

FCC PART 22H, PART 24E
MEASUREMENT AND TEST REPORT

For

Sam Radios Ltd.

No.18 Daxiamei Industrial Park, Nan'an, Quanzhou, Fujian, 362300, China

FCC ID: 2AGPQ-CM300W

Report Type: Original Report	Product Type: 3G IP Mobile Radio
Report Number: RXM170811050-00	
Report Date: 2017-08-31	
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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.(Dongguan).

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Sam Radios Ltd.*'s product, model number: CM-300 (**FCC ID: 2AGPQ-CM300W**) (the "EUT") in this report was a 3G IP Mobile Radio, which was measured approximately: 11.5 cm (L) x 10.5 cm (W) x 3.8 cm (H), rated input power: DC9-24V.

Note: The series product, model CM-310, CM-320 and CM-300 are electrically identical, the difference between them is model name, we selected CM-300 for testing, the details was explained in the declaration letter.

All measurement and test data in this report was gathered from production sample serial number: 170811050 (Assigned by BACL, Dongguan). The EUT was received on 2017-08-14.

Objective

This report is prepared on behalf of *Sam Radios Ltd.* 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)

N/A

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).

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 °C
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%

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

Bay Area Compliance Laboratories Corp. (Dongguan) has been accredited to ISO 17025 by CNAS(Lab code: L5662). And accredited to ISO 17025 by NVLAP(Test Laboratory Accreditation Certificate Number 500069-0), the FCC Designation No. CN5002 under the KDB 974614 D01.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 273710. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Bay Area Compliance Laboratories Corp. (Dongguan) was 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. The device only support data mode(GPRS and EDGE) and support maximum 2 uplink for GPRS and 4 uplink for EDGE.

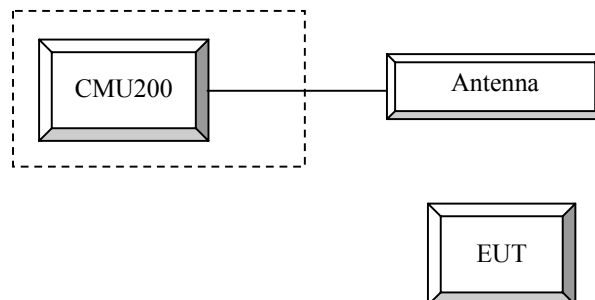
Equipment Modifications

No modification was made to the EUT.

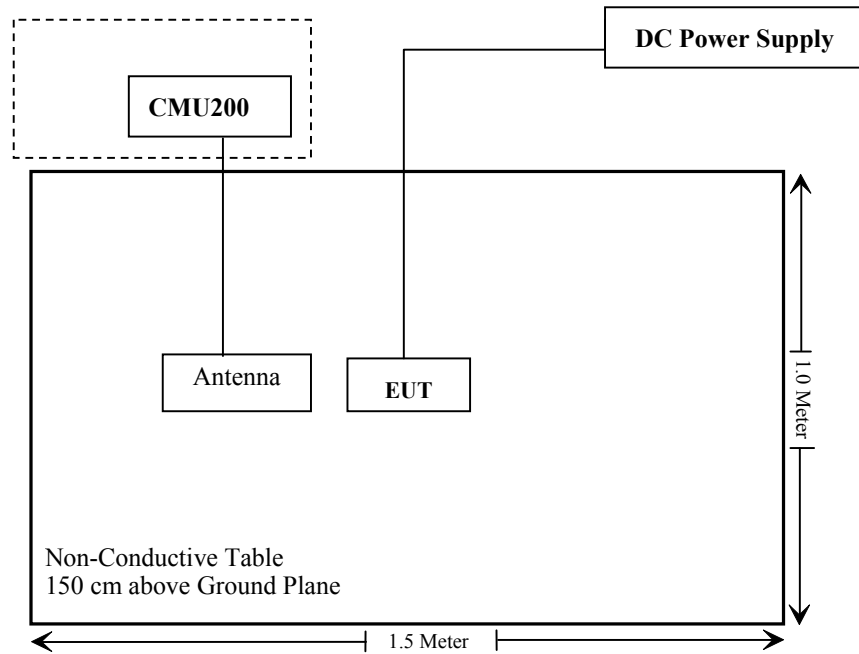
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
R&S	Universal Radio Communication Tester	CMU200	109038
Pro instrument	DC Power Supply	pps3300	N/A

Configuration of Test Setup



Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §1.1310 & §2.1091	Maximum Permissible Exposure (MPE)	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 , §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f ²)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculation Formula:

Prediction of power density at the distance of the applicable MPE limit:

$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm²);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Calculated Data:

Mode	Frequency (MHz)	Antenna Gain		Tune-up Power		Evaluation Distance (cm)	Power Density	MPE Limit
		(dBi)	(numeric)	(dBm)	(mW)		(mW/cm ²)	
GSM850	824-849	-1	0.79	31	1258.93	20.00	0.1990	0.55
PCS1900	1850-1910	1	1.26	30	1000.00	20.00	0.2506	1.0
WCDMA Band V	824-849	-1	0.79	23	199.53	20.00	0.0315	0.55
WCDMA Band II	1850-1910	1	1.26	23	199.53	20.00	0.0500	1.0

Result: Compliance, The device meets MPE requirement for Devices Used by the General Public (Uncontrolled Environment) at distance ≥ 20 cm.

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
	β_c / β_d	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			
	β_c	2/15	12/15	15/15	15/15
	β_d	15/15	15/15	8/15	4/15
	β_d (SF)	64			
	β_c / β_d	2/15	12/15	15/8	15/4
	β_{hs}	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			
	$A_{hs} = \beta_{hs} / \beta_c$	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 A General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2kbps RMC				
	HSDPA FRC	H-Set1				
	HSUPA Test	HSUPA Loopback				
	Power Control Algorithm	Algorithm2				
	β_c	11/15	6/15	15/15	2/15	15/15
	β_d	15/15	15/15	9/15	15/15	0
	β_{ec}	209/225	12/15	30/15	2/15	5/15
	β_c/β_d	11/15	6/15	15/9	2/15	-
	β_{hs}	22/15	12/15	30/15	4/15	5/15
	CM(dB)	1.0	3.0	2.0	3.0	1.0
HSDPA Specific Settings	MPR(dB)	0	2	1	2	0
	DACK	8				
	DNAK	8				
	DCQI	8				
	Ack-Nack repetition factor	3				
	CQI Feedback	4ms				
	CQI Repetition Factor	2				
HSUPA Specific Settings	$A_{hs}=\beta_{hs}/\beta_c$	30/15				
	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_FCI	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		

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	2016-09-01	2017-08-31
Sunol Sciences	Antenna	JB3	A060611-1	2014-11-06	2017-11-05
R&S	Spectrum Analyzer	FSU 26	200256	2016-12-08	2017-12-08
ETS LINDGREN	Horn Antenna	3115	000 527 35	2016-01-05	2019-01-04
HP	Signal Generator	1026	320408	2016-12-08	2017-12-08
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
Unknown	Coaxial Cable	ChamberA-1	14m	2016-09-01	2017-09-01
Unknown	Coaxial Cable	Chamber B-2	8m	2016-09-01	2017-09-01
Unknown	Coaxial Cable	0.1m	C-1	Each Time	/
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2017-05-06	2018-05-06
R&S	Universal Radio Communication Tester	CMU200	109 038	2017-07-18	2018-07-18
Unknown	RF Attenuator	6dB	6dB-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:	27.6 °C
Relative Humidity:	47 %
ATM Pressure:	100.2 kPa

The testing was performed by Gavin Xu on 2017-08-22.

Conducted Output Power**Cellular Band (Part 22H) & PCS Band (Part 24E)**

Band	Channel No.	Conducted Peak Output Power(dBm)					
		GPRS 1 TX Slot	GPRS 2 TX Slot	EDGE 1 TX Slot	EDGE 2 TX Slot	EDGE 3 TX Slot	EDGE 4 TX Slot
Cellular	128	30.75	29.85	25.54	24.72	23.78	22.71
	190	30.82	29.92	25.59	24.80	23.82	22.76
	251	30.88	29.96	25.67	24.82	23.88	22.77
PCS	512	29.35	28.39	25.70	24.85	23.84	22.85
	661	29.43	28.46	25.77	24.90	23.89	22.86
	810	29.45	28.47	25.81	24.96	23.93	22.94

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	22.92	3.21	22.28	3.24	22.54	3.27
HSDPA	1	22.30	3.44	22.14	3.45	21.90	3.47
	2	22.22	3.46	22.07	3.41	21.82	3.46
	3	22.17	3.40	21.95	3.40	21.73	3.52
	4	22.11	3.47	21.88	3.41	21.66	3.57
HSUPA	1	22.32	3.59	22.15	3.4	21.59	3.46
	2	22.26	3.54	22.08	3.41	21.87	3.43
	3	22.17	3.55	22.01	3.52	21.79	3.48
	4	22.09	3.45	21.88	3.43	21.66	3.46
	5	22.01	3.58	21.81	3.49	21.57	3.60
DC-HSDPA	1	22.35	3.41	22.18	3.51	22.03	3.57
	2	22.28	3.46	22.11	3.47	21.91	3.62
	3	22.21	3.55	22.03	3.48	21.85	3.50
	4	22.15	3.54	21.89	3.49	21.77	3.49
HSPA+	1	22.33	3.46	22.11	3.54	21.94	3.48

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

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	22.24	2.92	22.35	3.08	22.33	3.11
HSDPA	1	21.59	3.20	21.69	3.31	21.65	3.36
	2	21.20	3.14	21.22	3.45	21.19	3.28
	3	21.11	3.24	21.17	3.32	21.07	3.26
	4	21.01	3.30	21.04	3.44	21.00	3.31
HSUPA	1	21.55	3.19	21.66	3.31	21.61	3.45
	2	21.43	3.14	21.41	3.45	21.44	3.45
	3	21.22	3.16	21.33	3.47	21.31	3.34
	4	21.10	3.32	21.17	3.33	21.24	3.38
	5	21.02	3.25	21.08	3.32	21.13	3.39
DC-HSDPA	1	21.25	3.19	21.42	3.46	21.31	3.26
	2	21.16	3.17	21.28	3.44	21.20	3.40
	3	21.01	3.30	21.20	3.47	21.11	3.27
	4	20.88	3.33	21.09	3.33	21.04	3.43
HSPA+	1	21.20	3.14	21.25	3.28	21.17	3.28

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)			
GPRS 850_Middle Channel								
836.600	H	103.05	28.1	0.0	1	27.1	38.5	11.4
836.600	V	102.72	30.9	0.0	1	29.9	38.5	8.6
EDGE 850_Middle Channel								
836.600	H	100.18	25.3	0.0	1	24.3	38.5	14.2
836.600	V	97.51	25.7	0.0	1	24.7	38.5	13.8
WCDMA Band V Middle Channel								
836.600	H	95.81	20.9	0.0	1	19.9	38.5	18.6
836.600	V	94.03	22.2	0.0	1	21.2	38.5	17.3

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)			
GPRS 1900_Middle Channel								
1880.000	H	92.31	21.7	11.7	2.7	28.7	33.0	4.3
1880.000	V	93.68	21.2	11.7	2.7	30.2	33.0	2.8
EGPRS 1900_Middle Channel								
1880.000	H	86.87	14.3	11.7	2.7	23.3	33.0	9.7
1880.000	V	88.26	15.8	11.7	2.7	24.8	33.0	8.2
WCDMA Band II Middle Channel								
1880.000	H	86.16	13.6	11.7	2.7	22.6	33.0	10.4
1880.000	V	87.43	15	11.7	2.7	24.0	33.0	9.0

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

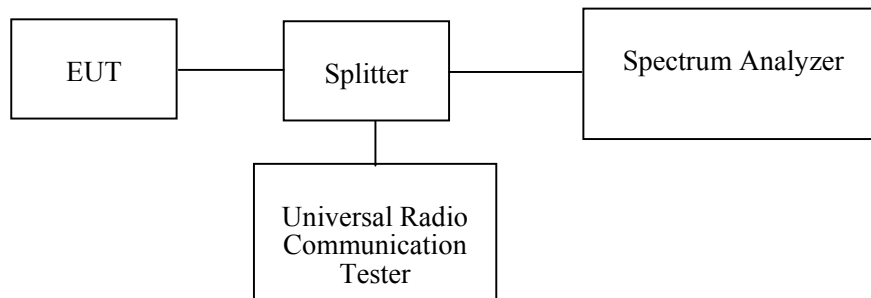
Applicable Standard

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	2016-12-08	2017-12-08
R&S	Universal Radio Communication Tester	CMU200	109 038	2017-07-18	2018-07-18
Unknown	Coaxial Cable	0.1m	C-1	Each Time	/
Unknown	RF Attenuator	6dB	6dB-1	Each Time	/
Pasternack	RF Coaxial Cable	0.5m	C-2	Each Time	/
E-Microwave	Two-way Splitter	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**

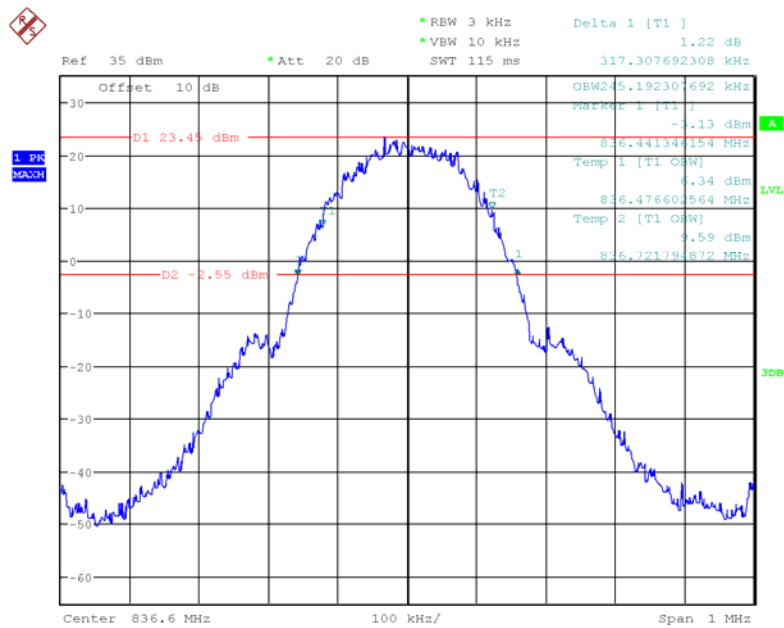
Temperature:	24.6~27.6 °C
Relative Humidity:	47-58 %
ATM Pressure:	98.9~100.3 kPa

The testing was performed by Gavin Xu from 2017-08-21 to 2017-08-28.

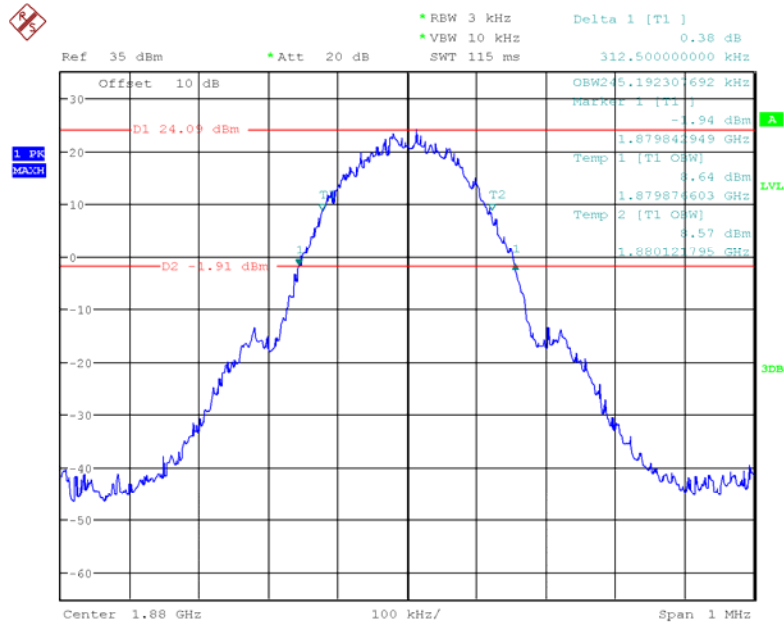
Test Mode: Transmitting

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

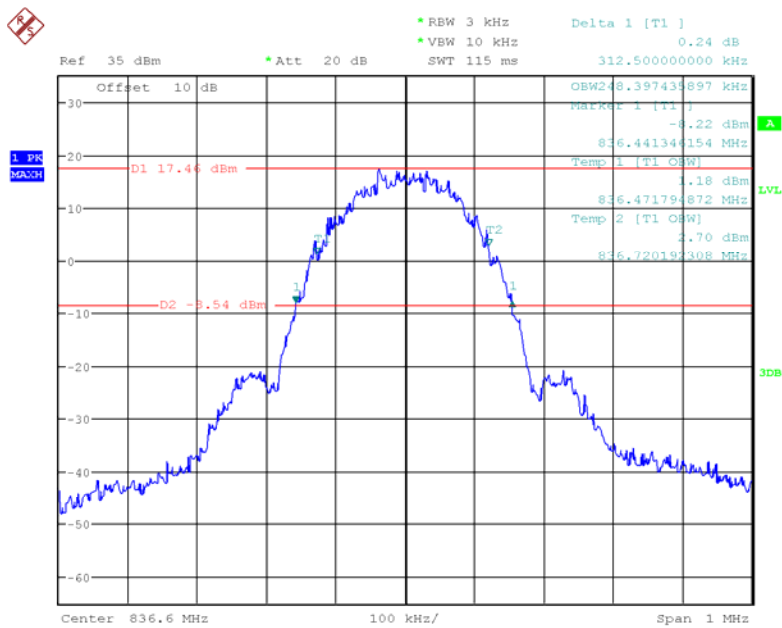
Band	Test Channel	Mode	99% Occupied Bandwidth (MHz)	26 dB Occupied Bandwidth (MHz)
Cellular	M	GPRS	0.245	0.317
		EDGE	0.248	0.313
PCS		GPRS	0.245	0.313
		EDGE	0.250	0.313
WCDMA Band II		Rel 99	4.16	4.68
		HSDPA	4.18	4.70
		HSUPA	4.16	4.69
WCDMA Band V		Rel 99	4.16	4.68
		HSDPA	4.18	4.68
		HSUPA	4.16	4.68

GPRS 850 Cellular Band

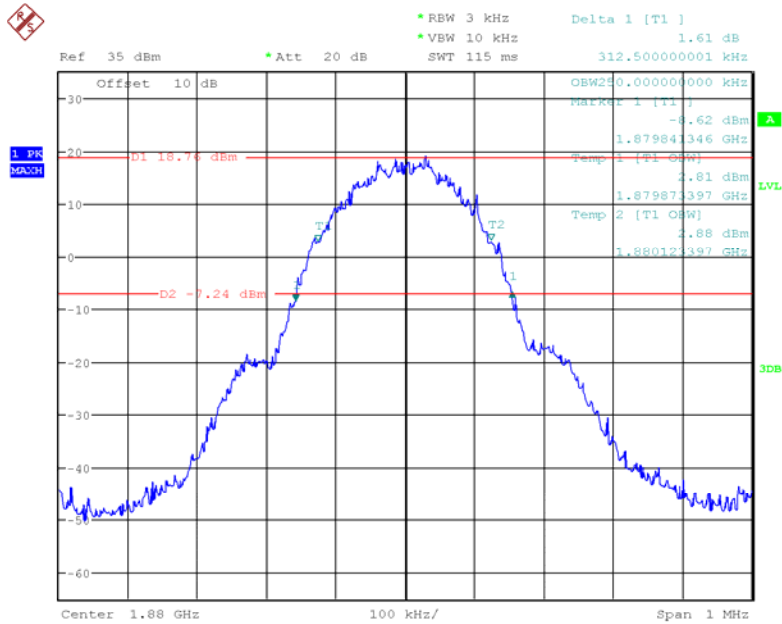
Date: 28.AUG.2017 17:04:27

GPRS 1900 PCS Band

Date: 28.AUG.2017 17:15:25

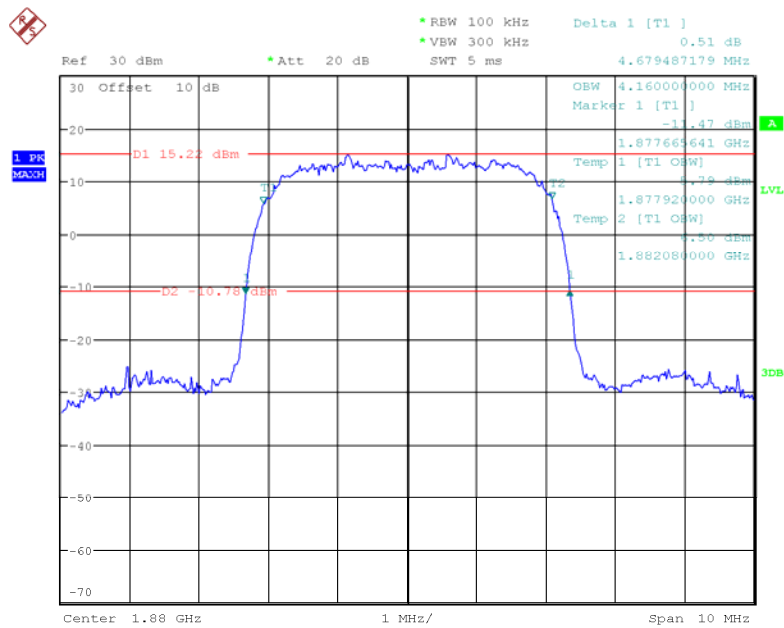
EDGE 850 Cellular Band

Date: 28.AUG.2017 17:00:18

EDGE1900 PCS Band

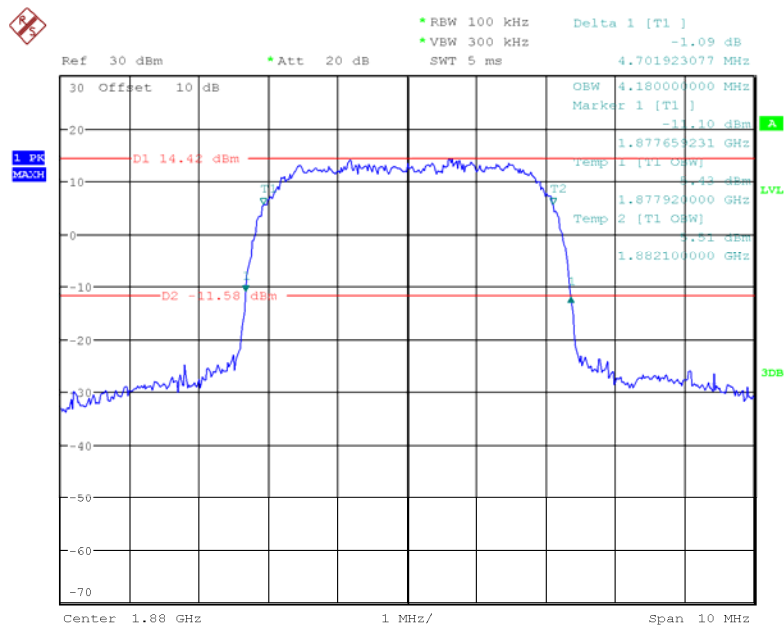
Date: 28.AUG.2017 17:30:22

REL99 Band II

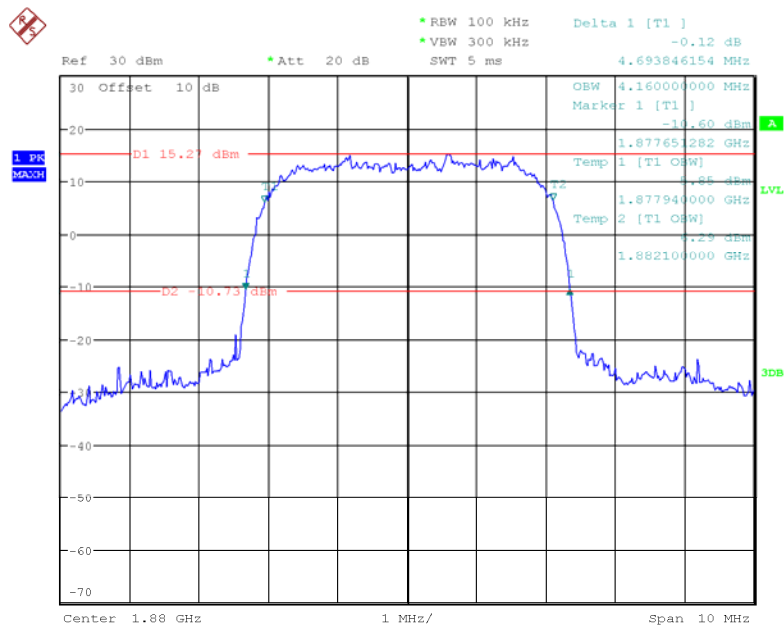


Date: 21.AUG.2017 16:11:44

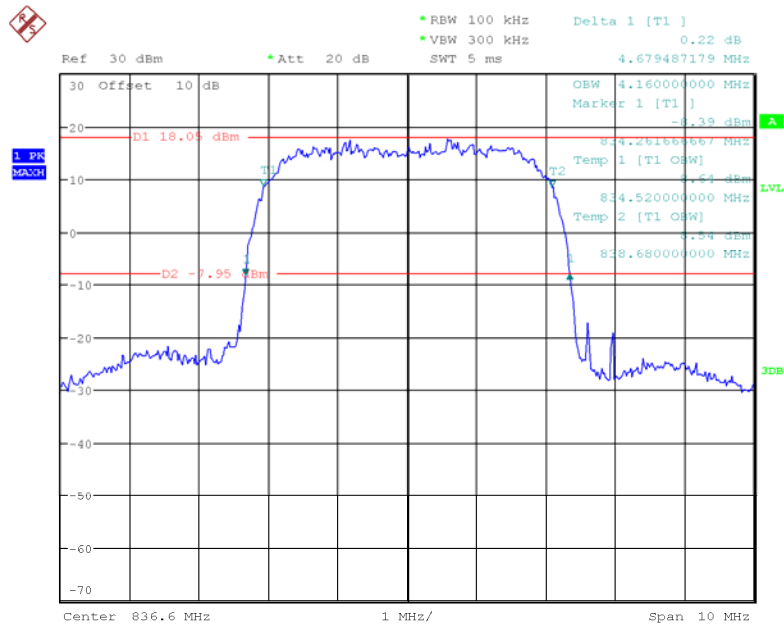
HSDPA Band II



Date: 21.AUG.2017 16:14:26

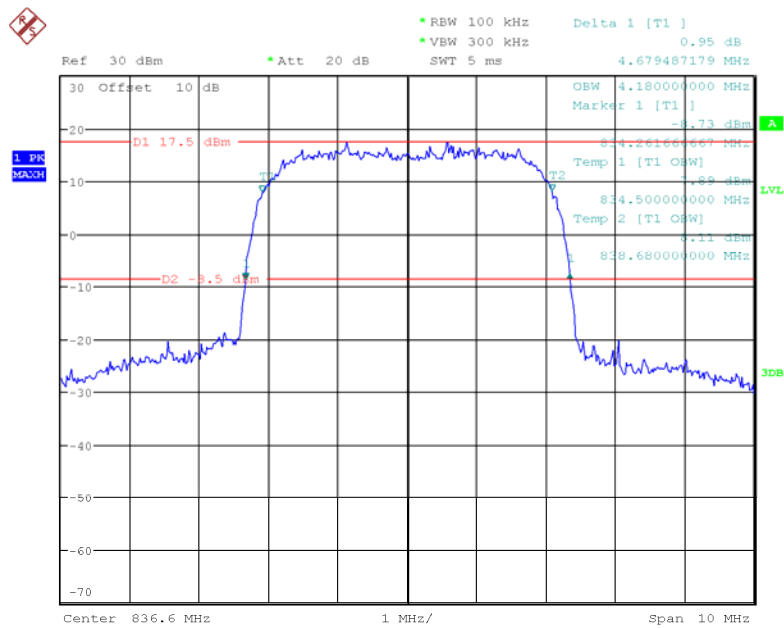
HSUPA Band II

Date: 21.AUG.2017 16:13:45

REL99 Band V

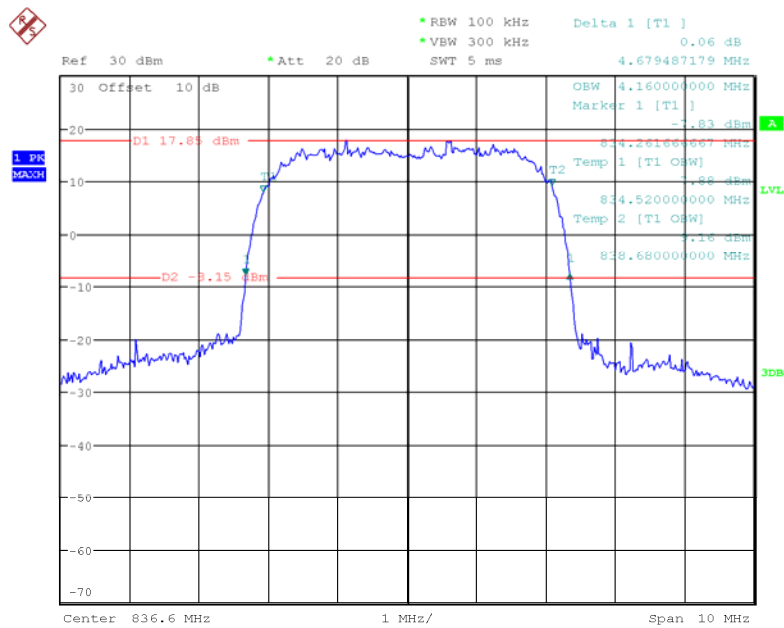
Date: 21.AUG.2017 15:40:23

HSDPA Band V



Date: 21.AUG.2017 15:44:34

HSUPA Band V



Date: 21.AUG.2017 15:42:40

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

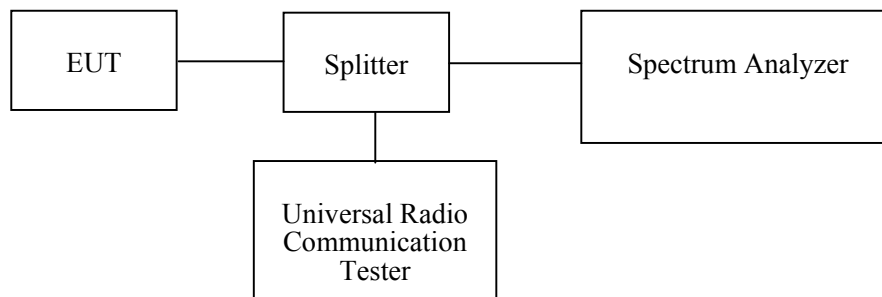
Applicable Standard

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	2016-12-08	2017-12-08
R&S	Universal Radio Communication Tester	CMU200	109 038	2017-07-18	2018-07-18
Unknown	RF Attenuator	6dB	6dB-1	Each Time	/
Unknown	Coaxial Cable	0.1m	C-1	Each Time	/
Pasternack	RF Coaxial Cable	0.5m	C-2	Each Time	/
E-Microwave	Two-way Splitter	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).

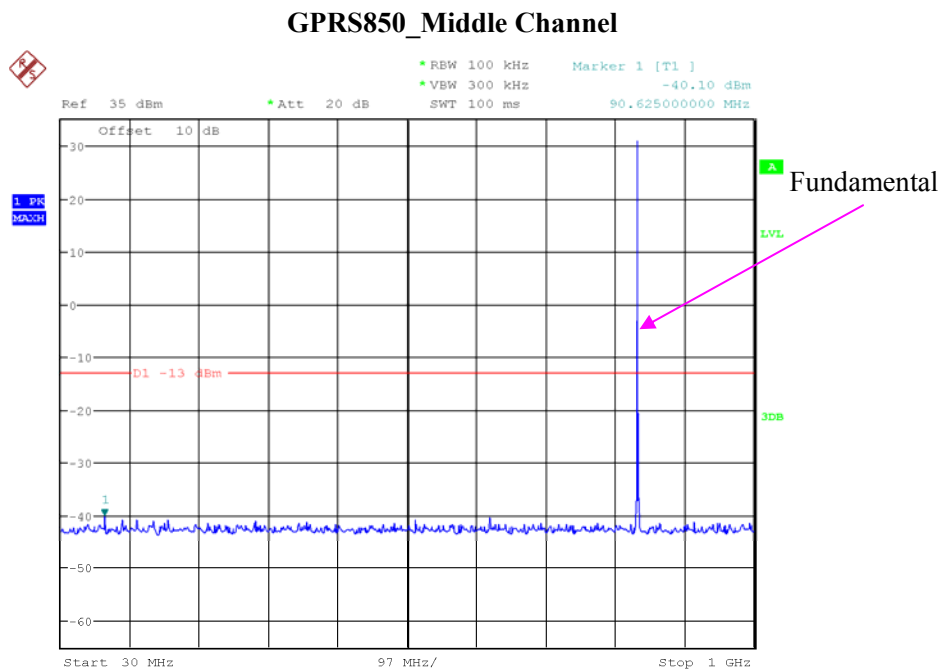
Test Data

Environmental Conditions

Temperature:	24.6~27.6 °C
Relative Humidity:	47-58 %
ATM Pressure:	98.9~100.3 kPa

The testing was performed by Gavin Xu from 2017-08-21 to 2017-08-28.

Please refer to the following plots.



Date: 28.AUG.2017 17:06:52



Date: 28.AUG.2017 17:19:16



REL99 Band II_ Middle Channel



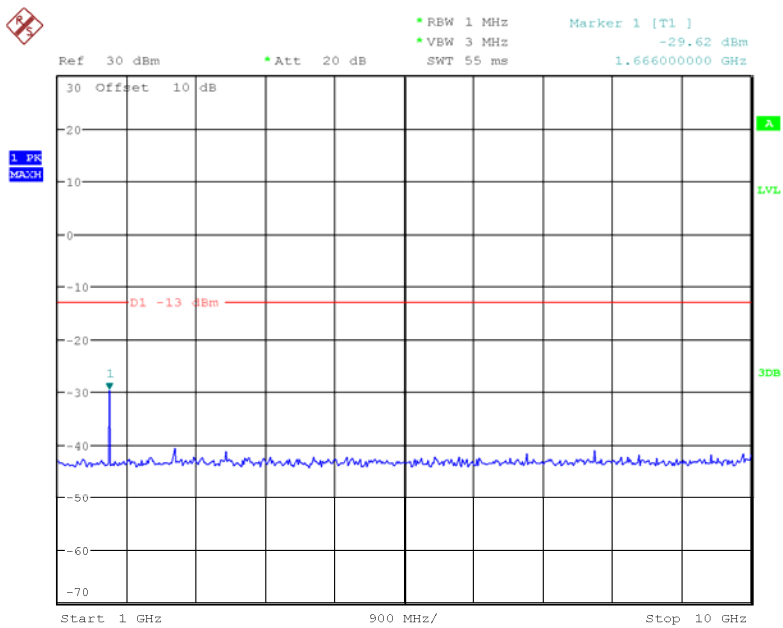
Page 28 of 50



REL99 Band V_ Middle Channel



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Date: 21.AUG.2017 15:48:30

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 Log₁₀ (power out in Watts)

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2016-09-01	2017-08-31
Sunol Sciences	Antenna	JB3	A060611-1	2014-11-06	2017-11-05
HP	Amplifier	8447E	2434A02181	2016-09-01	2017-09-01
R&S	Spectrum Analyzer	FSU 26	200256	2016-12-08	2017-12-08
ETS LINDGREN	Horn Antenna	3115	000 527 35	2016-01-05	2019-01-04
Mini-Circuit	Amplifier	ZVA-213-S+	SN054201245	2017-02-19	2018-02-19
HP	Signal Generator	1026	320408	2016-12-08	2017-12-08
EMCO	Adjustable Dipole Antenna	3121C	9109-753	N/A	N/A
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-02 1304	2017-06-16	2020-06-15
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-01 1304	2016-11-18	2019-11-18
TDK RF	Horn Antenna	HRN-0118	130 084	2016-01-05	2019-01-04
Unknown	Coaxial Cable	Chamber A-1	4m	2016-09-01	2017-09-01
Unknown	Coaxial Cable	Chamber B-1	0.75m	2016-09-01	2017-09-01
Unknown	Coaxial Cable	Chamber A-2	10m	2016-09-01	2017-09-01
Unknown	Coaxial Cable	Chamber B-2	8m	2016-09-01	2017-09-01

* **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:	28.4 °C
Relative Humidity:	45 %
ATM Pressure:	100.2 kPa

The testing was performed by Steven Zuo on 2017-08-22.

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								
1673.200	H	68.15	-46.1	10.6	0.7	-36.2	-13.0	23.2
1673.200	V	64.52	-50.3	10.6	0.7	-40.4	-13.0	27.4
2509.800	H	51.64	-61.4	13.1	1.2	-49.5	-13.0	36.5
2509.800	V	53.27	-59.8	13.1	1.2	-47.9	-13.0	34.9
3346.400	H	47.76	-62.9	13.8	1.6	-50.7	-13.0	37.7
3346.400	V	50.12	-60.6	13.8	1.6	-48.4	-13.0	35.4
2150.000	H	48.24	-64.4	11.1	1.1	-54.4	-13.0	41.4
2150.000	V	49.09	-63.5	11.1	1.1	-53.5	-13.0	40.5
452.000	H	44.27	-55.5	0.0	0.7	-56.2	-13.0	43.2
284.000	V	42.58	-64	0.0	0.5	-64.5	-13.0	51.5
WCDMA Band V R99,Frequency:836.600 MHz								
1673.200	H	52.43	-61.8	10.6	0.7	-51.9	-13.0	38.9
1673.200	V	52.19	-62.6	10.6	0.7	-52.7	-13.0	39.7
2509.800	H	50.17	-62.8	13.1	1.2	-50.9	-13.0	37.9
2509.800	V	49.68	-63.4	13.1	1.2	-51.5	-13.0	38.5
3346.400	H	46.22	-64.4	13.8	1.6	-52.2	-13.0	39.2
3346.400	V	46.06	-64.6	13.8	1.6	-52.4	-13.0	39.4
1955.000	H	45.62	-67.6	11.9	1.1	-56.8	-13.0	43.8
1955.000	V	45.71	-67.9	11.9	1.1	-57.1	-13.0	44.1
315.000	H	48.52	-55.3	0.0	0.5	-55.8	-13.0	42.8
412.000	V	44.17	-59.3	0.0	0.6	-59.9	-13.0	46.9

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)			
GPRS1900, Frequency:1880.000 MHz								
3760.000	H	74.31	-34.5	13.8	1.6	-22.3	-13.0	9.3
3760.000	V	77.49	-31.2	13.8	1.6	-19.0	-13.0	6.0
5640.000	H	58.64	-47.4	14.0	1.3	-34.7	-13.0	21.7
5640.000	V	61.52	-44.4	14.0	1.3	-31.7	-13.0	18.7
2235.000	H	45.52	-66.8	10.9	1.2	-57.1	-13.0	44.1
2235.000	V	46.34	-65.9	10.9	1.2	-56.2	-13.0	43.2
542.000	H	48.11	-50.4	0.0	0.7	-51.1	-13.0	38.1
297.000	V	46.21	-59.8	0.0	0.5	-60.3	-13.0	47.3
WCDMA Band II, R99, Frequency:1880.000 MHz								
3760.000	H	59.84	-49	13.8	1.6	-36.8	-13.0	23.8
3760.000	V	60.46	-48.2	13.8	1.6	-36.0	-13.0	23.0
5640.000	H	53.79	-52.2	14.0	1.3	-39.5	-13.0	26.5
5640.000	V	55.48	-50.4	14.0	1.3	-37.7	-13.0	24.7
2115.000	H	46.32	-66.5	11.3	1.1	-56.3	-13.0	43.3
2115.000	V	46.81	-66	11.3	1.1	-55.8	-13.0	42.8
876.000	H	58.50	-34.7	0.0	1	-35.7	-13.0	22.7
874.000	V	52.24	-43.4	0.0	1	-44.4	-13.0	31.4

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

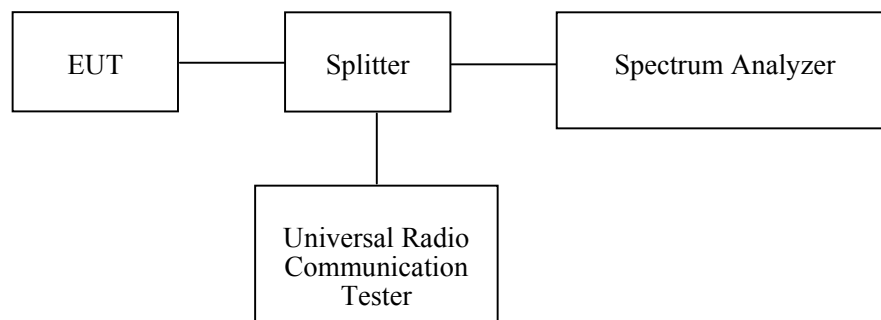
According to § 22.917(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

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	2016-12-08	2017-12-08
R&S	Universal Radio Communication Tester	CMU200	109 038	2017-07-18	2018-07-18
Unknown	Coaxial Cable	0.1m	C-1	Each Time	/
Pasternack	RF Coaxial Cable	0.5m	C-2	Each Time	/
Unknown	RF Attenuator	6dB	6dB-1	Each Time	/
E-Microwave	Two-way Splitter	ODP-1-6-2S	OE0120142	Each Time	/

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

Test Data**Environmental Conditions**

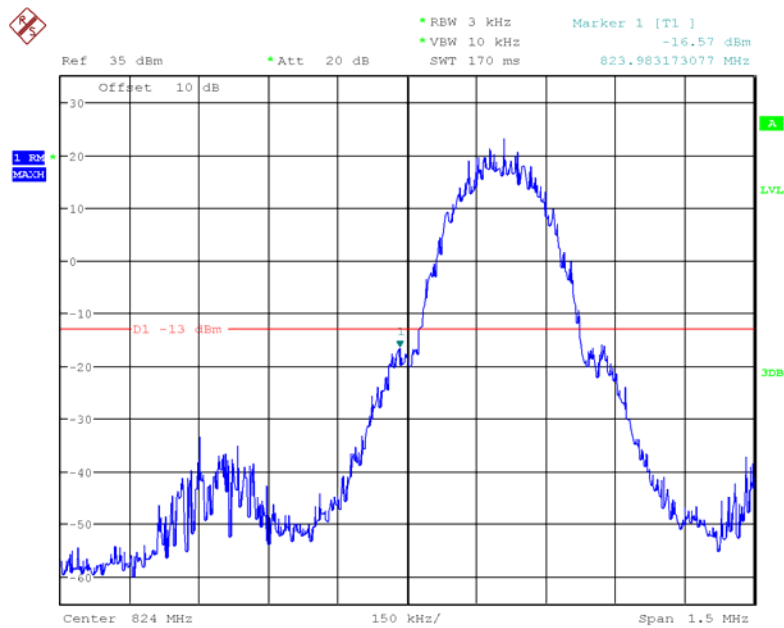
Temperature:	24.6~27.6 °C
Relative Humidity:	47-58 %
ATM Pressure:	98.9~100.3 kPa

The testing was performed by Gavin Xu from 2017-08-21 to 2017-08-28.

Test Mode: Transmitting

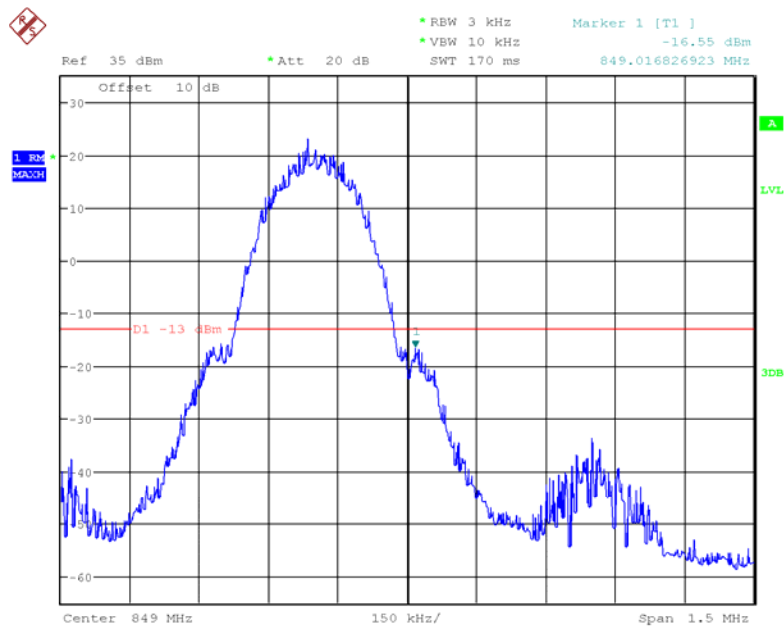
Test Result: Compliant. Please refer to the following plots.

GPRS 850, Left Band Edge



Date: 28.AUG.2017 16:48:14

GPRS 850, Right Band Edge



Date: 28.AUG.2017 16:47:25

MARKER 1
1.849990385 GHz

Ref 35 dBm Att 20 dB

* RBW 3 kHz
* VBW 10 kHz
SWT 170 ms

Marker 1 [T1]
-15.93 dBm
1.849990385 GHz

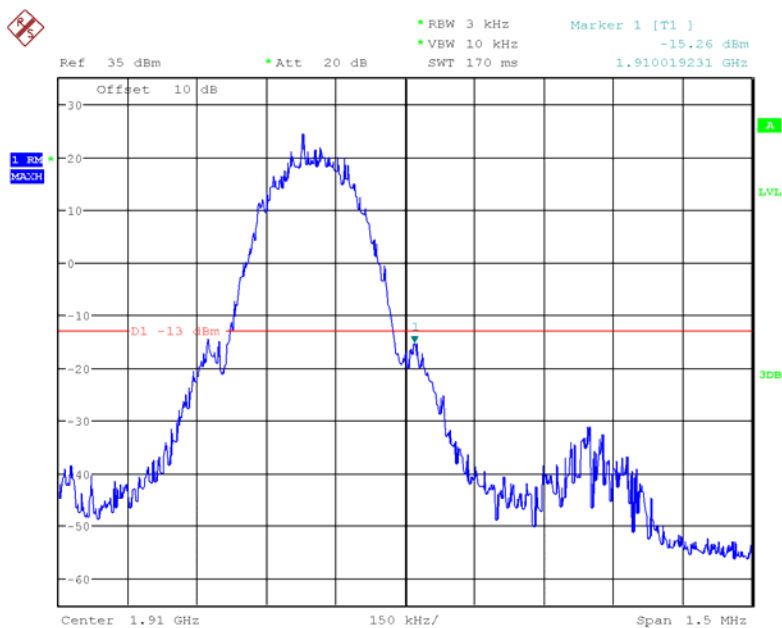
Offset 10 dB

1.849990385 GHz

D1 -13 dBm

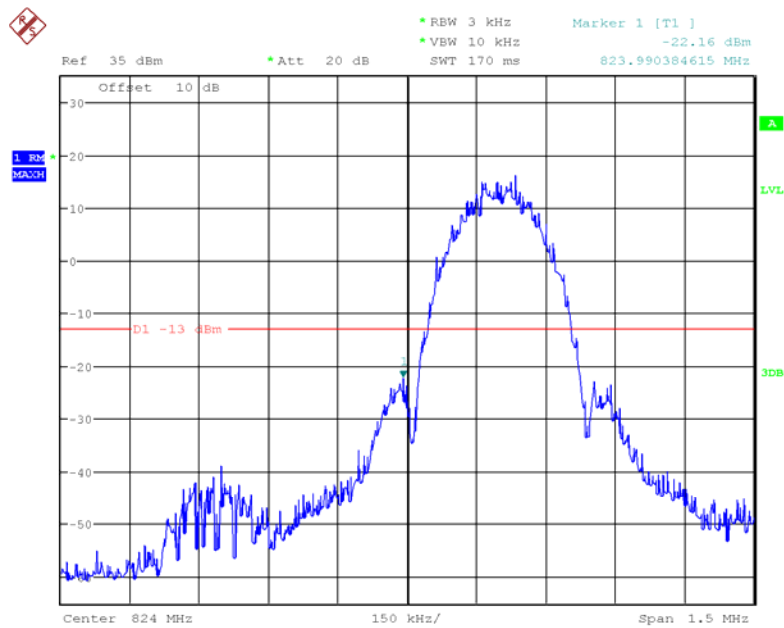
Center 1.85 GHz 150 kHz/ Span 1.5 MHz

GPRS 1900, Right Band Edge



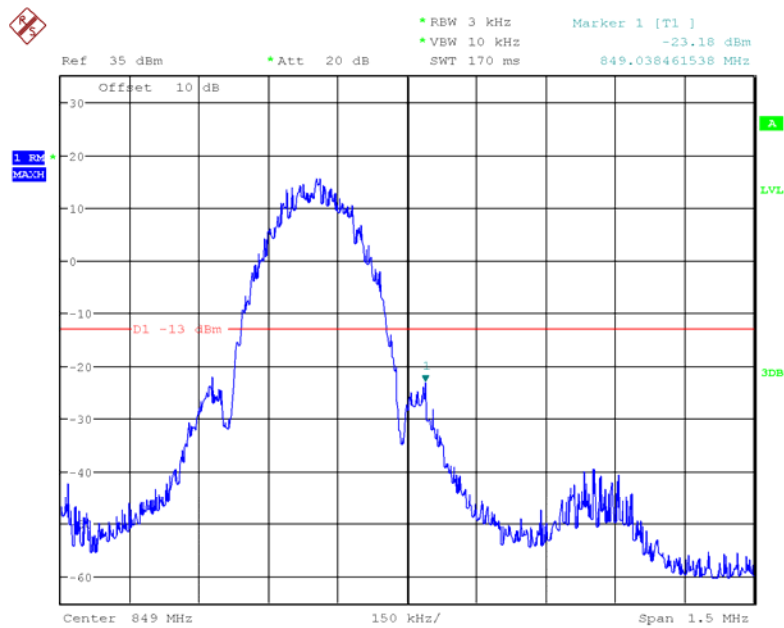
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EDGE 850, Left Band Edge



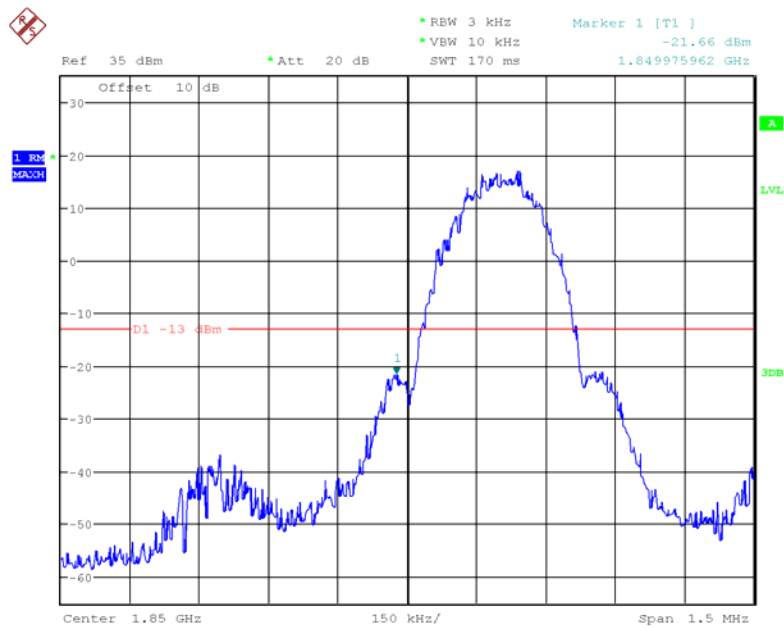
Date: 28.AUG.2017 16:52:11

EDGE 850, Right Band Edge



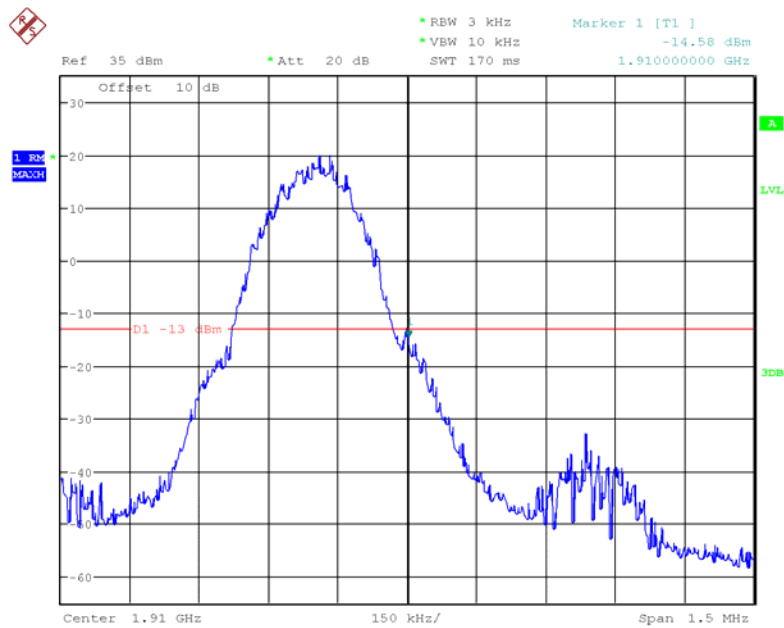
Date: 28.AUG.2017 16:53:03

EDGE 1900, Left Band Edge



Date: 28.AUG.2017 17:25:02

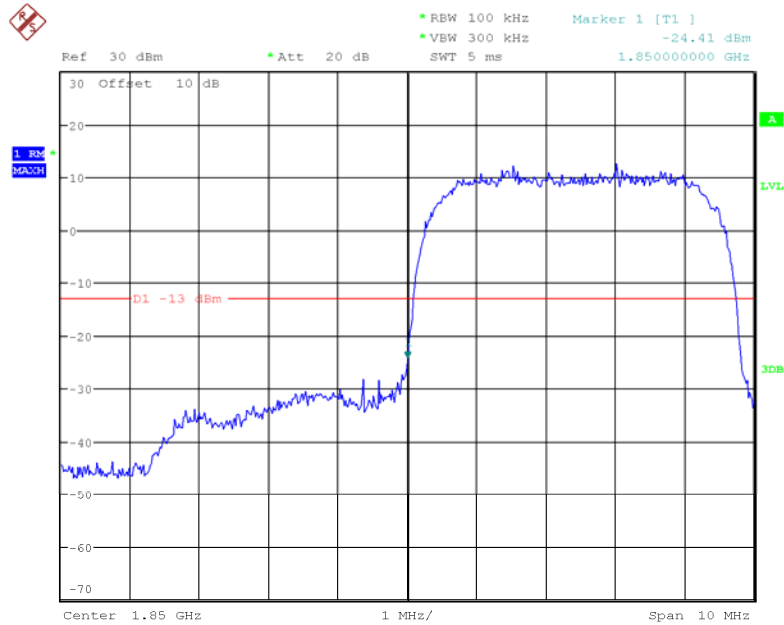
EDGE 1900, Right Band Edge



Date: 28.AUG.2017 17:25:52

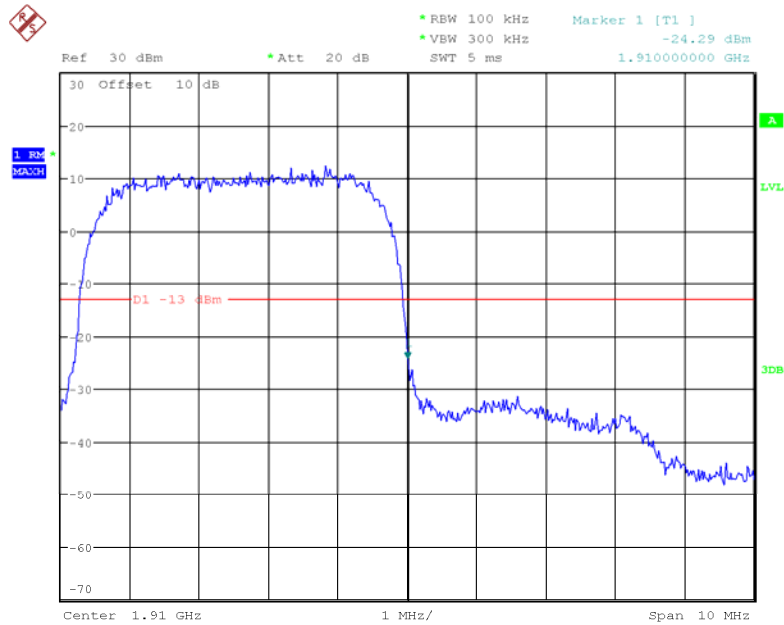
WCDMA Band II:

REL99 Band II, Left Band Edge



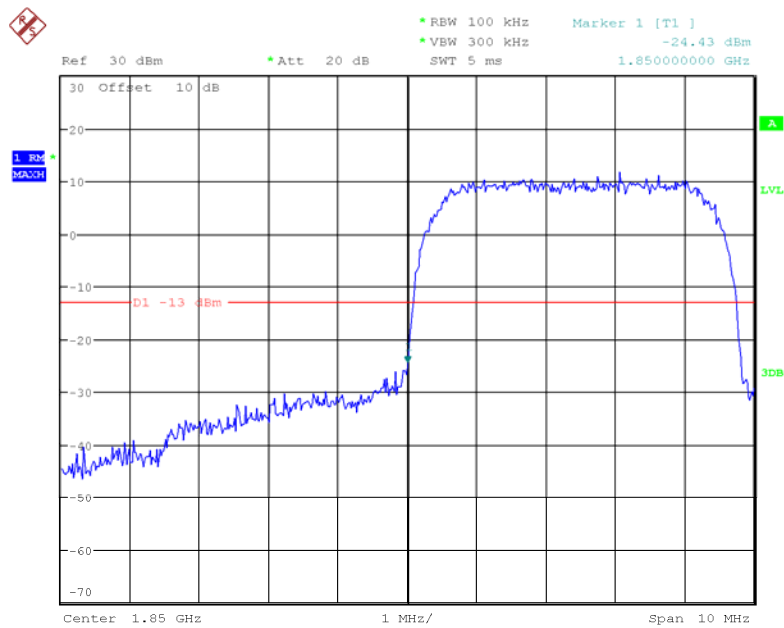
Date: 21.AUG.2017 15:59:07

REL99 Band II, Right Band Edge



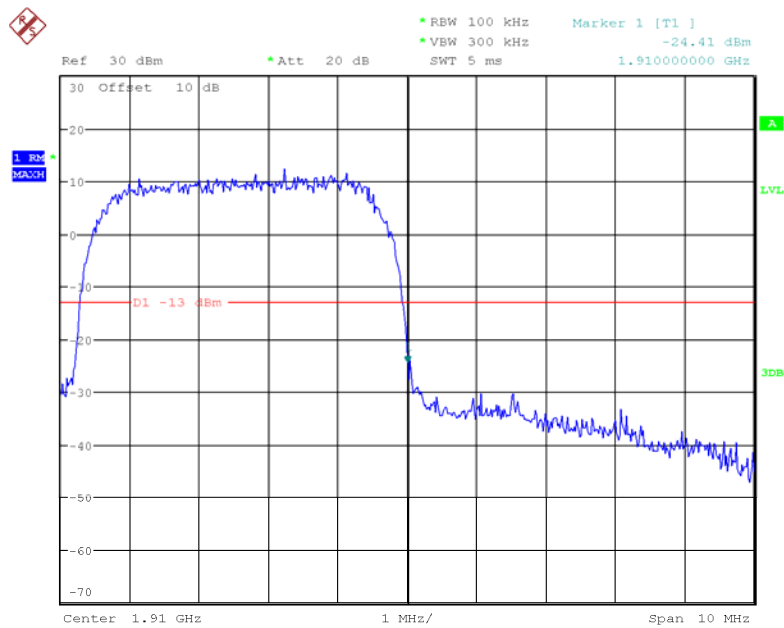
Date: 21.AUG.2017 15:58:34

HSDPA Band II, Left Band Edge



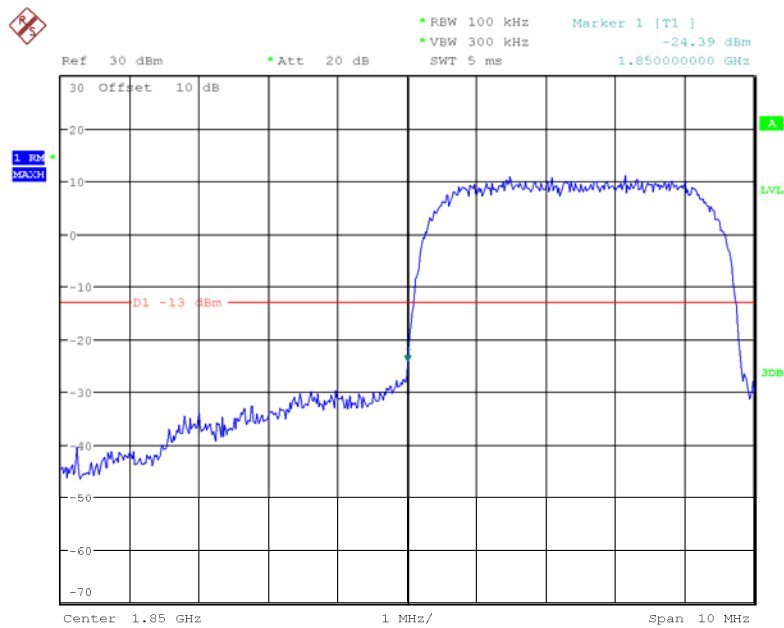
Date: 21.AUG.2017 15:59:51

HSDPA Band II, Right Band Edge



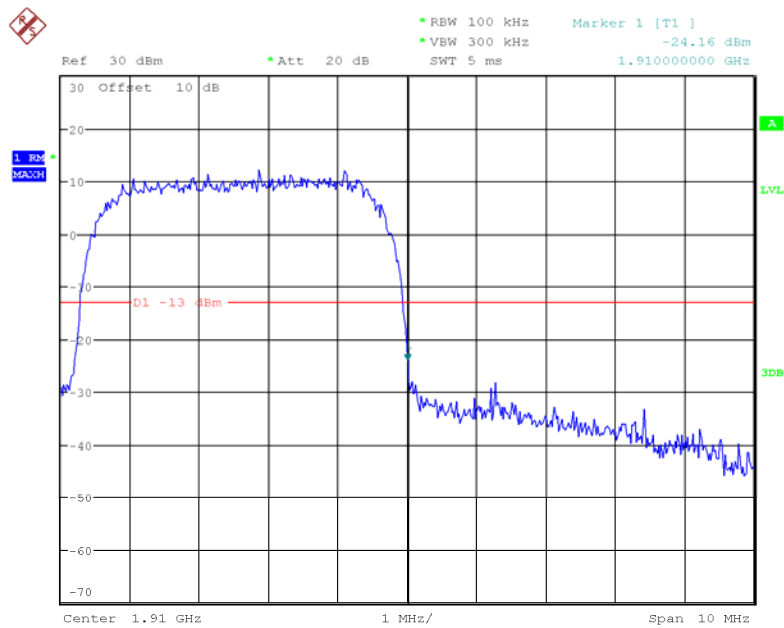
Date: 21.AUG.2017 16:00:29

HSUPA Band II, Left Band Edge



Date: 21.AUG.2017 16:00:06

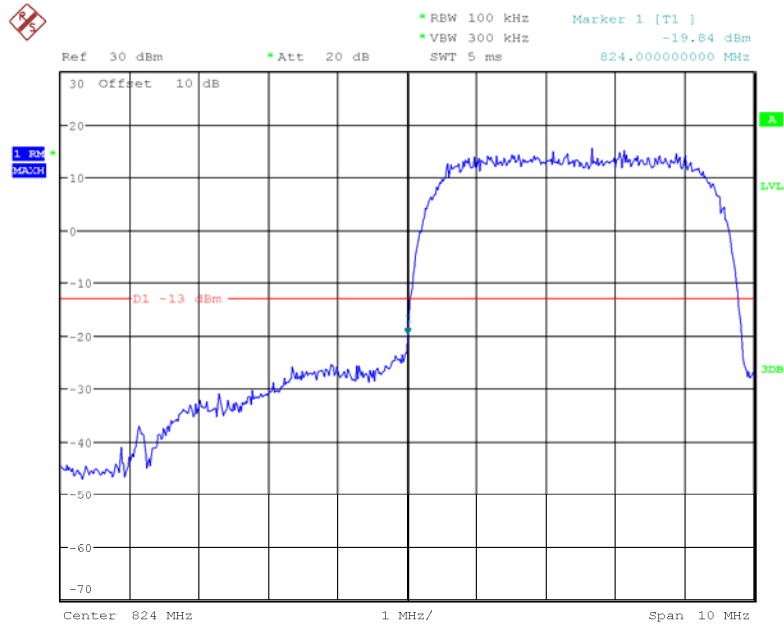
HSUPA Band II, Right Band Edge



Date: 21.AUG.2017 16:00:40

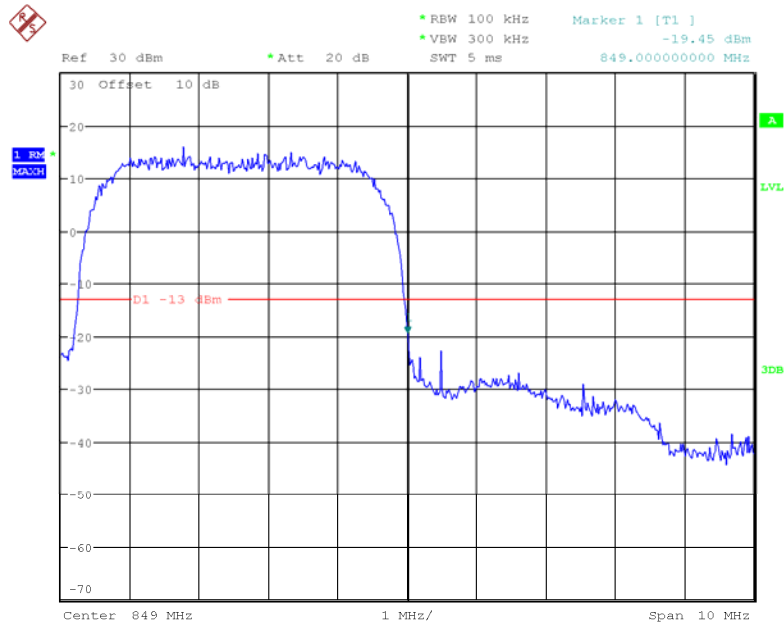
WCDMA Band V

REL99 Band V, Left Band Edge



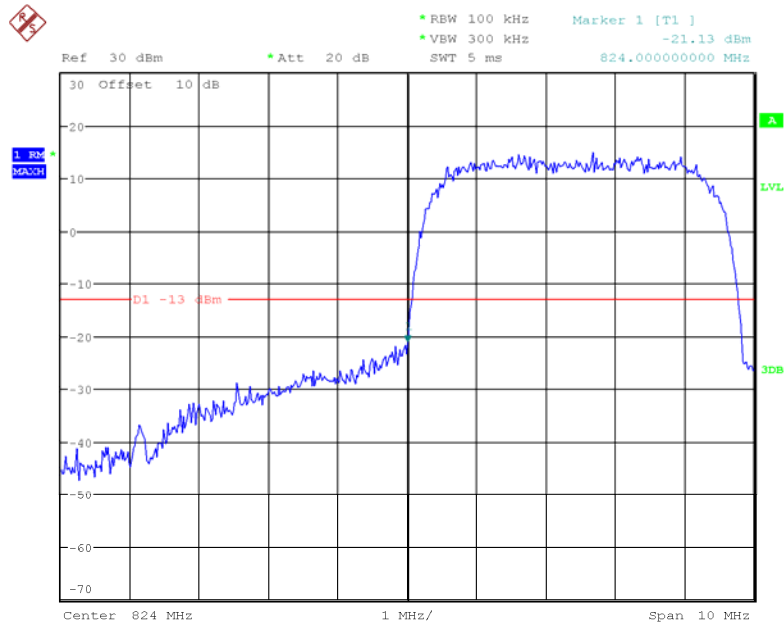
Date: 21.AUG.2017 15:55:21

REL99 Band V Right Band Edge



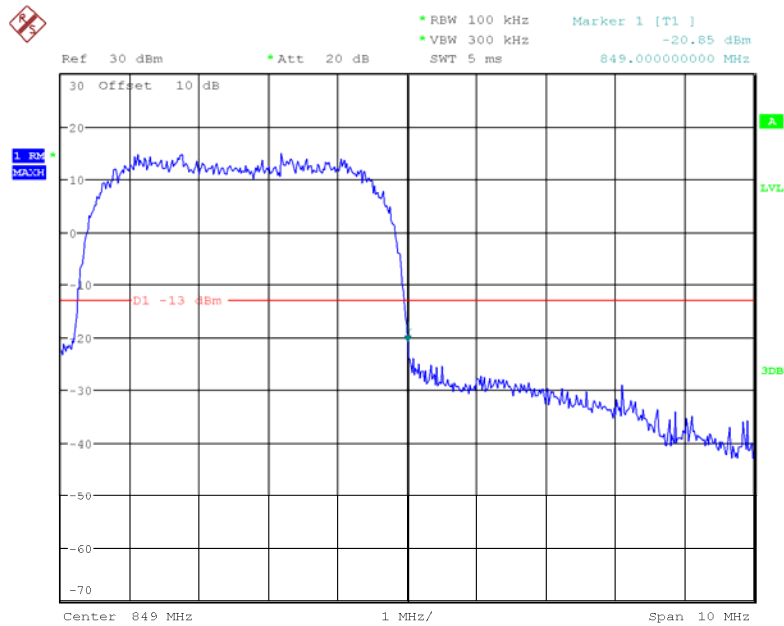
Date: 21.AUG.2017 15:54:50

HSDPA Band V, Left Band Edge



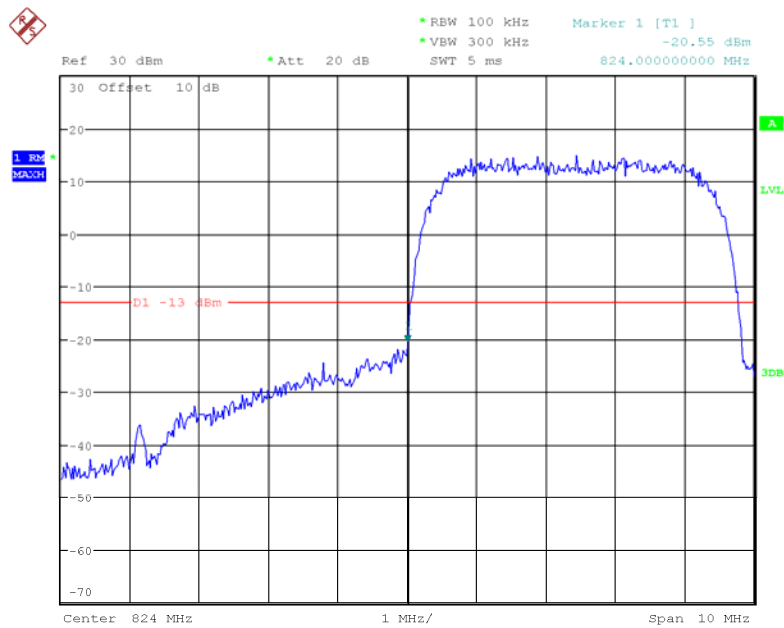
Date: 21.AUG.2017 15:53:27

HSDPA Band V, Right Band Edge



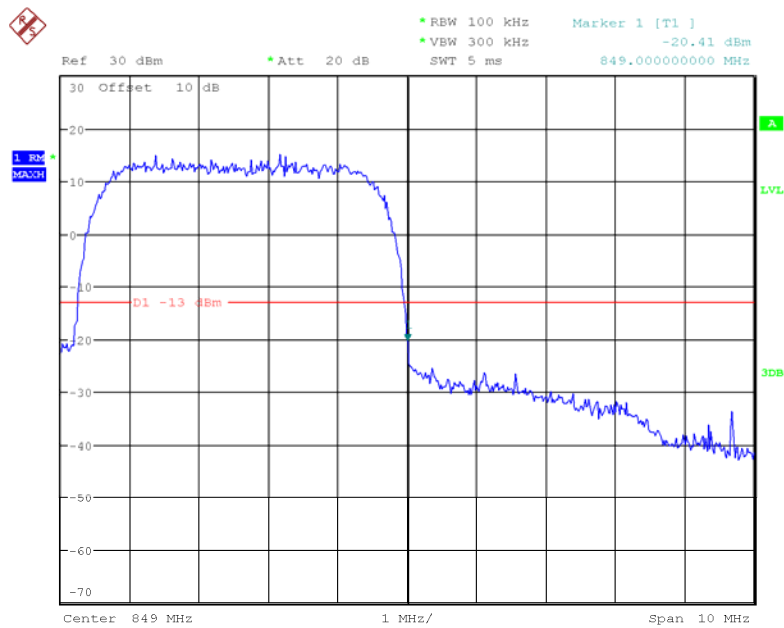
Date: 21.AUG.2017 15:54:21

HSUPA Band V, Left Band Edge



Date: 21.AUG.2017 15:53:12

HSUPA Band V, Right Band Edge



Date: 21.AUG.2017 15:54:03

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

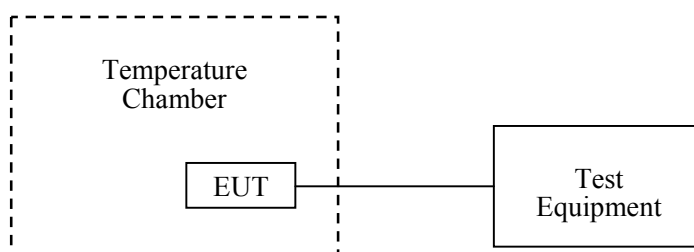
According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

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	2016-09-10	2017-09-09
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	/
Unknown	RF Attenuator	6dB	6dB-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:	27.6 °C
Relative Humidity:	47 %
ATM Pressure:	100.2 kPa

The testing was performed by Gavin Xu on 2017-08-22.

Cellular Band (Part 22H)

GMSK, Middle Channel, $f_c = 836.6$ MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Limit
°C	V _{DC}	Hz	ppm	ppm
-30	12	19	0.023	2.5
-20		22	0.026	
-10		25	0.030	
0		21	0.025	
10		26	0.031	
20		23	0.027	
30		27	0.032	
40		24	0.029	
50		18	0.022	
25	24	32	0.038	
25	9	28	0.033	

EDGE, Middle Channel, $f_c = 836.6$ MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Limit
°C	V _{DC}	Hz	ppm	ppm
-30	12	31	0.037	2.5
-20		26	0.031	
-10		25	0.030	
0		32	0.038	
10		18	0.022	
20		22	0.026	
30		27	0.032	
40		26	0.031	
50		15	0.018	
25	24	19	0.023	
25	9	22	0.026	

PCS Band (Part 24E)

GMSK, Middle Channel, $f_c = 1880.0$ MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Result
°C	V _{DC}	Hz	ppm	
-30	12	-1	-0.001	Compliance
-20		1	0.001	
-10		2	0.001	
0		0	0.000	
10		10	0.005	
20		12	0.006	
30		11	0.006	
40		-2	-0.001	
50		6	0.003	
25	24	6	0.003	
25	9	7	0.004	

EDGE, Middle Channel, $f_c = 1880.0$ MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Result
°C	V _{DC}	Hz	ppm	
-30	12	25	0.013	Compliance
-20		22	0.012	
-10		27	0.014	
0		32	0.017	
10		28	0.015	
20		35	0.019	
30		38	0.020	
40		26	0.014	
50		25	0.013	
25	24	30	0.016	
25	9	32	0.017	

WCDMA Band V: R99

Middle Channel, $f_c = 836.6$ MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Limit
°C	V _{DC}	Hz	ppm	ppm
-30	12	-3	-0.004	2.5
-20		-4	-0.005	2.5
-10		-9	-0.011	2.5
0		-7	-0.008	2.5
10		-6	-0.007	2.5
20		0	0.000	2.5
30		-5	-0.006	2.5
40		2	0.002	2.5
50		1	0.001	2.5
25	24	-2	-0.002	2.5
25	9	0	0.000	2.5

WCDMA Band II: R99

Middle Channel, $f_c = 1880.0$ MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Result
°C	V _{DC}	Hz	ppm	
-30	12	-6	-0.003	Compliance
-20		-7	-0.004	
-10		-6	-0.003	
0		0	0.000	
10		-9	-0.005	
20		-4	-0.002	
30		-3	-0.002	
40		-6	-0.003	
50		-5	-0.003	
25	24	-4	-0.002	
25	9	-1	-0.001	

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