



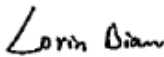
FCC PART 22H, PART 24E MEASUREMENT AND TEST REPORT

For

Quanzhou Tesunho Electronics Co., Ltd

2#, 5F E-19# Phase 2 Xunmei, Quanzhou, Fujian, China

FCC ID: 2AKS9TM980

Report Type: Original Report	Product Name: Mobile Network Radio
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Report Number: <u>RXM161223050A</u>	
Report Date: <u>2017-01-09</u>	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The **Quanzhou Tesunho Electronics Co., Ltd** 's product, model number: **TM-980 (FCC ID: 2AKS9TM980)** (the "EUT") in this report was a **Mobile Network Radio**, which was measured approximately: 118 mm (L) × 92 mm (W) × 38 mm (H), rated input voltage: DC9~24V.

**All measurement and test data in this report was gathered from final production sample, serial number: 161223050 (assigned by the BACL, Chengdu). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2016-12-26, and EUT conformed to test requirement.*

Objective

This report is prepared on behalf of **Quanzhou Tesunho Electronics Co., 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)

No related submittal.

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 emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Chengdu).

Test Facility

The test site used by BACL to collect test data is located in the 5040, HuiLongWan Plaza, No. 1, ShaWan Road, JinNiu District, ChengDu, China

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on April 24, 2015. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 560332. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

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.

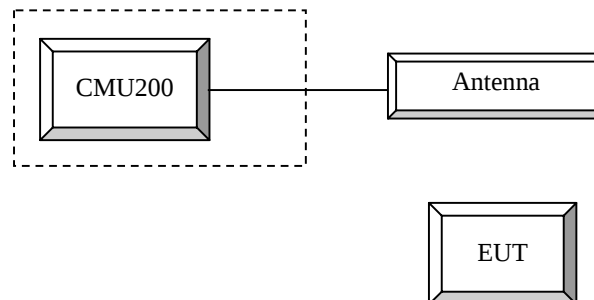
Equipment Modifications

No modification was made to the EUT.

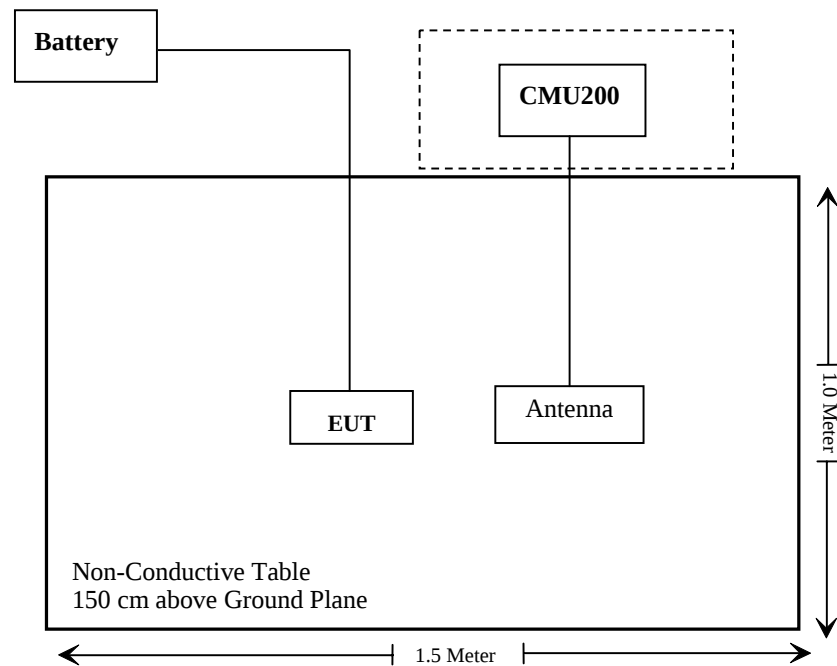
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
R&S	Universal Radio Communication Tester	CMU200	11-9435686-111

Configuration of Test Setup



Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

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

Applicable Standard

According to 1.1307 (b)(1), 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication 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;

MPE Calculation

Predication of MPE limit at a given distance

$$S = PG/4\pi R^2$$

Where: S = 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

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

Calculated Data:

Modes	Frequency (MHz)	Antenna Gain		Tune-up Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
		(dBi)	(numeric)	(dBm)	(mW)			
GSM850	824-849	1.5	1.41	32.5	1778.28	20.00	0.50	0.55
PCS1900	1850-1910	1.5	1.41	30.5	1122.02	20.00	0.32	1.0
WCDMA Band V	824-849	1.5	1.41	23.5	223.87	20.00	0.06	0.55
WCDMA Band II	1850-1910	1.5	1.41	22.5	177.83	20.00	0.05	1.0

Result: The device meet FCC MPE at 20 cm distance

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 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
	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				
	$A_{hs}=\beta_{hs}/\beta_c$	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_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		

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 (Note 3)	β_d	β_{HS} (Note 1)	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	β_{ed1} : 30/15 β_{ed2} : 30/15	β_{ed3} : 24/15 β_{ed4} : 24/15	3.5	2.5	14	105	105
Note 1: Δ_{ACK}, Δ_{NACK} and $\Delta_{CQI} = 30/15$ with $\beta_{hs} = 30/15 * \beta_c$. 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 $\beta_d = 0$ 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
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2016-12-02	2017-12-01
Sunol Sciences	Broadband Antenna	JB3	A101808	2016-04-10	2019-04-09
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2016-12-02	2017-12-01
ETS	Horn Antenna	3115	003-6076	2016-12-02	2017-12-01
ETS	Horn Antenna	3115	6751	2014-06-16	2017-06-15
EMCO	Adjustable Dipole Antenna	3121C	9109-258	N/A	N/A
HP	Signal Generator	8648C	3623A04150	2016-5-23	2017-5-22
WILTRON	SWEPT FREQUENCY SYNTHESIZER	6737	213001	2016-5-23	2017-5-22
EMCT	Semi-Anechoic Chamber	966	N/A	2015-04-24	2018-04-23
N/A	RF Cable (below 1GHz)	NO.1	N/A	2016-11-10	2017-11-09
N/A	RF Cable (below 1GHz)	NO.4	N/A	2016-11-10	2017-11-09
N/A	RF Cable (above 1GHz)	NO.2	N/A	2016-11-10	2017-11-09
R&S	Universal Radio Communication Tester	CMU200	11-9435686-111	2016-07-28	2017-07-27

*** Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	26.1 °C
Relative Humidity:	50%
ATM Pressure:	101.1 kPa

The testing was performed by Lorin Bian on 2017-01-05.

Conducted Output Power

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

Band	Channel No.	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	32.25	32.20	26.27	26.25	26.19	25.69
	190	32.22	32.16	26.26	26.21	26.17	25.64
	251	32.20	32.17	26.22	26.23	26.13	25.61
PCS	512	30.48	30.40	26.67	26.56	26.39	25.85
	661	29.40	29.33	25.62	25.54	25.40	24.84
	810	28.53	28.45	24.75	24.70	24.57	24.03

WCDMA Band II

Mode	3GPP Sub Test	Average Output Power (dBm)					
		Low Channel (Ave. Power)	Low Channel (PAR)	Middle Channel (Ave. Power)	Middle Channel (PAR)	High Channel (Ave. Power)	High Channel (PAR)
Rel 99	1	22	2.96	21.19	3.28	20.93	3.12
HSDPA (QPSK)	1	21.46	2.90	20.63	3.13	20.41	3.09
	2	21.41	3.11	20.59	3.33	20.38	3.18
	3	21.49	2.93	20.57	3.25	20.35	3.13
	4	21.44	3.05	20.61	3.27	20.44	3.03
HSUPA (QPSK)	1	21.43	2.87	20.6	3.14	20.42	3.16
	2	21.50	2.95	20.58	3.37	20.4	2.97
	3	21.40	3.06	20.68	3.30	20.40	3.19
	4	21.42	2.99	20.67	3.36	20.36	3.05
	5	21.51	3.00	20.59	3.39	20.35	3.11
DC-HSDPA (QPSK)	1	21.41	2.88	20.58	3.33	20.41	3.23
	2	21.40	2.93	20.57	3.32	20.46	3.11
	3	21.48	2.88	20.67	3.35	20.42	3.26
	4	21.45	3.10	20.62	3.39	20.45	3.18
HSPA+ (16QAM)	1	21.51	2.89	20.64	3.24	20.45	3.16

WCDMA Band V

Mode	3GPP Sub Test	Average Output Power (dBm)					
		Low Channel (Ave. Power)	Low Channel (PAR)	Middle Channel (Ave. Power)	Middle Channel (PAR)	High Channel (Ave. Power)	High Channel (PAR)
Rel 99 (QPSK)	1	22.98	3.20	22.97	3.16	23.01	3.24
HSDPA (QPSK)	1	22.42	3.29	22.43	3.17	22.49	3.36
	2	22.37	3.14	22.41	3.26	22.50	3.19
	3	22.46	3.30	22.39	3.00	22.43	3.26
	4	22.43	3.09	22.41	3.03	22.52	3.30
HSUPA (QPSK)	1	22.39	3.06	22.39	3.08	22.46	3.27
	2	22.44	3.32	22.45	3.10	22.54	3.12
	3	22.41	3.23	22.48	3.25	22.52	3.24
	4	22.40	3.29	22.43	3.15	22.49	3.15
DC-HSDPA (QPSK)	1	22.45	3.15	22.44	3.04	22.45	3.39
	2	22.46	3.05	22.38	3.18	22.52	3.35
	3	22.45	3.12	22.42	3.22	22.43	3.25
	4	22.44	3.18	22.46	3.02	22.47	3.33
	5	22.42	3.06	22.41	3.25	22.43	3.32
HSPA+ (16QAM)	1	22.47	3.30	22.40	3.23	22.43	3.18

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

ERP & EIRP

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			S.G. Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
GSM 850 Middle Channel								
836.600	H	107.05	30	0.0	0.6	29.4	38.5	9.1
836.600	V	105.12	30.1	0.0	0.6	29.5	38.5	9.0
EDGE 850 Middle Channel								
836.600	H	103.26	26.2	0.0	0.6	25.6	38.5	12.9
836.600	V	101.31	26.3	0.0	0.6	25.7	38.5	12.8
WCDMA Band V Middle Channel								
836.600	H	96.84	19.7	0.0	0.6	19.1	38.5	19.4
836.600	V	95.92	20.9	0.0	0.6	20.3	38.5	18.2
PCS 1900 Middle Channel								
1880.000	H	96.23	22.6	8.0	0.9	29.7	33.0	3.3
1880.000	V	90.71	18.3	8.0	0.9	25.4	33.0	7.6
EDGE 1900 Middle Channel								
1880.000	H	92.62	19	8.0	0.9	26.1	33.0	6.9
1880.000	V	87.13	14.7	8.0	0.9	21.8	33.0	11.2
WCDMA Band II Middle Channel								
1880.000	H	91.20	17.6	8.0	0.9	24.7	33.0	8.3
1880.000	V	85.73	13.3	8.0	0.9	20.4	33.0	12.6

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 = SG Level - Cable loss + Antenna Gain
- 3) Margin = Limit-Absolute Level

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

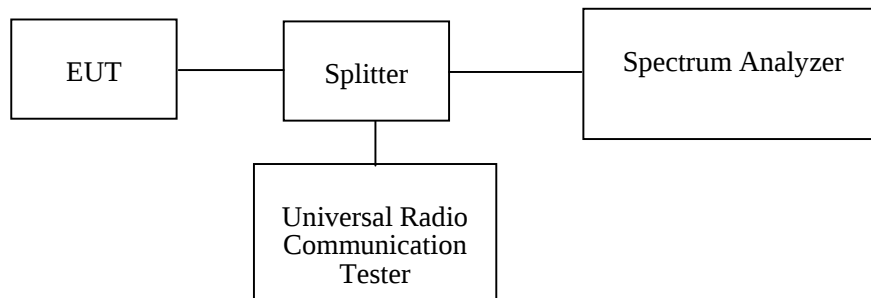
Applicable Standard

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
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
N/A	RF Cable	N/A	N/A	Each Time	/
N/A	Two-way Splitter	N/A	OE0120121	Each Time	/
N/A	10dB Attenuator	N/A	N/A	Each Time	/

* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	25.2 °C
Relative Humidity:	49%
ATM Pressure:	101.1 kPa

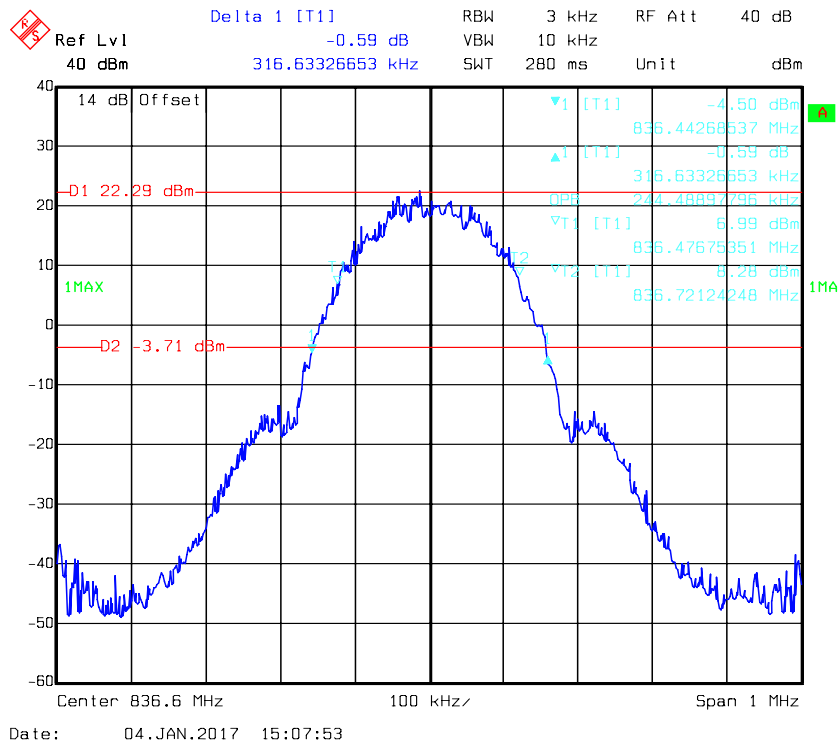
The testing was performed by Lorin Bian on 2017-01-04.

Test Mode: Transmitting

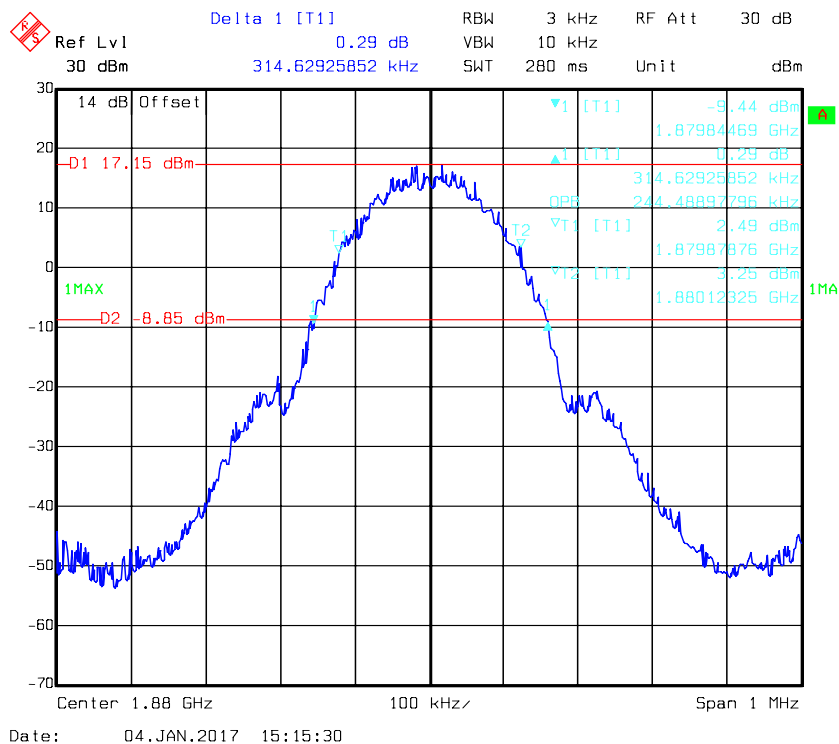
Test Result: Compliant. Please refer to the following table and plots.

Band	Test Channel	Mode	99% Occupied Bandwidth (MHz)	26 dB Occupied Bandwidth (MHz)
Cellular	M	GPRS	0.244	0.317
		EDGE	0.248	0.309
PCS		GPRS	0.244	0.315
		EDGE	0.251	0.315
WCDMA Band II		Rel 99	4.168	4.709
		HSDPA	4.168	4.689
		HSUPA	4.148	4.729
WCDMA Band V		Rel 99	4.168	4.732
		HSDPA	4.188	4.729
		HSUPA	4.188	4.709

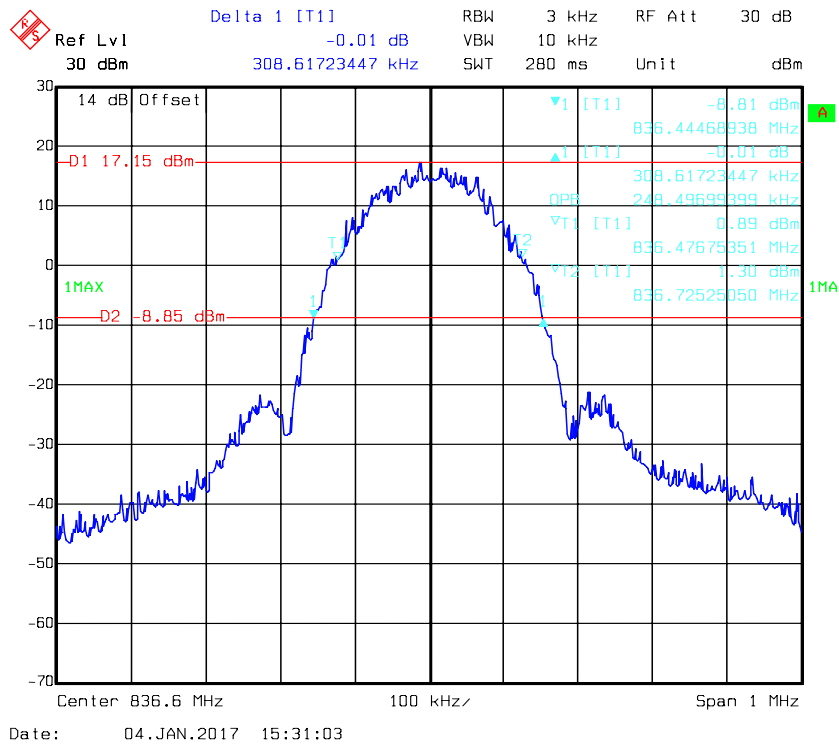
GPRS 850 Cellular Band



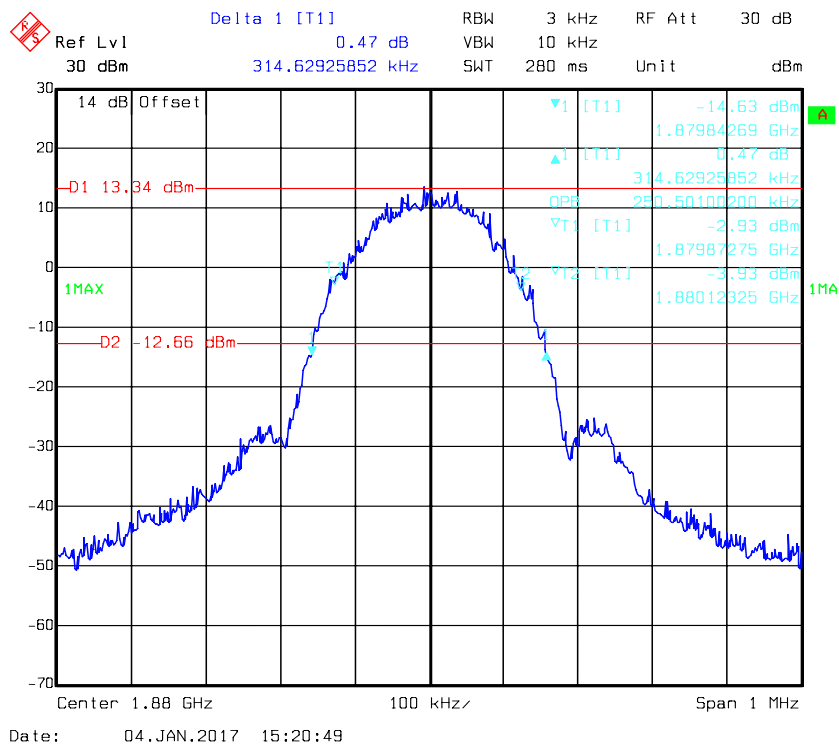
GPRS PCS Band



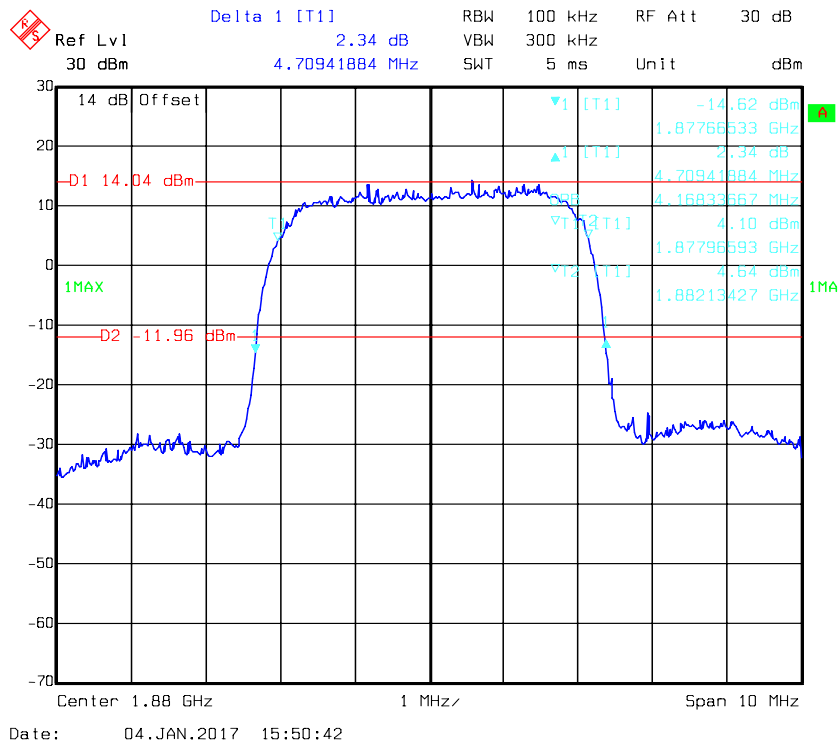
EDGE 850 Cellular Band



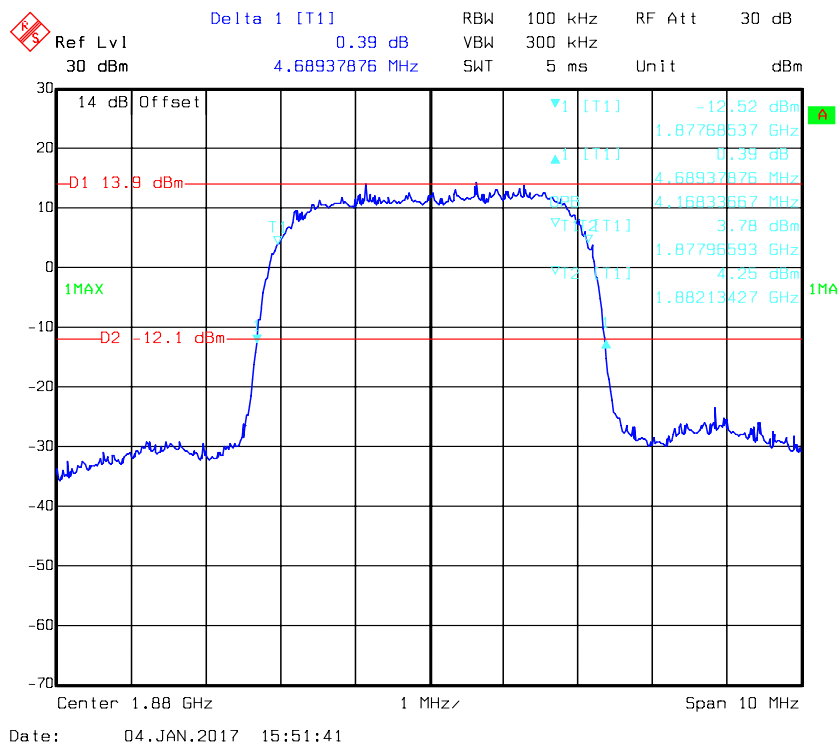
EDGE PCS Band



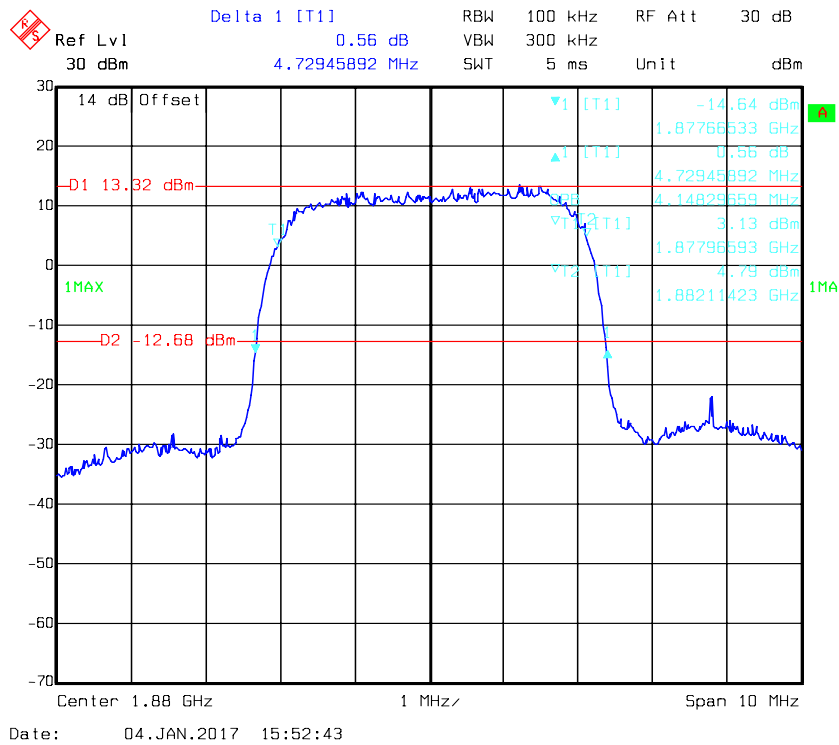
REL99 Band II



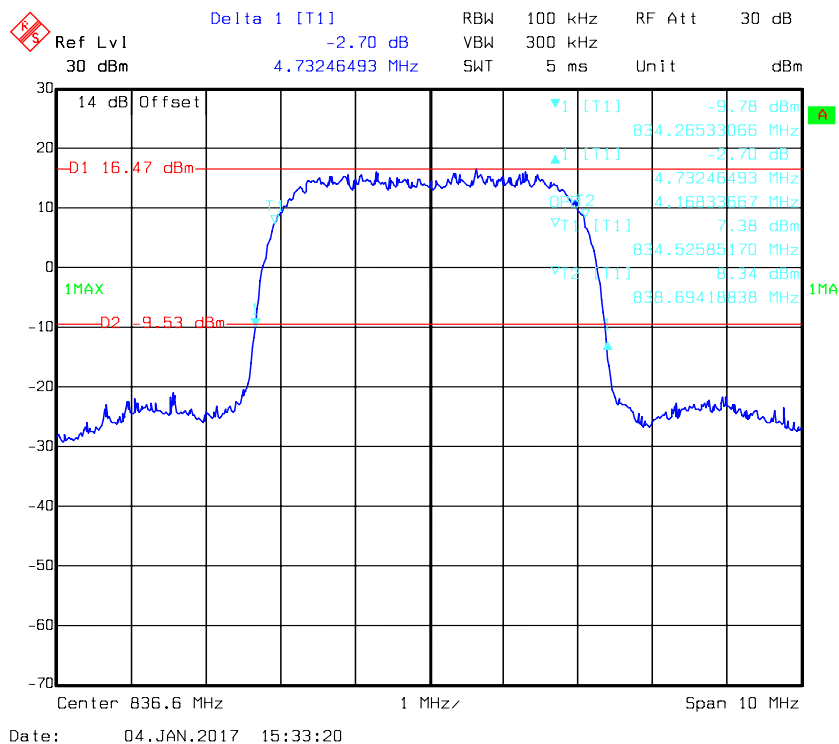
HSDPA Band II



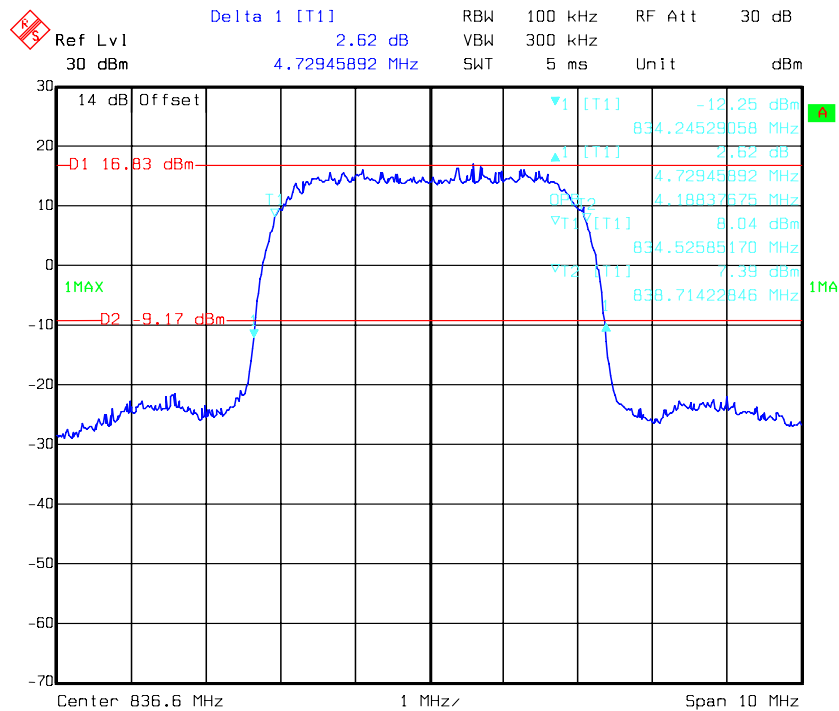
HSUPA Band II



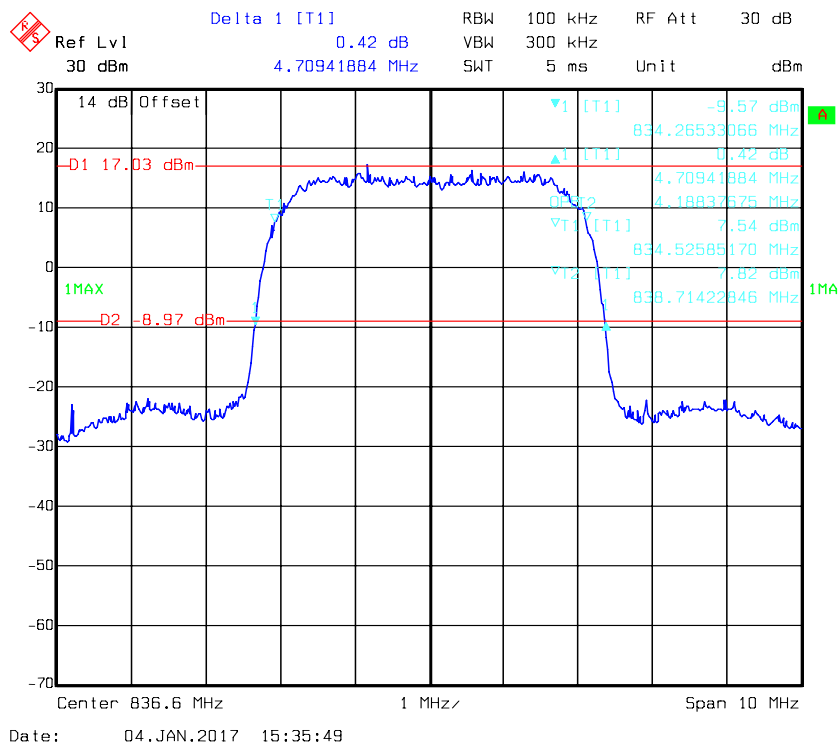
REL99 Band V



HSDPA Band V



HSUPA Band V



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

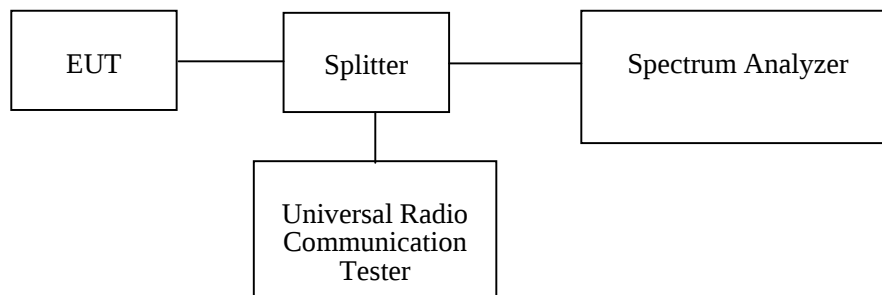
Applicable Standard

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
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
N/A	RF Cable	N/A	N/A	Each Time	/
N/A	Two-way Splitter	N/A	OE0120121	Each Time	/
N/A	10dB Attenuator	N/A	N/A	Each Time	/

* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

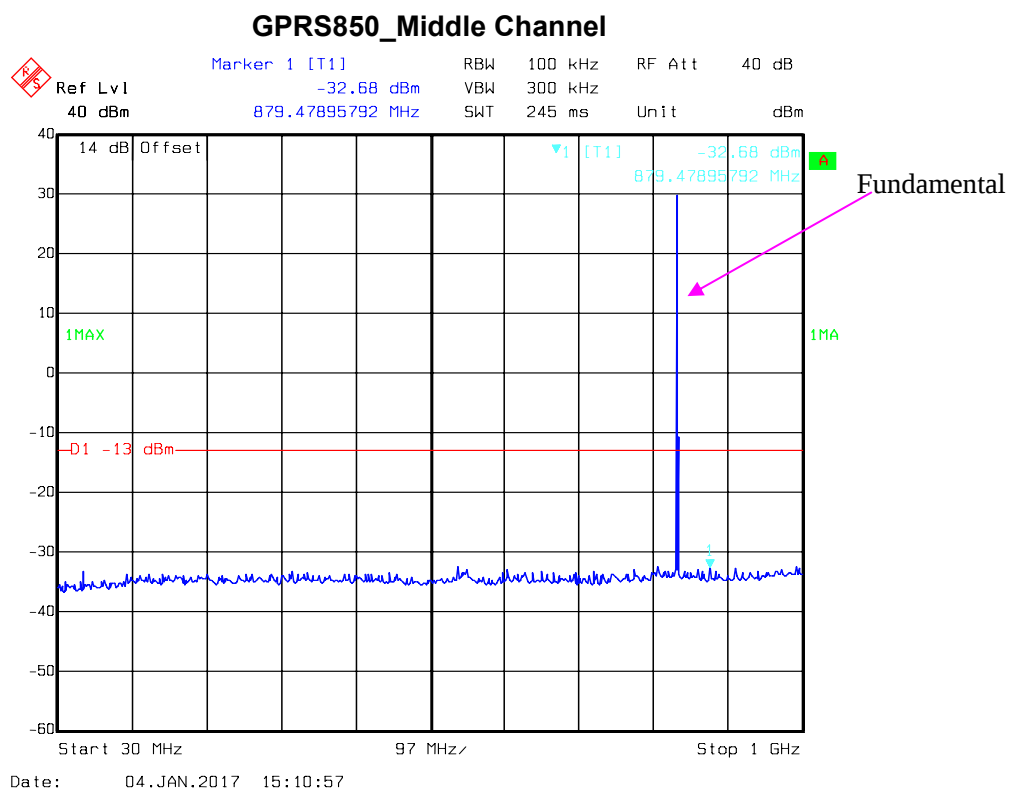
Test Data

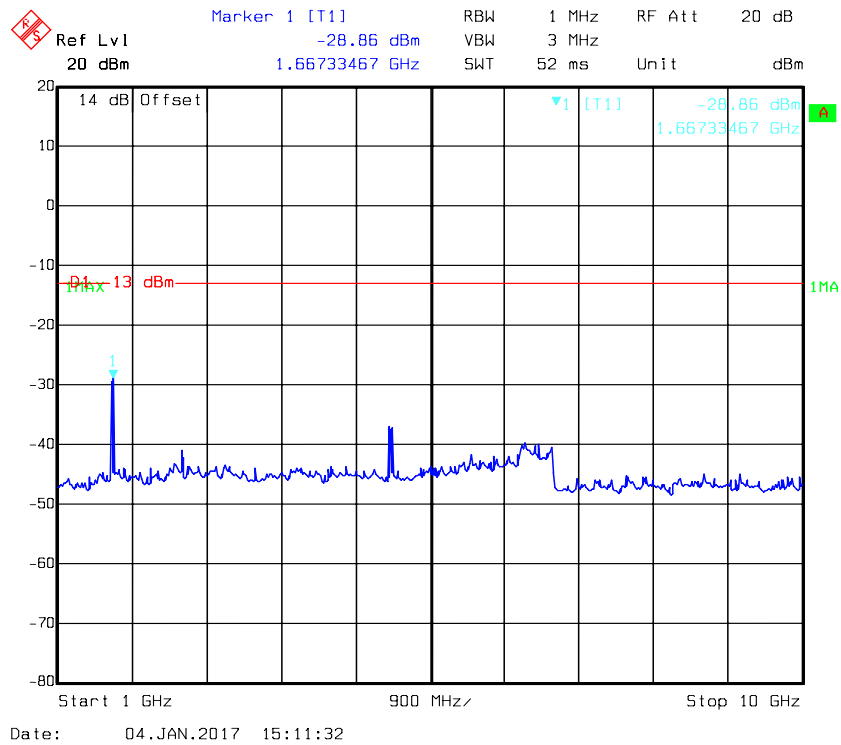
Environmental Conditions

Temperature:	25.2 °C
Relative Humidity:	49%
ATM Pressure:	101.1 kPa

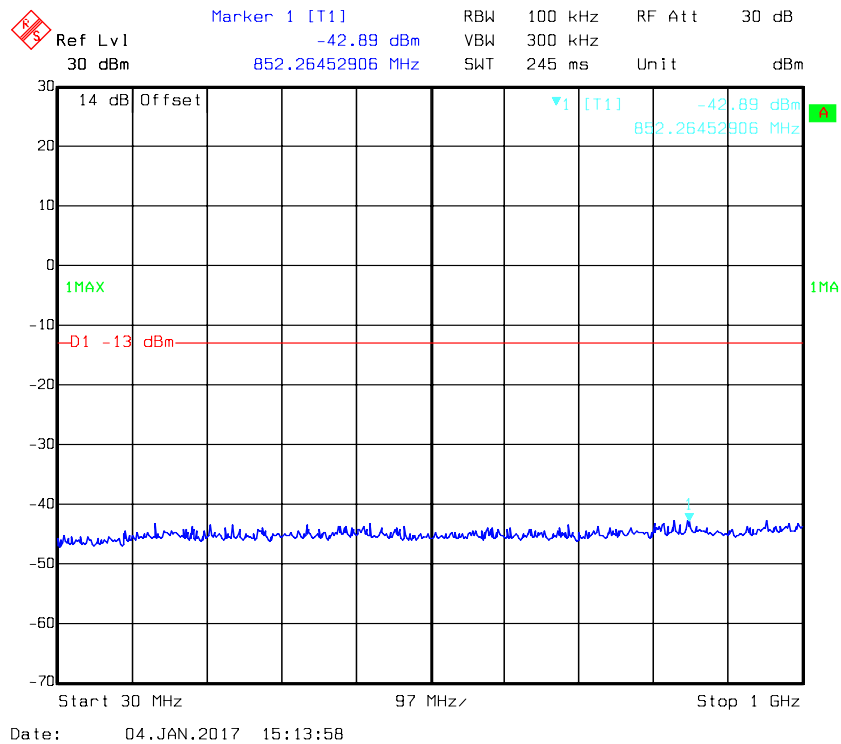
The testing was performed by Lorin Bian on 2017-01-04.

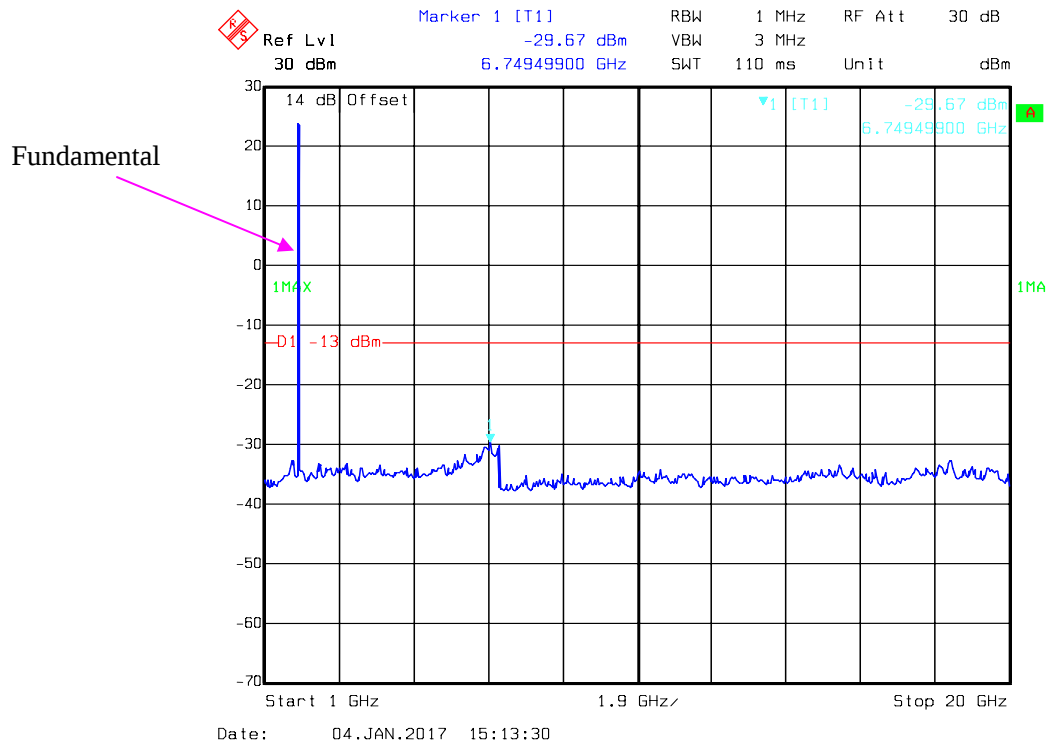
Please refer to the following plots.



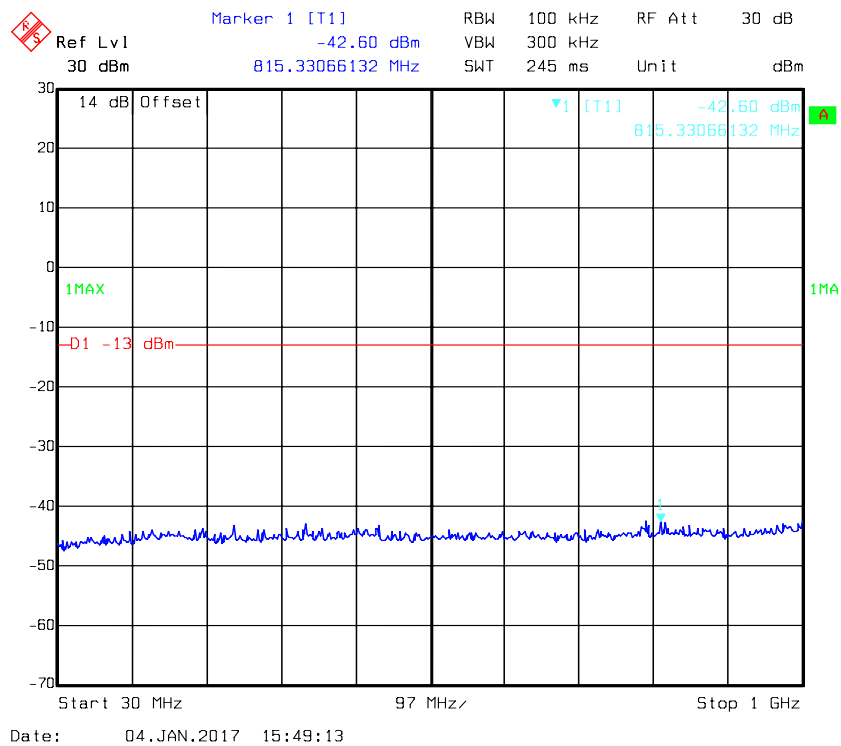


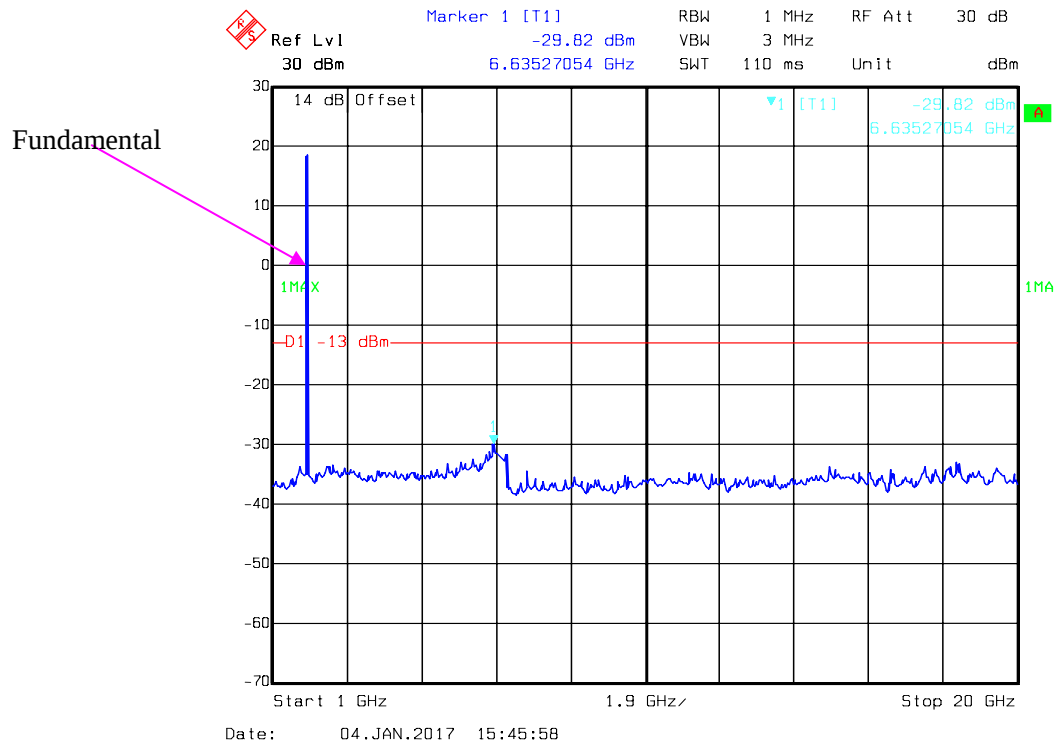
GPRS 1900_ Middle Channel



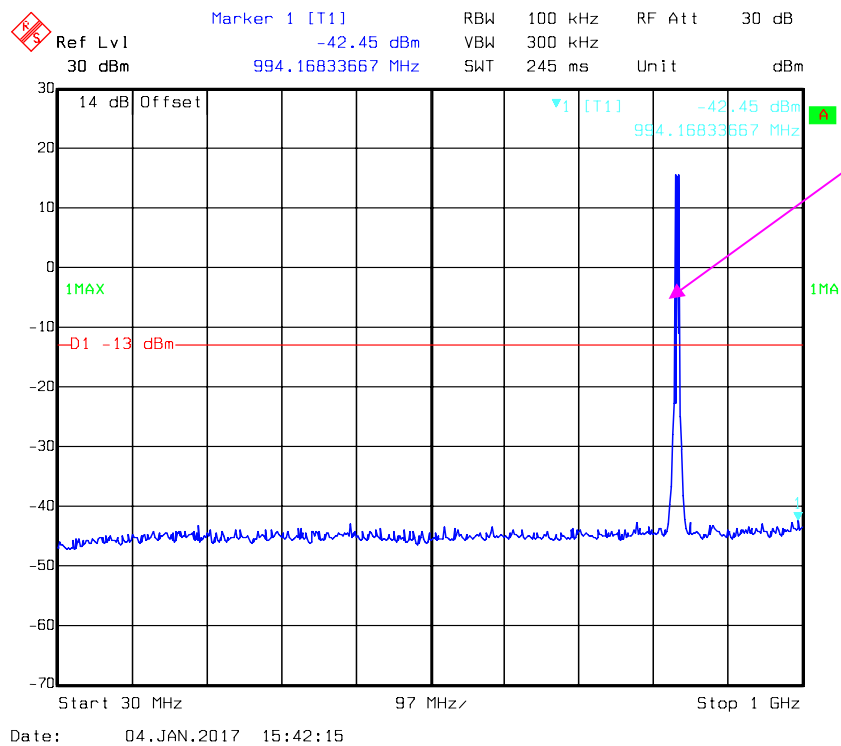


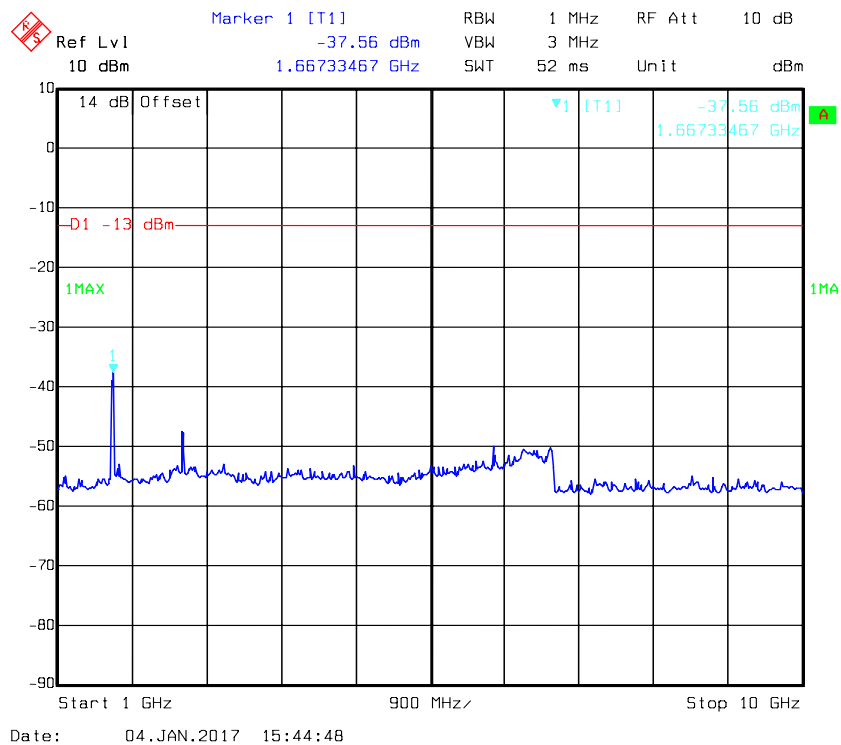
REL99 Band II_ Middle Channel





REL99 Band V_ Middle Channel





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 = $10 \lg (\text{TXpwr in Watts}/0.001)$ – the absolute level

Spurious attenuation limit in dB = $43 + 10 \log_{10} (\text{power out in Watts})$

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Amplifier	8447D	2944A10442	2016-12-02	2017-12-01
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2016-12-02	2017-12-01
Sunol Sciences	Broadband Antenna	JB3	A101808	2016-04-10	2019-04-09
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2016-12-02	2017-12-01
ETS	Horn Antenna	3115	003-6076	2016-12-02	2017-12-01
ETS	Horn Antenna	3115	6751	2014-06-16	2017-06-15
EMCO	Adjustable Dipole Antenna	3121C	9109-258	N/A	N/A
HP	Signal Generator	8648C	3623A04150	2016-5-23	2017-05-22
WILTRON	SWEPT FREQUENCY SYNTHESIZER	6737	213001	2016-5-23	2017-5-22
Mini-circuits	Amplifier	ZVA-183-S+	771001215	2016-05-20	2017-05-19
HP	Amplifier	8449B	3008A00277	2016-12-02	2017-12-01
EMCT	Semi-Anechoic Chamber	966	N/A	2015-04-24	2018-04-23
N/A	RF Cable (below 1GHz)	NO.1	N/A	2016-11-10	2017-11-09
N/A	RF Cable (below 1GHz)	NO.4	N/A	2016-11-10	2017-11-09
N/A	RF Cable (above 1GHz)	NO.2	N/A	2016-11-10	2017-11-09
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-01 1315	2016-08-18	2017-08-18
Ducommun Technologies	Horn Antenna	ARH-2823-02	1007726-01 1312	2016-08-18	2017-08-18

* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	23.7 °C
Relative Humidity:	49 %
ATM Pressure:	101.1 kPa

The testing was performed by Lorin Bian on 2017-01-05.

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)
			S.G. Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
GSM850, Frequency:836.600 MHz								
1673.200	H	71.12	-32	7.9	0.8	-24.9	-13.0	11.9
1673.200	V	70.36	-31	7.9	0.8	-23.9	-13.0	10.9
2509.800	H	59.87	-39.9	8.9	1.3	-32.3	-13.0	19.3
2509.800	V	61.19	-36.3	8.9	1.3	-28.7	-13.0	15.7
176.450	H	42.39	-73	0.0	0.2	-73.2	-13.0	60.2
176.450	V	43.57	-67.9	0.0	0.2	-68.1	-13.0	55.1
WCDMA Band V R99, Frequency:836.600 MHz								
1673.200	H	59.74	-43.4	7.9	0.8	-36.3	-13.0	23.3
1673.200	V	60.97	-40.4	7.9	0.8	-33.3	-13.0	20.3
2509.800	H	48.64	-51.1	8.9	1.3	-43.5	-13.0	30.5
2509.800	V	50.40	-47.1	8.9	1.3	-39.5	-13.0	26.5
176.450	H	42.35	-73.1	0.0	0.2	-73.3	-13.0	60.3
176.450	V	43.64	-67.8	0.0	0.2	-68.0	-13.0	55.0

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)
			S.G. Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
GSM1900, Frequency:1880.000 MHz								
3760.000	H	43.00	-51.9	8.8	1.4	-44.5	-13.0	31.5
3760.000	V	48.17	-46.7	8.8	1.4	-39.3	-13.0	26.3
5640.000	H	41.24	-51.9	10.3	1.8	-43.4	-13.0	30.4
5640.000	V	40.92	-52.2	10.3	1.8	-43.7	-13.0	30.7
176.450	H	42.42	-73	0.0	0.2	-73.2	-13.0	60.2
176.450	V	43.51	-68	0.0	0.2	-68.2	-13.0	55.2
WCDMA Band II, R99, Frequency:1880.000 MHz								
3760.000	H	49.20	-45.7	8.8	1.4	-38.3	-13.0	25.3
3760.000	V	48.38	-46.5	8.8	1.4	-39.1	-13.0	26.1
5640.000	H	37.74	-55.4	10.3	1.8	-46.9	-13.0	33.9
5640.000	V	39.74	-53.4	10.3	1.8	-44.9	-13.0	31.9
176.450	H	42.51	-72.9	0.0	0.2	-73.1	-13.0	60.1
176.450	V	43.37	-68.1	0.0	0.2	-68.3	-13.0	55.3

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 = SG Level - Cable loss + Antenna Gain
- 3) Margin = Limit-Absolute Level

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

Applicable Standard

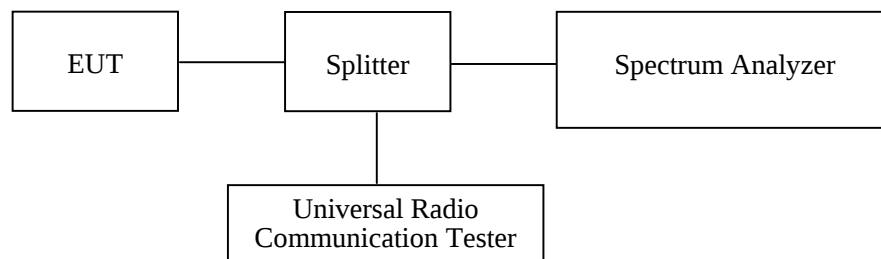
According to § 22.917(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

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
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
N/A	RF Cable	N/A	N/A	Each Time	/
N/A	Two-way Splitter	N/A	OE0120121	Each Time	/
N/A	10dB Attenuator	N/A	N/A	Each Time	/

* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

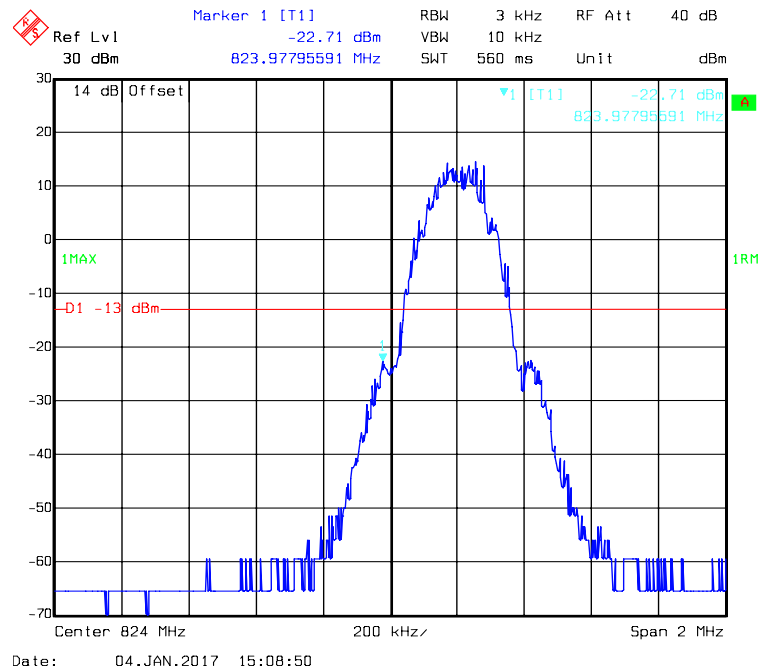
Temperature:	25.2 °C
Relative Humidity:	49%
ATM Pressure:	101.1 kPa

The testing was performed by Lorin Bian on 2017-01-04.

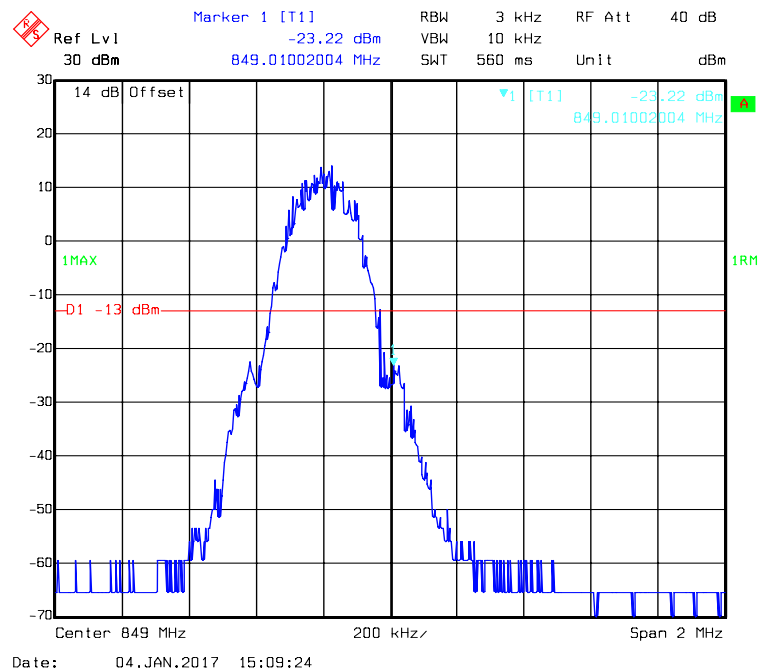
Test Mode: Transmitting

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

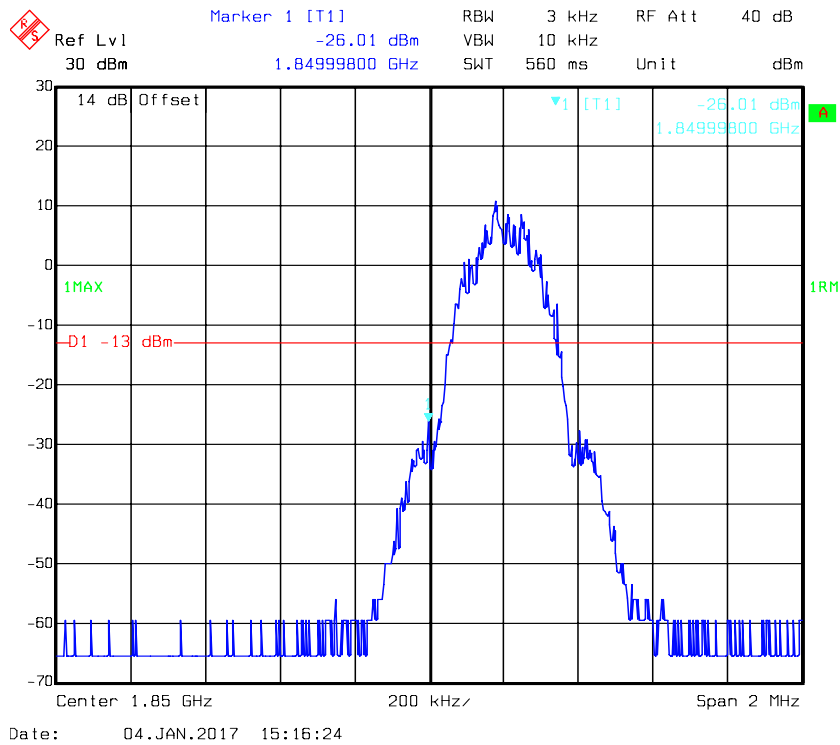
GPRS 850, Left Band Edge



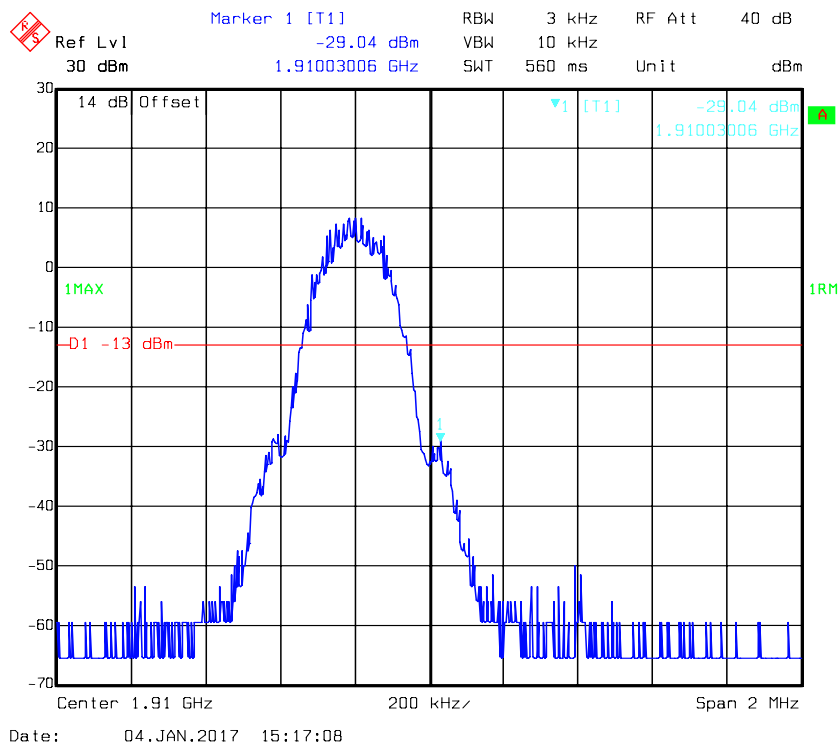
GPRS 850, Right Band Edge



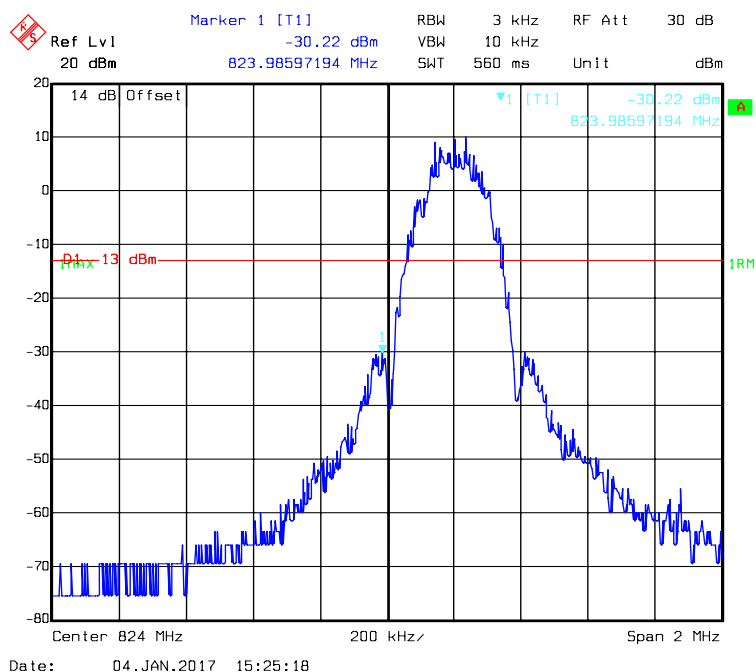
GPRS 1900, Left Band Edge



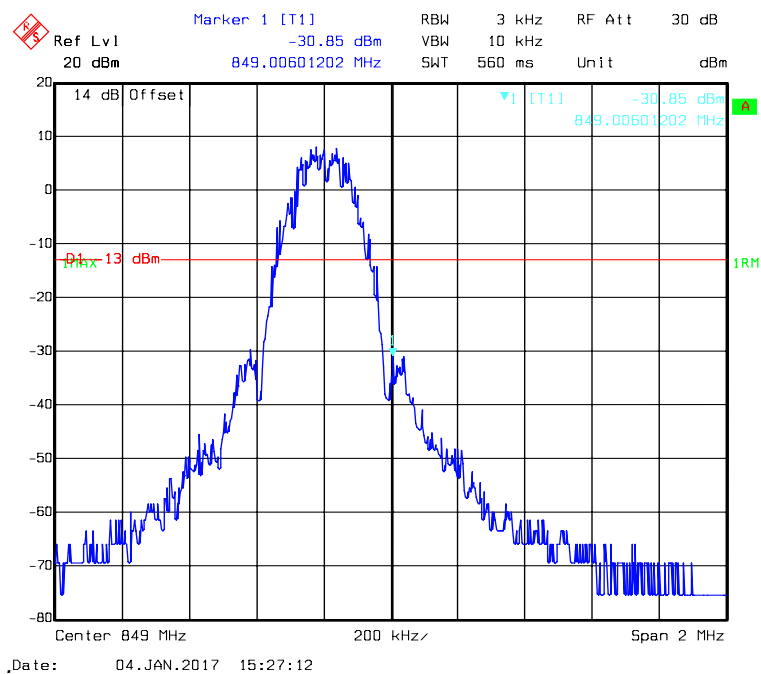
GPRS 1900, Right Band Edge



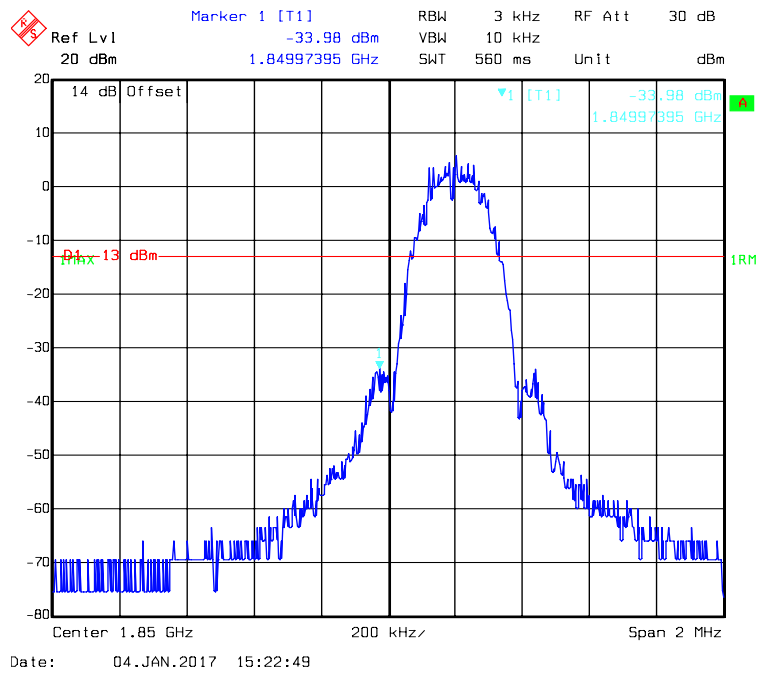
EDGE 850, Left Band Edge



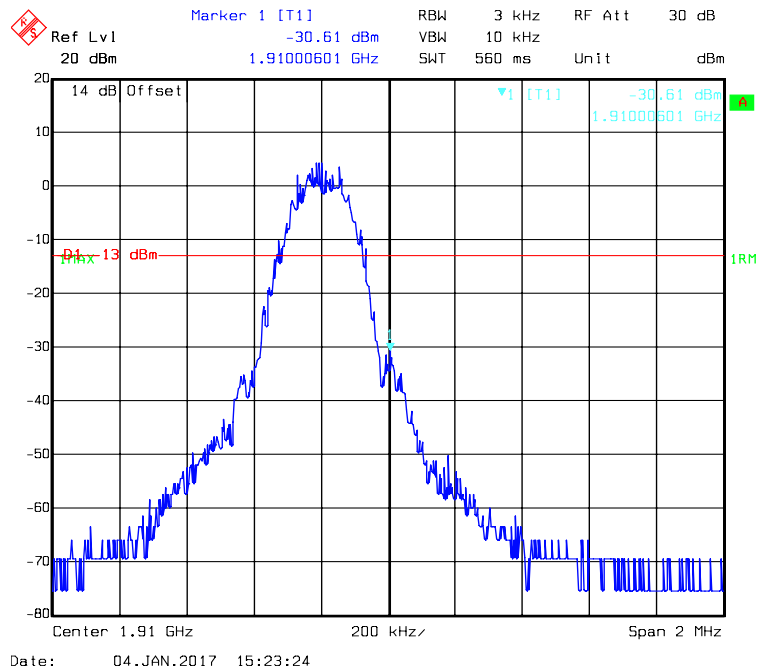
EDGE 850, Right Band Edge



EDGE 1900, Left Band Edge

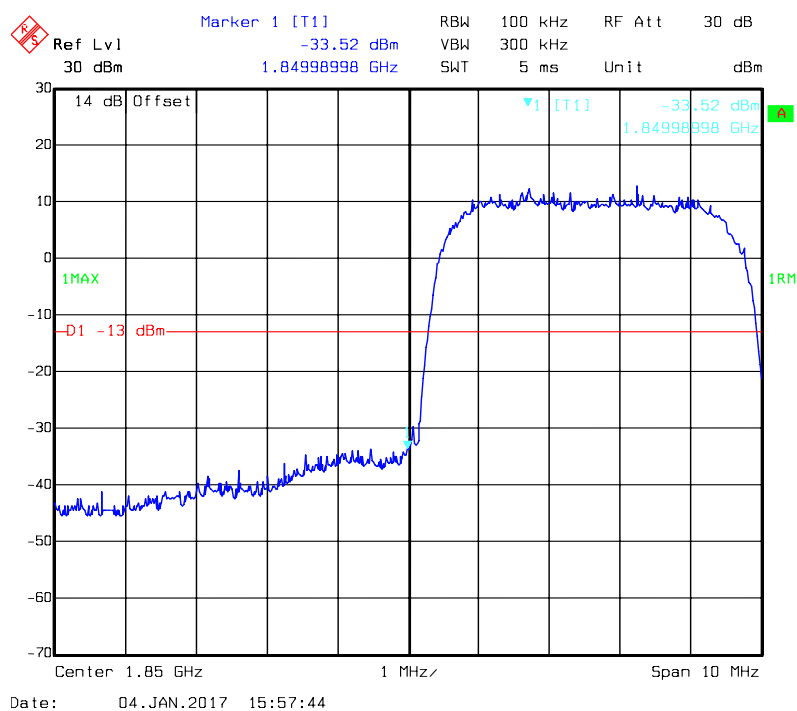


EDGE 1900, Right Band Edge

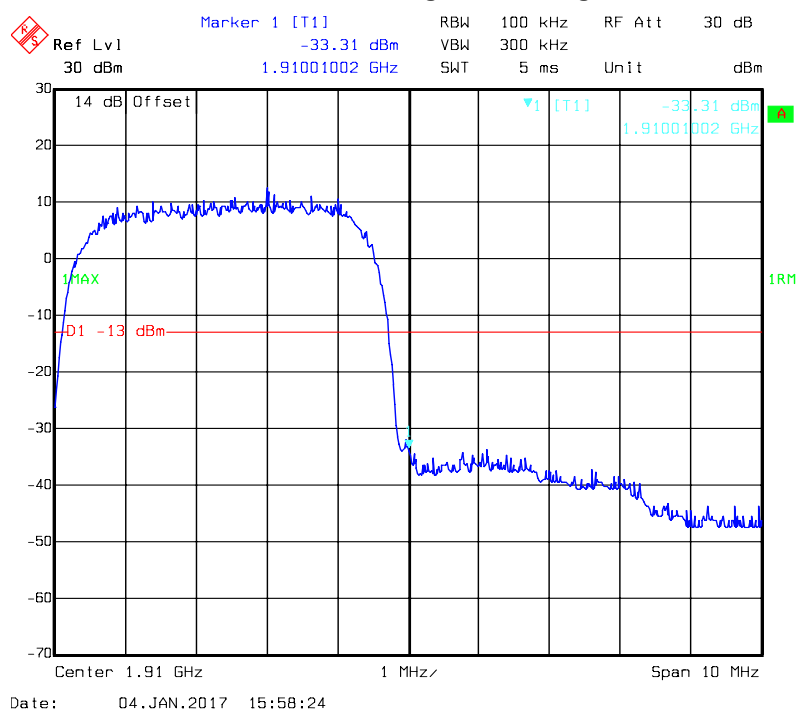


WCDMA Band II:

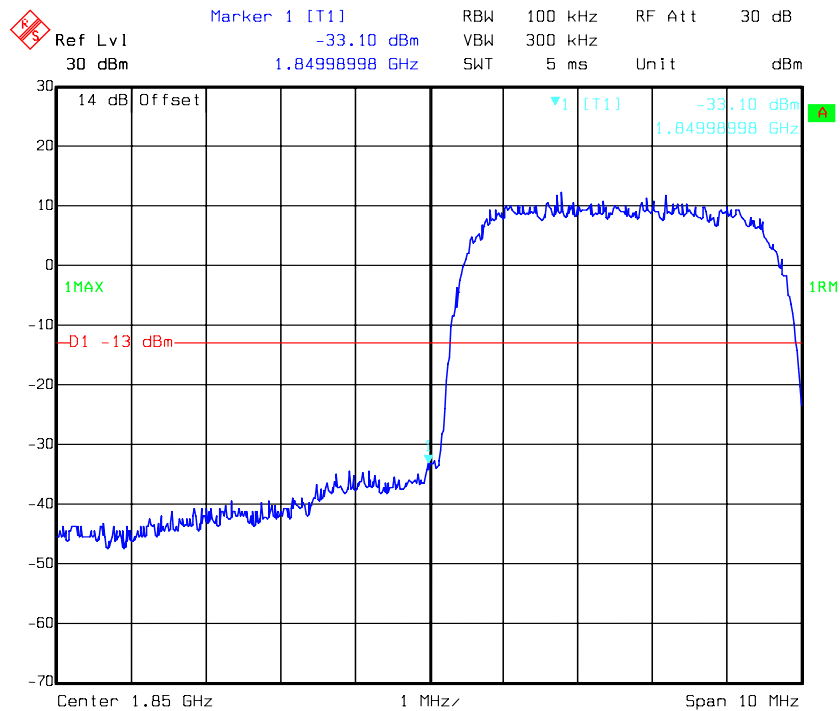
REL99 Band II, Left Band Edge



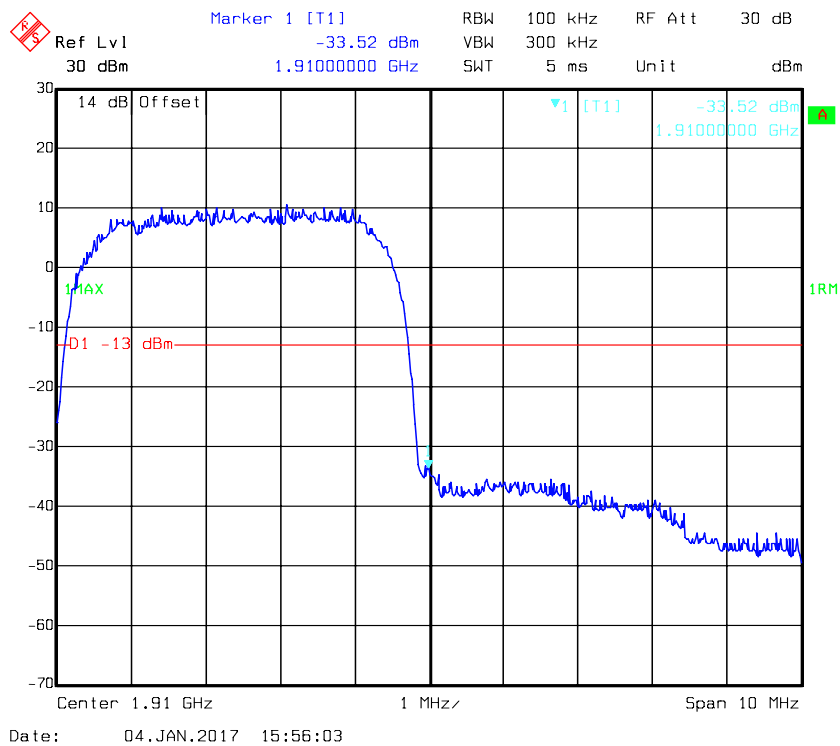
REL99 Band II, Right Band Edge



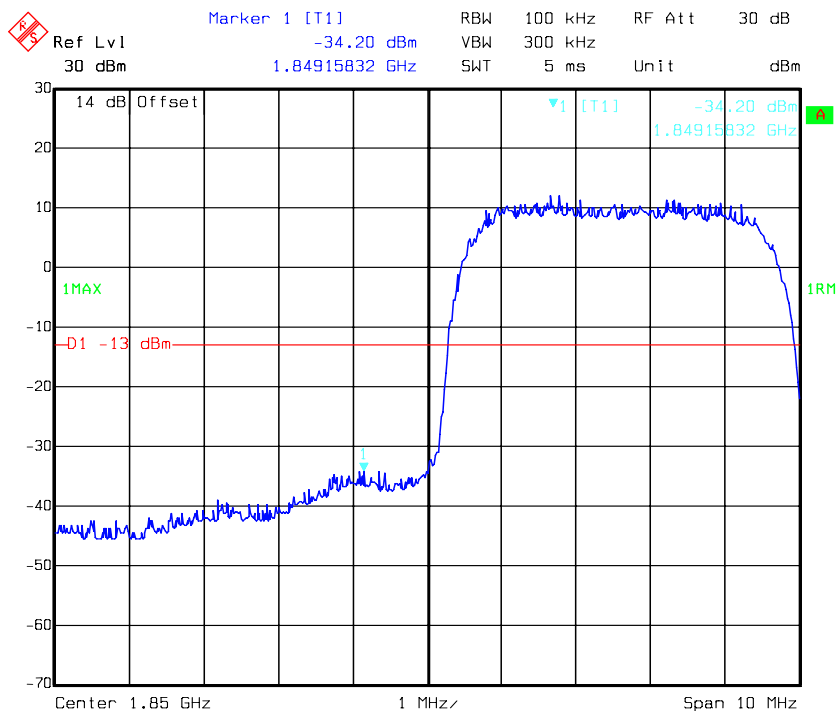
HSDPA Band II, Left Band Edge



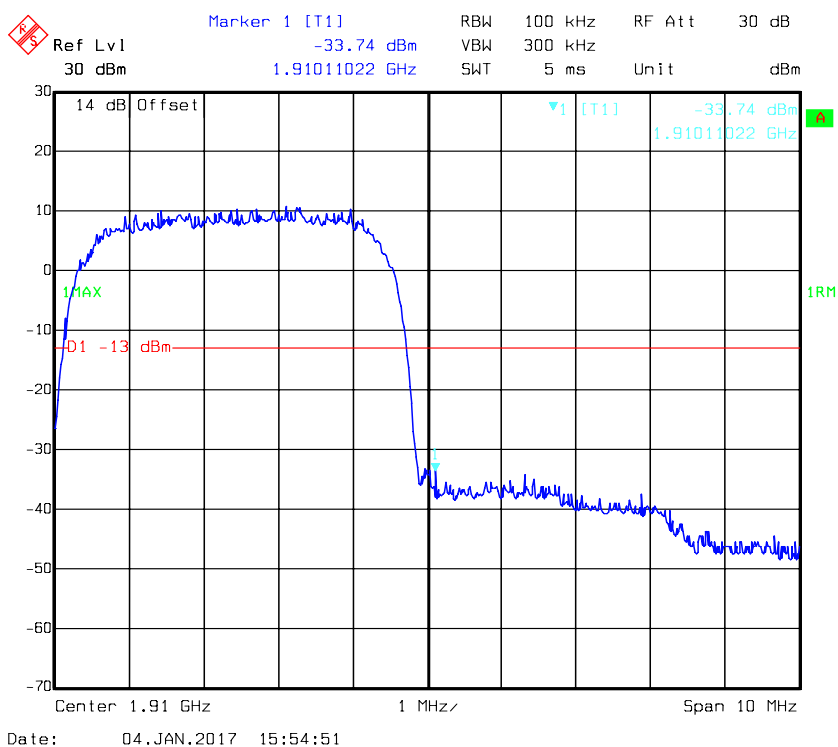
HSDPA Band II, Right Band Edge



HSUPA Band II, Left Band Edge

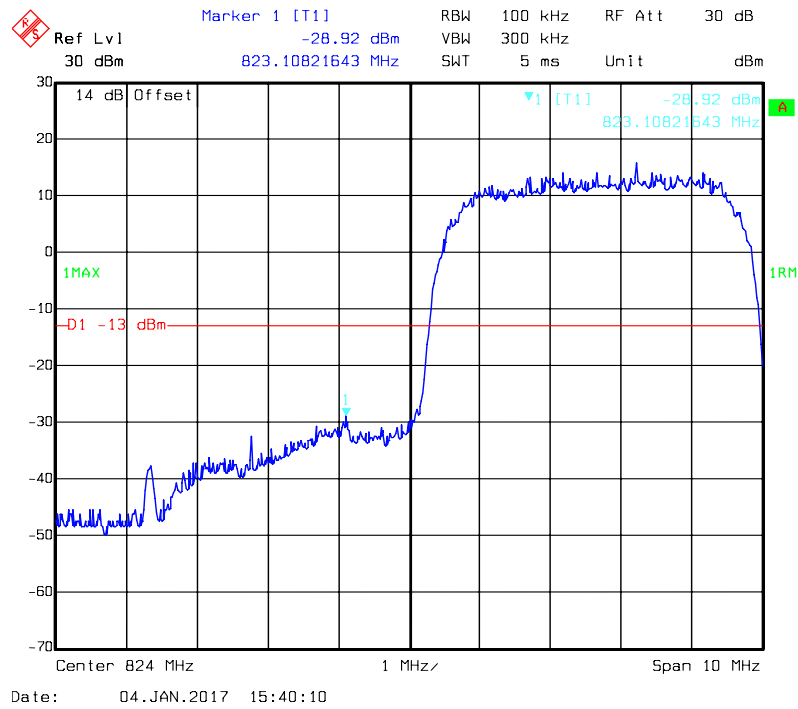


HSUPA Band II, Right Band Edge

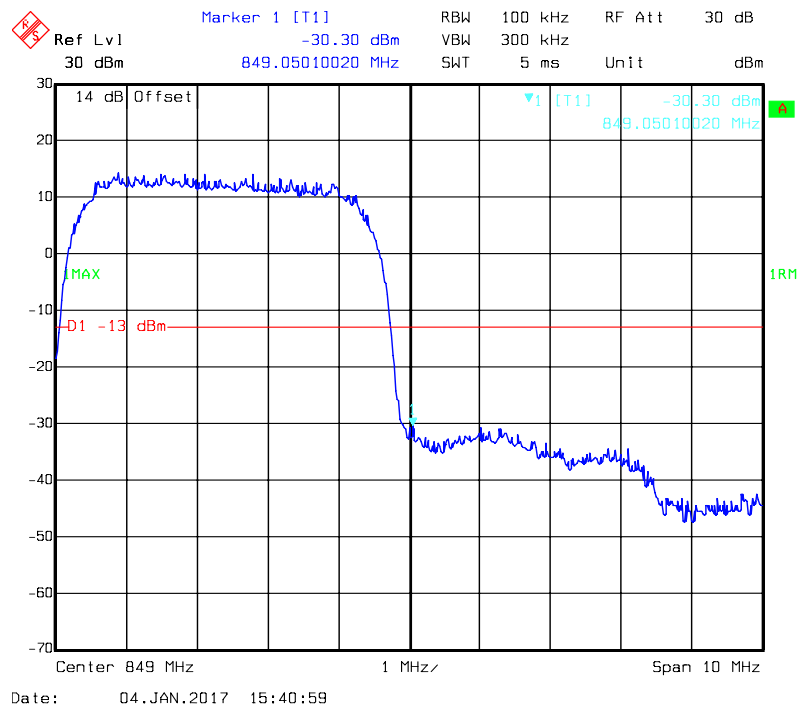


WCDMA Band V

REL99 Band V, Left Band Edge



REL99 Band V Right Band Edge



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

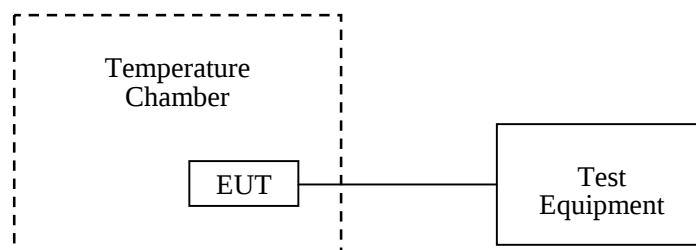
According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

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
FLUKE	Multimeter	1587	27870099	2016-12-30	2017-12-29
R&S	Universal Radio Communication Tester	CMU200	11-9435686-111	2016-07-28	2017-07-27
N/A	RF Cable	N/A	N/A	Each Time	/
BACL	High Temperature Test Chamber	BTH-150	30024	2016-12-02	2017-12-01

* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	25.2 °C
Relative Humidity:	49%
ATM Pressure:	101.1 kPa

The testing was performed by Lorin Bian on 2017-01-04.

Cellular Band (Part 22H)

GPRS, Middle Channel, $f_c = 836.6$ MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Limit
°C	V _{DC}	Hz	ppm	ppm
-30	12	-16	-0.019	2.5
-20		-21	-0.025	
-10		-23	-0.027	
0		-14	-0.017	
10		-22	-0.026	
20		-13	-0.016	
30		-8	-0.010	
40		-11	-0.013	
50		-7	-0.008	
20	9	-13	-0.016	
20	24	-9	-0.011	

Cellular Band (Part 22H)

EDGE, Middle Channel, $f_c = 836.6$ MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Limit
°C	V _{DC}	Hz	ppm	ppm
-30	12	32	0.038	2.5
-20		20	0.024	
-10		29	0.035	
0		21	0.025	
10		16	0.019	
20		26	0.031	
30		28	0.033	
40		20	0.024	
50		31	0.037	
20	9	24	0.029	
20	24	18	0.022	

PCS Band (Part 24E)

GPRS, Middle Channel, $f_c = 1880.0$ MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Result
°C	V _{DC}	Hz	ppm	
-30	12	21	0.011	Compliance
-20		25	0.013	
-10		20	0.011	
0		18	0.010	
10		27	0.014	
20		23	0.012	
30		14	0.007	
40		15	0.008	
50		18	0.010	
20	9	19	0.010	
20	24	23	0.012	

PCS Band (Part 24E)

EDGE, Middle Channel, $f_c = 1880.0$ MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Result
°C	V _{DC}	Hz	ppm	
-30	12	11	0.006	Compliance
-20		22	0.012	
-10		11	0.006	
0		13	0.007	
10		17	0.009	
20		18	0.010	
30		15	0.008	
40		12	0.006	
50		11	0.006	
20	9	20	0.011	
20	24	13	0.007	

WCDMA Band V: Re99

Middle Channel, $f_c = 836.6$ MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Limit
°C	V _{DC}	Hz	ppm	ppm
-30	12	-16	-0.019	2.5
-20		-6	-0.007	2.5
-10		-1	-0.001	2.5
0		-5	-0.006	2.5
10		-12	-0.014	2.5
20		-6	-0.007	2.5
30		-1	-0.001	2.5
40		-14	-0.017	2.5
50		-9	-0.011	2.5
20	9	-9	-0.011	2.5
20	24	-2	-0.002	2.5

WCDMA Band II: Re99

Middle Channel, $f_c = 1880.0$ MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Result
°C	V _{DC}	Hz	ppm	
-30	12	-18	-0.010	Compliance
-20		-11	-0.006	
-10		-13	-0.007	
0		-17	-0.009	
10		-15	-0.008	
20		-8	-0.004	
30		-6	-0.003	
40		-4	-0.002	
50		-14	-0.007	
20	9	-8	-0.004	
20	24	-12	-0.006	

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