	UT39A	M130199938	2017-04-02	2018-04-02
Unknown	Coaxial Cable	0.1m	C-1	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:	23.1 °C
Relative Humidity:	41 %
ATM Pressure:	102 kPa

The testing was performed by Harry Yang on 2017-12-16.

Cellular Band (Part 22H)

GMSK, Middle Channel, f_c = 836.6 MHz				
Temperature	**Voltage**	**Frequency Error**	**Frequency Error**	**Limit**
℃	**V_{DC}**	**Hz**	**ppm**	**ppm**
-30	3.7	-12	-0.014	2.5
-20		-13	-0.016	
-10		-11	-0.013	
0		-9	-0.011	
10		-12	-0.014	
20		-11	-0.013	
30		-12	-0.014	
40		-13	-0.016	
50		-12	-0.014	
25	3.4	-11	-0.013	
25	4.2	-11	-0.013	

PCS Band (Part 24E)

GMSK, Middle Channel, f_c = 1880.0 MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Result
℃	V_{DC}	Hz	ppm	
-30	3.7	-8	-0.004	Compliance
-20		-7	-0.004	
-10		-4	-0.002	
0		-5	-0.003	
10		-6	-0.003	
20		-5	-0.003	
30		-6	-0.003	
40		-3	-0.002	
50		-4	-0.002	
25	3.4	-5	-0.003	
25	4.2	-5	-0.003	

WCDMA Band II: Rel99

Middle Channel, f_c = 1880.0 MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Result
℃	V_{DC}	Hz	ppm	
-30	3.7	-4	-0.002	Compliance
-20		-2	-0.001	
-10		5	0.003	
0		2	0.001	
10		3	0.002	
20		4	0.002	
30		-4	-0.002	
40		5	0.003	
50		-1	-0.001	
25	3.4	-2	-0.001	
25	4.2	5	0.003	

WCDMA Band V: Rel 99

Middle Channel, f_c = 836.6 MHz				
Temperature	**Voltage**	**Frequency Error**	**Frequency Error**	**Limit**
℃	**V_{DC}**	**Hz**	**ppm**	**ppm**
-30	3.7	-1	-0.001	2.5
-20		0	0.000	2.5
-10		2	0.002	2.5
0		3	0.004	2.5
10		1	0.001	2.5
20		0	0.000	2.5
30		1	0.001	2.5
40		1	0.001	2.5
50		2	0.002	2.5
25	3.4	-1	-0.001	2.5
25	4.2	0	0.000	2.5

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