

TEST REPORT

of

Part 2 Subpart J, Part 22 Subpart C/H and Part 24 Subpart E

FCC ID: YZP-VL3000

Equipment Under Test : Telematics Modem
Model Name : LTD-VL3000
Variant Model Name(s) : -
Applicant : LG Innotek Co., Ltd.
Manufacturer : LG Innotek Co., Ltd.
Date of Receipt : 2023.05.23
Date of Test(s) : 2023.05.24 ~ 2023.07.28
Date of Issue : 2023.07.28

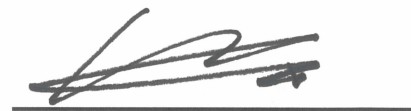
In the configuration tested, the EUT complied with the standards specified above. This test report does not assure KOLAS accreditation.

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Tested by:


Murphy Kim

Technical
Manager:


Inho Park

SGS Korea Co., Ltd. Gunpo Laboratory

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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)

- 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- Designation number: KR0150

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1.2. Details of Applicant

Applicant : LG Innotek Co., Ltd.

Address : 26, Hanamsandan 5beon-ro, Gwangsan-gu, Gwangju, South Korea, 506-731

Contact Person : Jeong, In-chang

Phone No. : +82 62 950 0332

1.3. Details of Manufacturer

Company : LG Innotek Co., Ltd.

Address : 30, Magokjungang 10-ro, Gangseo-gu, Seoul, Korea, 07796

1.4. Description of EUT

Kind of Product	Telematics Modem
Model Name	LTD-VL3000
Serial Number	CR1
Power Supply	DC 4 V
Rated Power	CDMA BC0, BC1: 24 dB m
Frequency Range	CDMA BC0: 824 MHz ~ 849 MHz CDMA BC1: 1 850 MHz ~ 1 910 MHz
Modulation Technique	QPSK, 16QAM
Antenna Type	Dipole Antenna
Antenna Gain*	Refer to the clause 1.12
H/W Version	B.0
S/W Version	01T_WVZW, 01U_WVZW

1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Signal Generator	R&S	SMA100B	106887	Oct. 13, 2022	Annual	Oct. 13, 2023
Spectrum Analyzer	R&S	FSV30	103210	Dec. 07, 2022	Annual	Dec. 07, 2023
Spectrum Analyzer	Agilent	N9020A	MY53421758	Aug. 26, 2022	Annual	Aug. 26, 2023
Mobile Test Unit	Agilent	E515C	GB43345198	Mar. 14, 2023	Annual	Mar. 14, 2024
Power Meter	Anritsu	ML2495A	1223004	May 30, 2023	Annual	May 30, 2024
Power Sensor	Anritsu	MA2411B	1207272	May 30, 2023	Annual	May 30, 2024
Temperature Chamber	ESPEC CORP.	SH-662	93000533	Jun. 01, 2023	Annual	Jun. 01, 2024
Low Pass Filter	Mini-Circuits	NLP-1200+	V 8979400903-1	May 16, 2023	Annual	May 16, 2024
High Pass Filter	Wainwright Instrument GmbH	WHKX10-900-1000-18000-40SS	7	Mar. 02, 2023	Annual	Mar. 02, 2024
High Pass Filter	Wainwright Instrument GmbH	WHKX2.2/12.75G-10SS	8	Mar. 02, 2023	Annual	Mar. 02, 2024
High Pass Filter	Wainwright Instrument GmbH	WHKX3.0/18G-6SS	21	Jun. 01, 2023	Annual	Jun. 01, 2024
High Pass Filter	Wainwright Instrument GmbH	WHNX7.5/26.5G-6SS	11	Oct. 24, 2022	Annual	Oct. 24, 2023
BRIDGE COUPLER	MARKI MICROWAVE INC	CBR16-0012	1542	May 16, 2023	Annual	May 16, 2024
Directional Coupler	KRYTAR	152613	122660	Jul. 13, 2023	Annual	Jul. 13, 2024
DC Power Supply	Agilent	U8002A	MY49030063	Jan. 20, 2023	Annual	Jan. 20, 2024
Preamplifier	H.P.	8447F	2944A03909	Aug. 04, 2022	Annual	Aug. 04, 2023
Preamplifier	R&S	SCU18F	100959	Jul. 13, 2023	Annual	Jul. 13, 2024
Preamplifier	TESTEK	TK-PA1840H	130016	Jan. 11, 2023	Annual	Jan. 11, 2024
Test Receiver	R&S	ESU26	100109	Jan. 18, 2023	Annual	Jan. 18, 2024
Loop Antenna	Schwarzbeck Mess-Elektronik	FMZB 1519	1519-039	Aug. 23, 2021	Biennial	Aug. 23, 2023
Bilog Antenna	Schwarzbeck Mess-Elektronik	VULB9163	01126	Feb. 09, 2023	Annual	Feb. 09, 2024
Horn Antenna	R&S	HF906	100326	Feb. 28, 2023	Annual	Feb. 28, 2024
Horn Antenna	Schwarzbeck Mess-Elektronik	BBHA 9170	9170-540	Nov. 30, 2022	Annual	Nov. 30, 2023
Antenna Master	Innco systems GmbH	MA4640-XP-ET	MA4640/536/383 30516/L	N.C.R.	N/A	N.C.R.
Turn Table	Innco systems GmbH	DS 1200S	N/A	N.C.R.	N/A	N.C.R.
Controller	Innco systems GmbH	CONTROLLER CO3000-4P	CO3000/963/383 30516/L	N.C.R.	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.6 m)	N/A	N.C.R.	N/A	N.C.R.
Coaxial Cable	RFONE	MWX221-NMSNMS (4 m)	J1023142	Apr. 04, 2023	Semi-Annual	Oct. 04, 2023
Coaxial Cable	Qualwave Inc.	QA500-18-NN-10 (10 m)	22200114	Apr. 04, 2023	Semi-Annual	Oct. 04, 2023
Coaxial Cable	RADIALL	TESTPRO 3	182287	Apr. 14, 2023	Semi-Annual	Oct. 14, 2023
Coaxial Cable	RADIALL	TESTPRO 3	182288	Apr. 14, 2023	Semi-Annual	Oct. 14, 2023
Coaxial Cable	RADIALL	TESTPRO 3	182291	Apr. 14, 2023	Semi-Annual	Oct. 14, 2023

Note;

- For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

1.6. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD: Part 2, 22 and 24		
Section(s)	Test Item	Result
§2.1046 §22.913(a)(5) §24.232(c)	E.R.P. / E.I.R.P.	Complied
§2.1053 §22.917(a) §24.238(a)	Radiated Spurious Emissions	Complied
§2.1046	Conducted Output Power	Complied
§2.1049	Occupied Bandwidth	Complied
§22.913(d) §24.232(d)	Peak-Average Ratio	Complied
§2.1051 §22.917(a) §24.238(a)	Spurious Emission at Antenna Terminal	Complied
§22.917(a) §24.238(a)	Band Edge	Complied
§2.1055 §22.355 §24.235	Frequency Stability	Complied

Note;

Due to the following changes, the test was performed for C2PC.
- PCB layout, PAM, RF Filter, RF switch, Matching component

1.7. Sample Calculation for Offset

Where relevant, the following sample calculation is provided:

1.7.1. Conducted Test

Offset value (dB) = Directional Coupler (dB) + Cable loss (dB)

1.7.2. Radiation test

- E.I.R.P. (dB m) = Measured level (dB μ V) + Antenna factor (dB/m) + Cable loss (dB) + 20 Log D - 104.8;
where D is the measurement distance in meters.
- E.R.P. (dB m) = E.I.R.P. (dB m) - 2.15 (dB)

1.8. Worst Case Configuration and Mode

CDMA mode, Output power measurements were measured on 1XRTT and EV-DO. All testing was performed using 1XRTT and EV-DO, except radiated spurious emission and emission at antenna terminal were tested only 1XRTT modulation as worst case. The worst-case is based on the average conducted output power measurement investigation results.

The radiation test of the EUT was investigated in three orthogonal orientations X, Y, and Z, and the worst case data is reported.

1.9. Measurement Configuration

Test Items	Band	Test Channel			Modulation	
		Low	Mid	High	1XRTT	EV-DO
Conducted Output Power	CDMA BC 0	V	V	V	V	V
	CDMA BC 1	V	V	V	V	V
Frequency Stability	CDMA BC 0	-	V	-	V	-
	CDMA BC 1	-	V	-	V	-
Occupied Bandwidth	CDMA BC 0	V	V	V	V	V
	CDMA BC 1	V	V	V	V	V
Peak to Average Ratio	CDMA BC 0	V	V	V	V	V
	CDMA BC 1	V	V	V	V	V
Band Edge	CDMA BC 0	V	-	V	V	V
	CDMA BC 1	V	-	V	V	V
Spurious Emission at Antenna Terminal	CDMA BC 0	V	V	V	V	-
	CDMA BC 1	V	V	V	V	-
Radiated Spurious Emissions	CDMA BC 0	V	V	V	V	-
	CDMA BC 1	V	V	V	V	-

1.10. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty	
Conducted Output Power	0.33 dB	
Occupied Bandwidth	0.04 MHz	
Conducted Spurious Emission	0.85 dB	
Peak to Average Ratio	0.66 dB	
Frequency Stability	0.11 kHz	
Radiated Emission, 9 kHz to 30 MHz	H	3.40 dB
	V	3.40 dB
Radiated Emission, below 1 GHz	H	4.50 dB
	V	5.10 dB
Radiated Emission, above 1 GHz	H	3.70 dB
	V	3.90 dB

All measurement uncertainty values are shown with a coverage factor of $k=2$ to indicate a 95 % level of confidence.

1.11. Test Report Revision

Revision	Report Number	Date of Issue	Description
0	F690501-RF-RTL004280	2023.07.28	Initial

1.12. Antenna Information

Band	Operating Frequency (MHz)	Antenna Peak Gain (dB i)
CDMA BC 0	824 ~ 849	2.18
CDMA BC 1	1 850 ~ 1 910	5.97

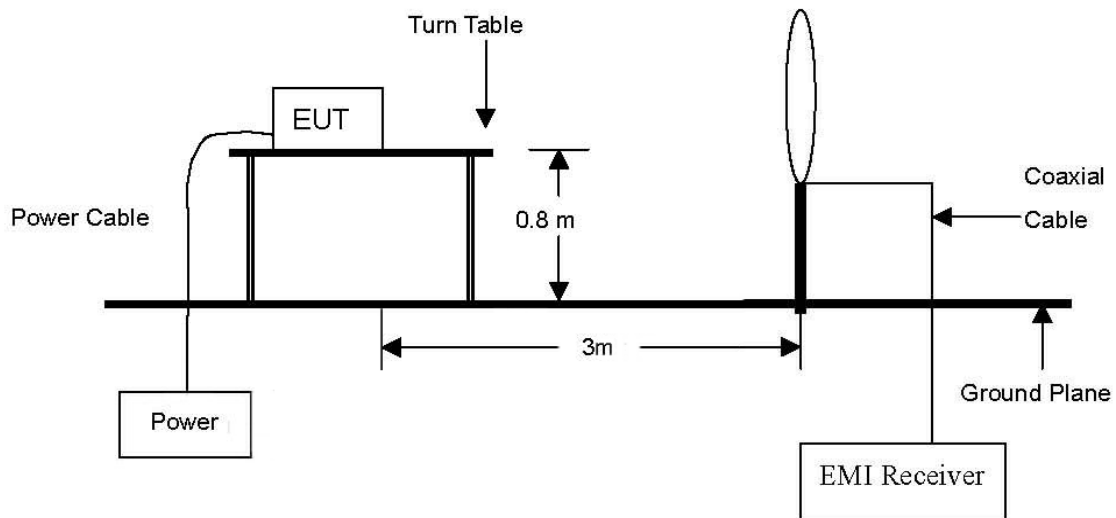
1.13. Emission Designator and Max Power

Band	Modulation	Low Freq. (MHz)	Upper Freq. (MHz)	Conducted Power (dB m)	Ant. Gain (dB i)	E.R.P. / E.I.R.P. Average (dB m)	E.R.P. / E.I.R.P. Average (W)	Emission Designator
CDMA BC 0	1XRTT	824.7	848.31	22.95	2.18	22.98	0.199	1M30F9W
	EVDO			22.94		22.97	0.198	1M29F9W
CDMA BC 0	1XRTT	1 851.25	1 908.75	23.85	5.97	29.82	0.959	1M28F9W
	EVDO			23.83		29.80	0.955	1M29F9W

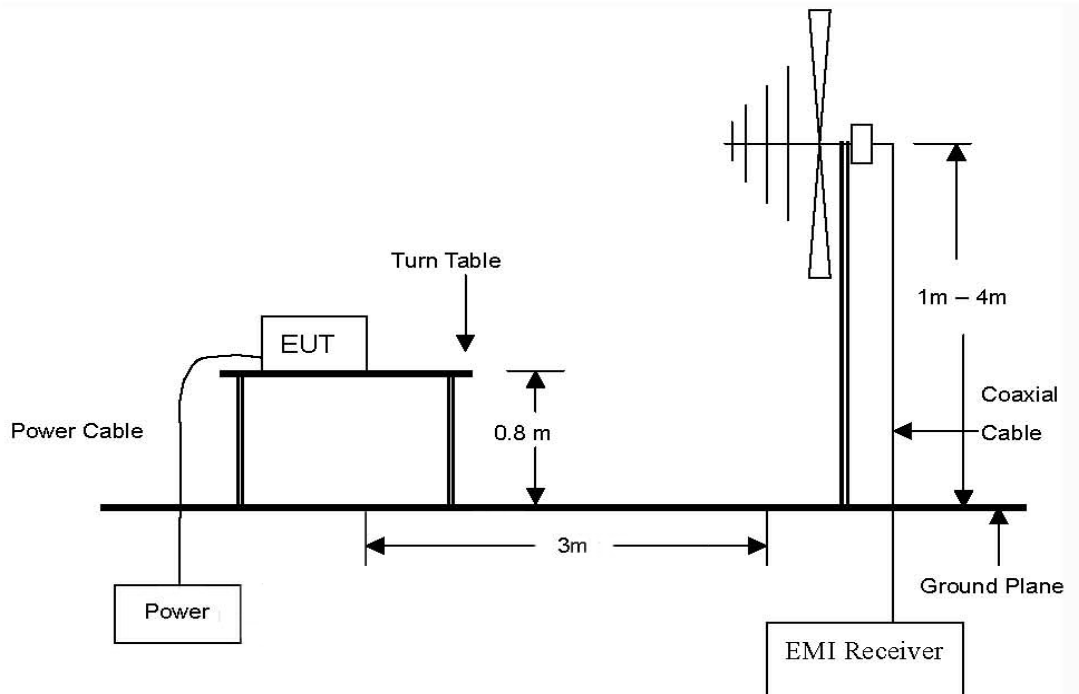
2. E.R.P. / E.I.R.P. & Radiated Spurious Emissions

2.1. Test setup

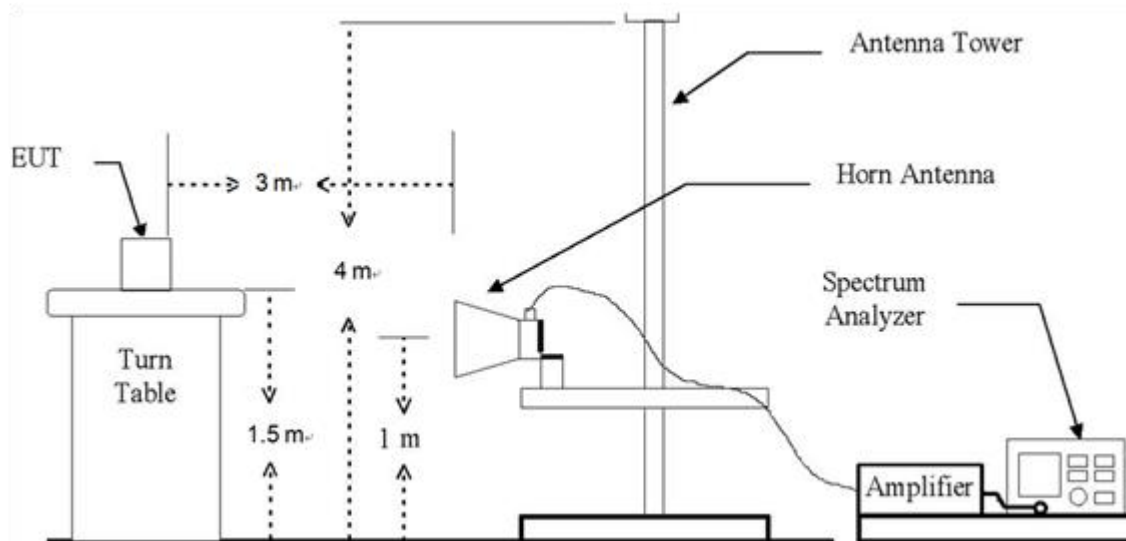
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 20 GHz Emissions.



2.2. Limit

2.2.1. Limit of E.R.P. / E.I.R.P.

- §22.913(a)(5), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

- §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.

2.2.2. Limit of Radiated Spurious Emissions

- §22.917(a), the power of any emission 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.

- §24.238(a), the power of any emission 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.

2.3. Test Procedure: Based on ANSI/TIA 603E: 2016 and ANSI C63.26-2015, KDB 971168 D01 Power Meas License Digital Systems v03r01.

1. On a test site, the EUT shall be placed at 0.8 m or 1.5 m height on a turn table, and in the position close to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to correspond to the fundamental frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the peak detector is used for the measurement.
4. Radiated spurious emissions measurement method was set as follows:
RBW = 100 kHz for emissions below 1 GHz and 1 MHz for emissions above 1 GHz, VBW $\geq 3 \times$ RBW,
Detector = RMS, trace mode = max hold, per the guidelines of KDB 971168 D01 Power Meas License Digital Systems v03r01.
5. The transmitter shall be switched on, the measuring receiver shall be tuned to the frequency of the transmitter under test.
6. The test antenna shall be raised and lowered through the specified range of height until the maximum signal level is detected by the measuring receiver.
7. The transmitter shall be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
8. The test antenna shall be raised and lowered again through the specified range of height until the maximum signal level is detected by the measuring receiver.
9. The maximum signal level detected by the measuring receiver shall be noted.
10. In necessary, the input attenuator setting on the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
11. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
12. The measurement shall be repeated with the test antenna orientated for horizontal polarization.

2.4. Test results

Ambient temperature : $(23 \pm 1) ^\circ\text{C}$
 Relative humidity : 47 % R.H.

2.4.1. E.R.P. / E.I.R.P.

Band	Frequency (MHz)	Maximum Conducted Power (dB m)	Maximum Conducted Power (W)	Antenna Gain (dB i)	Maximum E.I.R.P. (dB m)	Maximum E.I.R.P. (W)	Maximum E.R.P. (dB m)	Maximum E.R.P. (W)	Limit
CDMA BC 0	824 ~ 849	22.95	0.197	2.18	25.13	0.326	22.98	0.199	7 W E.R.P.
CDMA BC 1	1 850 ~ 1 910	23.85	0.243	5.97	29.82	0.959			2 W E.I.R.P.

Remark;

1. E.I.R.P. (dB m) = Maximum Conducted Power (dB m) + Antenna Gain (dB i)
2. E.R.P. (dB m) = E.I.R.P. (dB m) - 2.15 (dB); where E.R.P. and E.I.R.P. are expressed in consistent units.

2.4.2. Radiated Spurious Emissions

CDMA BC 0

Frequency (MHz)	Measured Level (dBμV)	Ant. Pol.	AF (dB/m)	AMP+CL (dB)	E (dBμV/m)	CF (dB)	E.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (824.7 MHz)									
1 650.00	60.01	H	25.70	-37.36	48.35	-97.41	-49.06	-13	36.06
1 648.69	60.19	V	25.69	-37.35	48.53	-97.41	-48.88	-13	35.88
Above 1 700.00	Not detected	-	-	-	-	-	-	-	-
Middle Channel (836.52 MHz)									
1 672.26	63.29	H	26.06	-37.55	51.80	-97.41	<u>-45.61</u>	-13	32.61
1 672.37	59.71	V	26.06	-37.55	48.22	-97.41	-49.19	-13	36.19
Above 1 700.00	Not detected	-	-	-	-	-	-	-	-
High Channel (848.31 MHz)									
1 695.96	60.88	H	26.44	-37.36	49.96	-97.41	-47.45	-13	34.45
1 695.83	59.36	V	26.43	-37.36	48.43	-97.41	-48.98	-13	35.98
Above 1 700.00	Not detected	-	-	-	-	-	-	-	-

CDMA BC 1

Frequency (MHz)	Measured Level (dBμV)	Ant. Pol.	AF (dB/m)	AMP+CL (dB)	E (dBμV/m)	CF (dB)	E.I.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (1 851.25 MHz)									
3 701.83	44.80	H	32.21	-33.16	43.85	-95.26	-51.41	-13	38.41
3 701.74	43.20	V	32.21	-33.16	42.25	-95.26	-53.01	-13	40.01
5 554.72	40.69	H	34.20	-30.92	43.97	-95.26	-51.29	-13	38.29
5 553.80	48.14	V	34.20	-30.91	51.43	-95.26	-43.83	-13	30.83
Above 5 600.00	Not detected	-	-	-	-	-	-	-	-
Middle Channel (1 880.00 MHz)									
3 760.92	43.90	H	32.40	-32.76	43.54	-95.26	-51.72	-13	38.72
3 759.31	46.30	V	32.40	-32.74	45.96	-95.26	-49.30	-13	36.30
5 640.39	39.97	H	34.12	-29.91	44.18	-95.26	-51.08	-13	38.08
5 640.09	45.46	V	34.12	-29.91	49.67	-95.26	-45.59	-13	32.59
Above 5 700.00	Not detected	-	-	-	-	-	-	-	-
High Channel (1 908.75 MHz)									
3 816.98	42.90	V	32.37	-33.05	42.22	-95.26	-53.04	-13	40.04
3 816.96	47.24	H	32.37	-33.05	46.56	-95.26	-48.70	-13	35.70
5 726.13	48.17	V	34.20	-30.18	52.19	-95.26	-43.07	-13	30.07
5 727.25	55.07	V	34.21	-30.19	59.09	-95.26	<u>-36.17</u>	-13	23.17
Above 5 800.00	Not detected	-	-	-	-	-	-	-	-

Remark;

1. AF = Antenna Factor, CL = Cable Loss, CF = Conversion Factor.
2. $E \text{ (dB}\mu\text{V/m)} = \text{Measured Level (dB}\mu\text{V)} + \text{Antenna Factor (dB/m)} + \text{AMP (dB)} + \text{Cable Loss (dB)}$.
3. $E.I.R.P. \text{ (dB m)} = E \text{ (dB}\mu\text{V/m)} + CF \text{ (dB)}$.
4. $E.R.P. \text{ (dB m)} = E \text{ (dB}\mu\text{V/m)} + CF \text{ (dB)} - 2.15 \text{ (dB)}$; where E.R.P. and E.I.R.P. are expressed in consistent units.
5. $CF \text{ (dB)} = 20 \log D - 104.8$; where D is the measurement distance in meters, According to ANSI C63.26-2015 5.2.7 and KDB 971168 D01 v03r01 5.8.4.
6. The frequency spectrum is examined from 9 kHz to the 10th harmonic of the fundamental frequency of the transmitter. No other spurious and harmonic emissions were reported greater than listed emissions above table.

3. Conducted Output Power

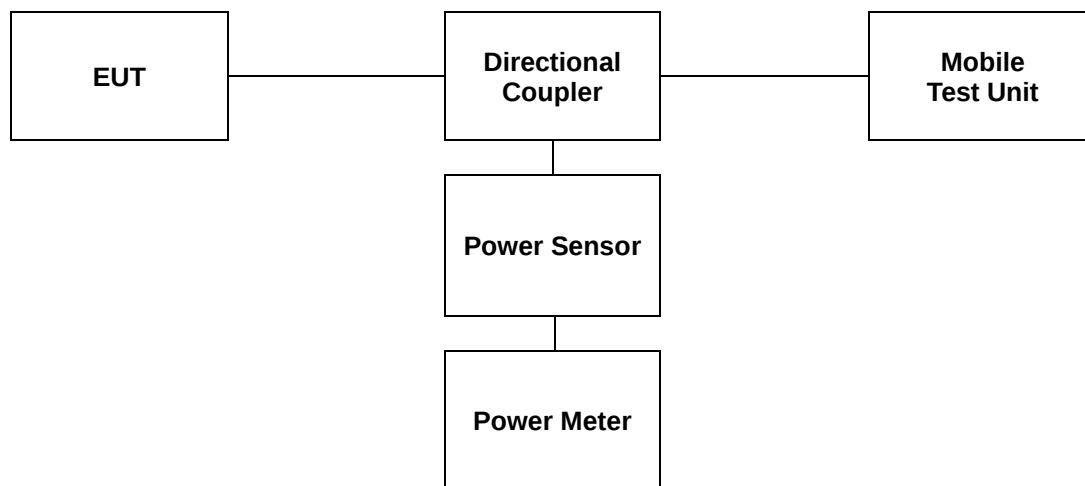
3.1. Limit

CFR 47, Section FCC §2.1046 and IC RSS-Gen Issue 5 6.12.

3.2. Test Procedure

Output power shall be measured at the RF output terminals for all configurations.

1. The RF output of the transmitter was connected to the input of the mobile test unit in order to establish communication with the EUT.
2. The EUT was set up for the max. output power with pseudo random data modulation by using mobile test unit parameters.
3. The measurement performed using a wideband RF power meter.
4. This EUT was tested under all configurations and the highest power was investigated and reported.



3.3. Test Result

Ambient temperature : (23 ± 1) °C
 Relative humidity : 47 % R.H.

CDMA BC 0 - 1XRTT							
Radio Configuration	Service Option	Conducted Output Power					
		1013 (824.70 MHz)		384 (836.52 MHz)		777 (848.31 MHz)	
		(dB m)	(W)	(dB m)	(W)	(dB m)	(W)
RC1 (Fwd1, Rvs1)	2 (Loopback)	22.81	0.191	22.69	0.186	<u>22.95</u>	<u>0.197</u>
	55 (Loopback)	22.84	0.192	22.65	0.184	22.89	0.195
RC2 (Fwd2, Rvs2)	9 (Loopback)	22.83	0.192	22.69	0.186	22.93	0.196
	55 (Loopback)	22.89	0.195	22.68	0.185	22.92	0.196
RC3 (Fwd3, Rvs3)	2 (Loopback)	22.82	0.191	22.64	0.184	22.91	0.195
	55 (Loopback)	22.81	0.191	22.63	0.183	22.89	0.195
	32 (+F-SCH)	22.88	0.194	22.69	0.186	22.88	0.194
	32 (+SCH)	22.89	0.195	22.65	0.184	22.91	0.195
RC4 (Fwd4, Rvs3)	2 (Loopback)	22.87	0.194	22.69	0.186	22.93	0.196
	55 (Loopback)	22.88	0.194	22.68	0.185	22.95	0.197
	32 (+F-SCH)	22.88	0.194	22.70	0.186	22.92	0.196
	32 (+SCH)	22.88	0.194	22.69	0.186	22.93	0.196
RC5 (Fwd5, Rvs4)	9 (Loopback)	22.82	0.191	22.65	0.184	22.92	0.196
	55 (Loopback)	22.81	0.191	22.70	0.186	22.90	0.195

CDMA BC 0 - EV-DO							
Radio Configuration	3GPP Release Version	Conducted Output Power					
		1013 (824.70 MHz)		384 (836.52 MHz)		777 (848.31 MHz)	
		(dB m)	(W)	(dB m)	(W)	(dB m)	(W)
Rel. 0	FTAP (307.2 kbps, QPSK)	22.79	0.190	22.66	0.185	22.89	0.195
	RTAP (153.6 kbps)	22.83	0.192	22.75	0.188	<u>22.94</u>	<u>0.197</u>
Rev. A	FETAP (307.2 kbps, QPSK)	22.84	0.192	22.66	0.185	22.87	0.194
	RETAP (4096 bits)	22.86	0.193	22.69	0.186	22.94	0.197

CDMA BC 1 - 1XRTT							
Radio Configuration	Service Option	Conducted Output Power					
		25 (1 851.25 MHz)		666 (1 880 MHz)		1175 (1 908.75 MHz)	
		(dB m)	(W)	(dB m)	(W)	(dB m)	(W)
RC1 (Fwd1, Rvs1)	2 (Loopback)	23.81	0.240	23.49	0.223	23.02	0.200
	55 (Loopback)	23.82	0.241	23.48	0.223	23.00	0.200
RC2 (Fwd2, Rvs2)	9 (Loopback)	23.85	0.243	23.49	0.223	22.97	0.198
	55 (Loopback)	23.81	0.240	23.45	0.221	22.96	0.198
RC3 (Fwd3, Rvs3)	2 (Loopback)	23.79	0.239	23.44	0.221	22.99	0.199
	55 (Loopback)	23.80	0.240	23.45	0.221	22.96	0.198
	32 (+F-SCH)	23.81	0.240	23.41	0.219	22.98	0.199
	32 (+SCH)	22.82	0.191	23.41	0.219	22.95	0.197
RC4 (Fwd4, Rvs3)	2 (Loopback)	23.82	0.241	23.41	0.219	22.95	0.197
	55 (Loopback)	23.81	0.240	23.46	0.222	22.99	0.199
	32 (+F-SCH)	23.82	0.241	23.44	0.221	22.98	0.199
	32 (+SCH)	23.81	0.240	23.49	0.223	22.99	0.199
RC5 (Fwd5, Rvs4)	9 (Loopback)	23.82	0.241	23.42	0.220	22.97	0.198
	55 (Loopback)	23.81	0.240	23.46	0.222	22.99	0.199

CDMA BC 1 - EV-DO							
Radio Configuration	3GPP Release Version	Conducted Output Power					
		25 (1 851.25 MHz)		666 (1 880 MHz)		1175 (1 908.75 MHz)	
		(dB m)	(W)	(dB m)	(W)	(dB m)	(W)
Rel. 0	FTAP (307.2 kbps, QPSK)	23.78	0.239	23.46	0.222	22.98	0.199
	RTAP (153.6 kbps)	23.72	0.236	23.44	0.221	22.92	0.196
Rev. A	FETAP (307.2 kbps, QPSK)	23.76	0.238	23.52	0.225	22.99	0.199
	RETAP (4096 bits)	23.83	0.242	23.46	0.222	22.93	0.196

4. Occupied Bandwidth

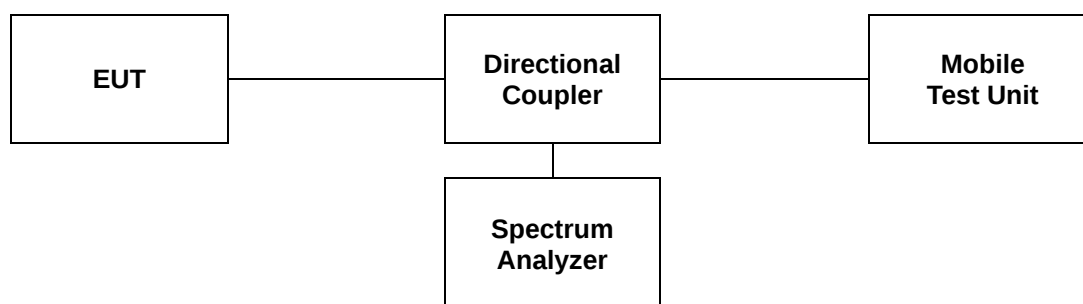
4.1. Limit

CFR 47, Section FCC §2.1049

4.2. Test Procedure

The test follows section 5.4.4 of ANSI C63.26-2015.

- The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation. products including the emission skirts (typically a span of $1.5 \times \text{OBW}$ is sufficient).
- The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1 % to 5 % of the anticipated OBW, and the VBW shall be set $\geq 3 \times \text{RBW}$.
- Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
- Set the detection mode to peak, and the trace mode to max-hold.
- If the instrument does not have a 99 % OBW function, recover the trace data points and sum directly in linear power terms. Place the recovered amplitude data points, beginning at the lowest frequency, in a running sum until 0.5 % of the total is reached. Record that frequency as the lower OBW frequency. Repeat the process until 99.5 % of the total is reached and record that frequency as the upper OBW frequency. The 99 % power OBW can be determined by computing the difference these two frequencies.
- The OBW shall be reported and plot(s) of the measuring instrument display shall be provided with the test report. The frequency and amplitude axis and scale shall be clearly labeled. Tabular data can be reported in addition to the plot(s).



4.3 Test Results

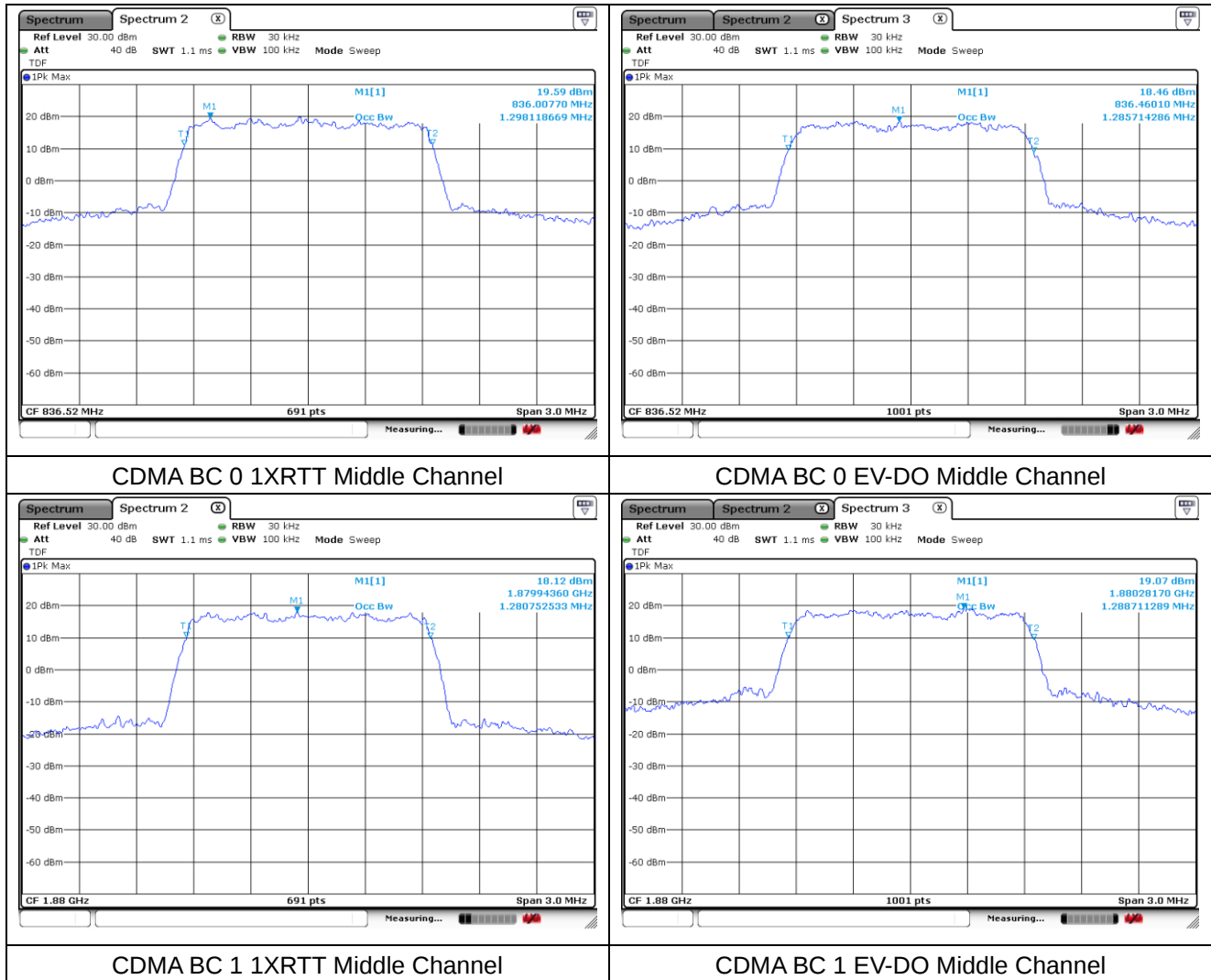
Ambient temperature : $(23 \pm 1) ^\circ\text{C}$
 Relative humidity : 47 % R.H.

Band	Mode	Frequency (MHz)	Occupied Bandwidth (MHz)
CDMA BC 0	1XRTT	836.52	1.298
	EV-DO		1.286
CDMA BC 1	1XRTT	1 880	1.281
	EV-DO		1.289

Note;

There is no limit required and power is the same for low, middle and high channel; therefore, All channels were tested but only middle was reported.

- Test plots



5. Peak-Average Ratio

5.1. Limit

- §22.913(d) Measurement of the ERP of Cellular base transmitters and repeaters must be made using an average power measurement technique. The peak-to-average ratio (PAR) of the transmission must not exceed 13 dB.

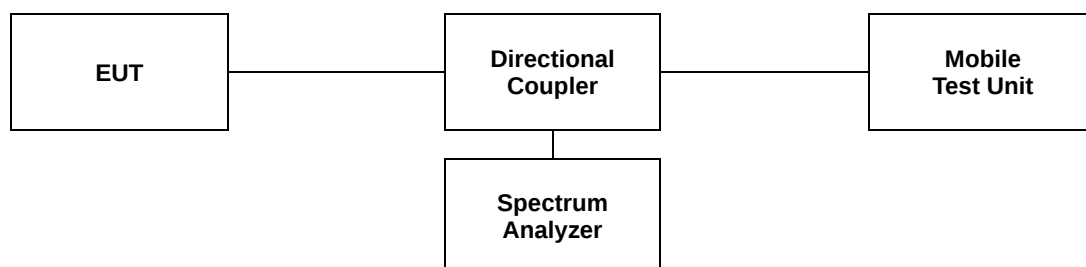
- §24.232(d), power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance 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.

5.2. Test Procedure

The test follows section 5.2.3.4 of ANSI C63.26-2015.

See instrumentation-specific application literature for further guidance regarding use of the CCDF capability. The following guidelines are offered for performing a CCDF measurement.

- a. Set resolution/measurement bandwidth $\geq$ OBW or specified reference bandwidth.
- b. Set the number of counts to a value that stabilizes the measured CCDF curve.
- c. Set the measurement interval as follows:
 - 1) For continuous transmissions, set to greater of $[10 \times (\text{number of points in sweep}) \times (\text{transmission symbol period})]$ or 1 ms.
 - 2) For burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize. Set the measurement interval to a time that is less than or equal to the burst duration.
 - 3) If there are several carriers in a single antenna port, the peak power shall be determined for each individual carrier (by disabling the other carriers while measuring the required carrier) and the total peak power calculated from the sum of the individual carrier peak powers.
- d. Record the maximum PAPR level associated with a probability of 0.1 %.
- e. The peak power level is calculated from the sum of the PAPR value from step d) to the measured average power.



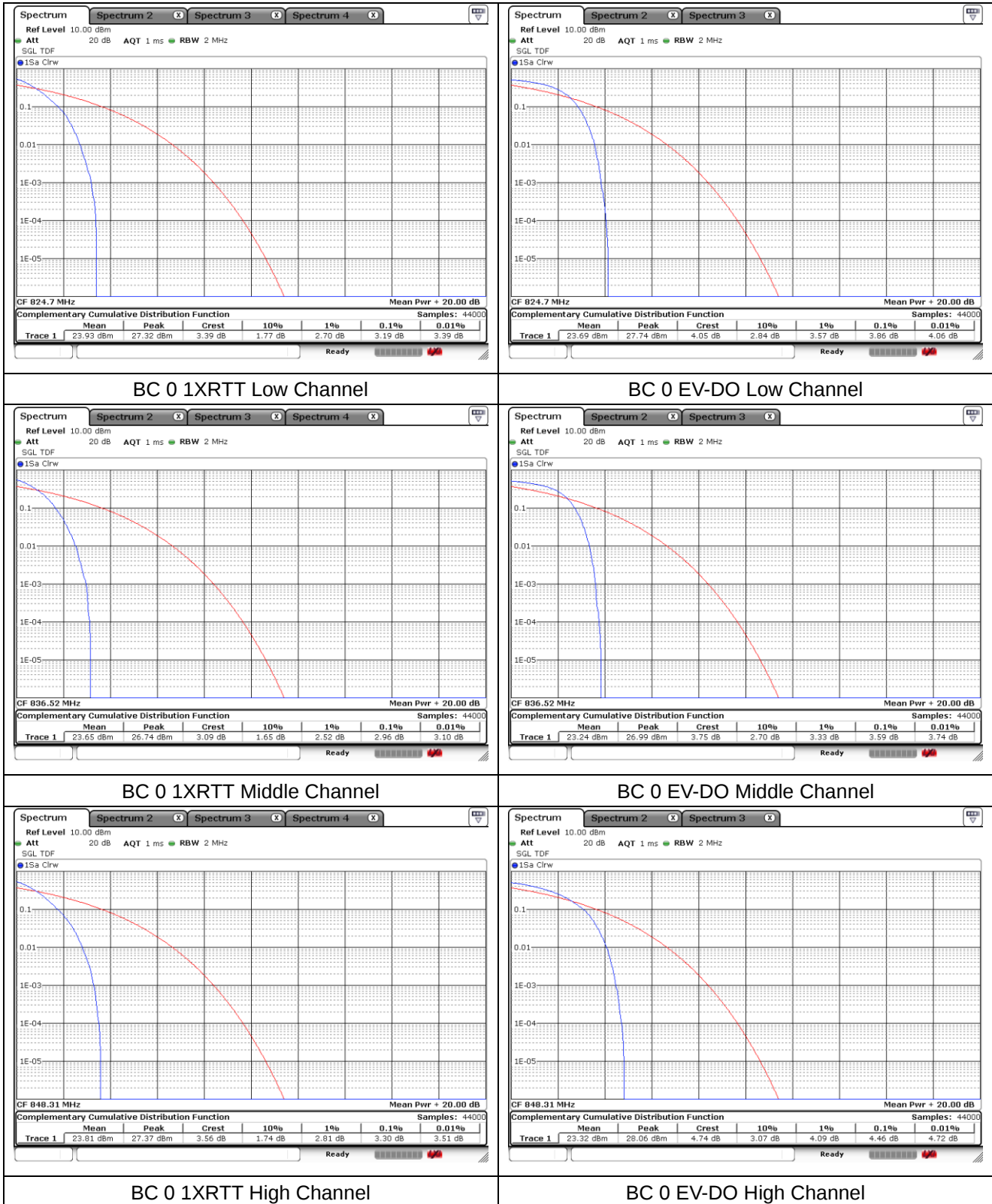
5.3 Test Results

Ambient temperature : (23 ± 1) °C
 Relative humidity : 47 % R.H.

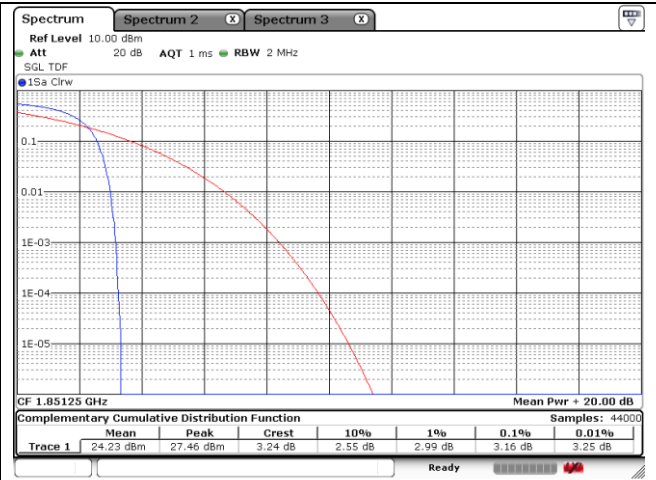
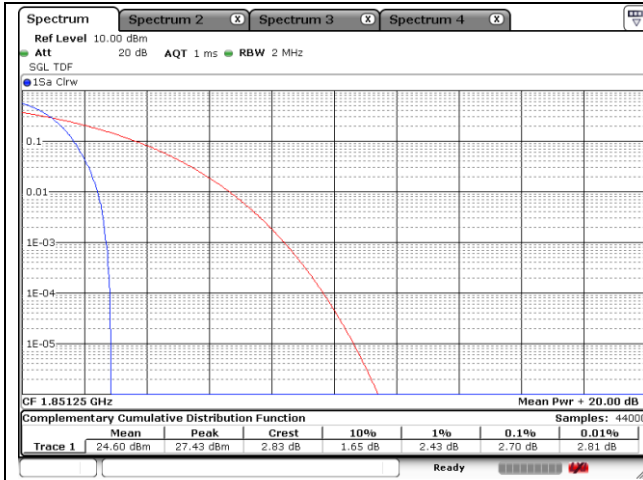
Band	Mode	Frequency (MHz)	PAR (dB)
CDMA BC 0	1XRTT	824.70	3.19
		836.52	2.96
		848.31	3.30
	EV-DO	824.70	3.86
		836.52	3.59
		848.31	4.46
CDMA BC 1	1XRTT	1 851.25	2.70
		1 880	3.13
		1 908.75	2.90
	EV-DO	1 851.25	3.16
		1 880	3.51
		1 908.75	2.78

- Test plots

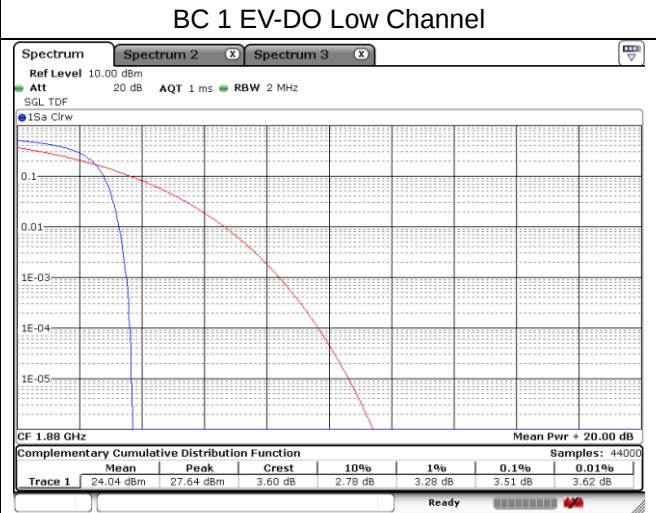
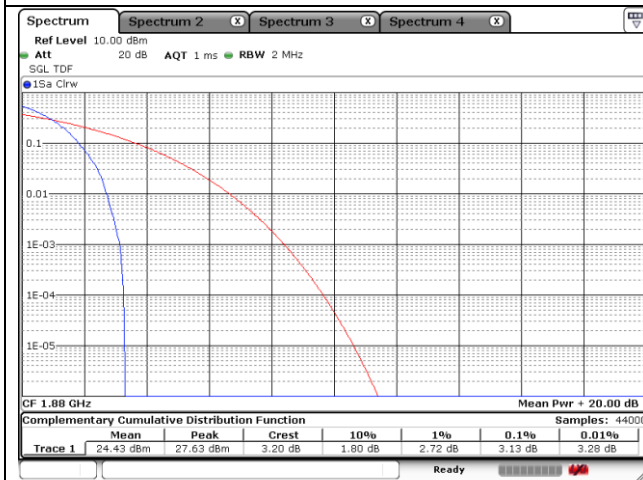
CDMA BC 0



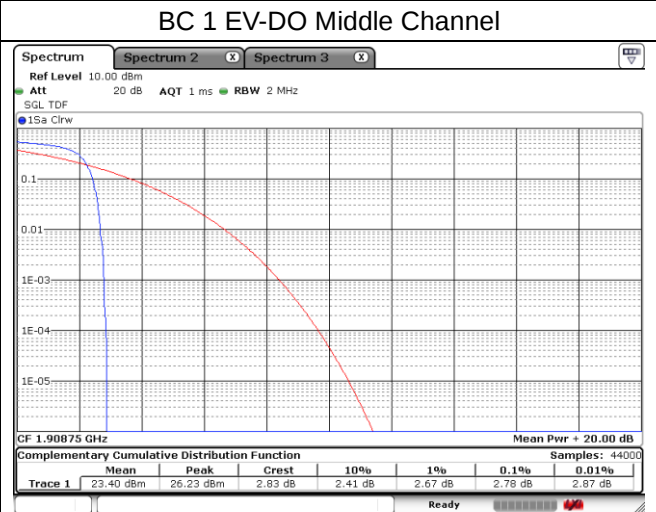
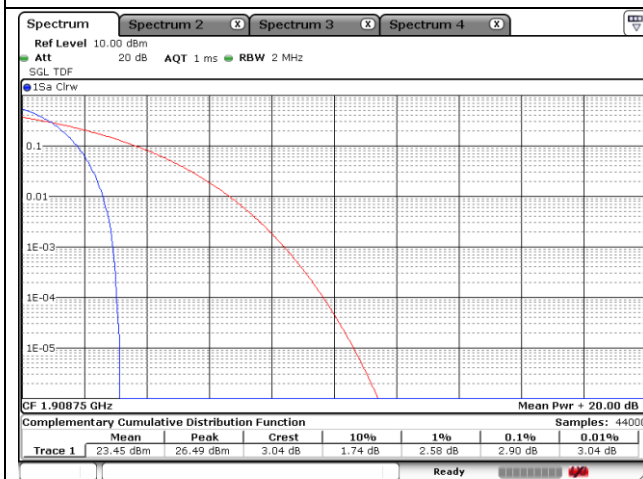
CDMA BC 1



BC 1 1XRTT Low Channel



BC 1 1XRTT Middle Channel



BC 1 1XRTT High Channel

BC 1 EV-DO High Channel

6. Spurious Emissions at Antenna Terminal

6.1. Limit

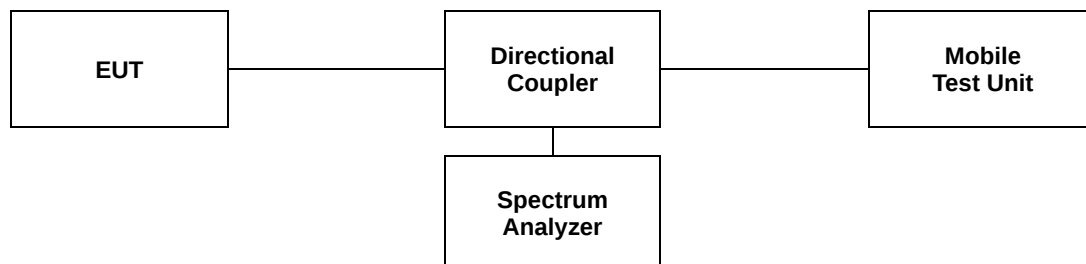
- §22.917(a), the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10\log(P)$ dB.

- §24.238(a), the power of any emission 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.

6.2. Test Procedure

The test follows section 5.7 of ANSI C63.26-2015.

1. Start frequency was set to 9 kHz and stop frequency was set to at least 10* the fundamental frequency.
2. Detector = Peak.
3. Trace mode = Max hold.
4. Sweep time = Auto couple.
5. The trace was allowed to stabilize.
6. Please see notes below for RBW and VBW settings.
7. For plots showing conducted spurious emissions from 9 kHz to 20 GHz, all path loss of wide frequency range was investigated and compensated to spectrum analyzer as TDF function.



Note;

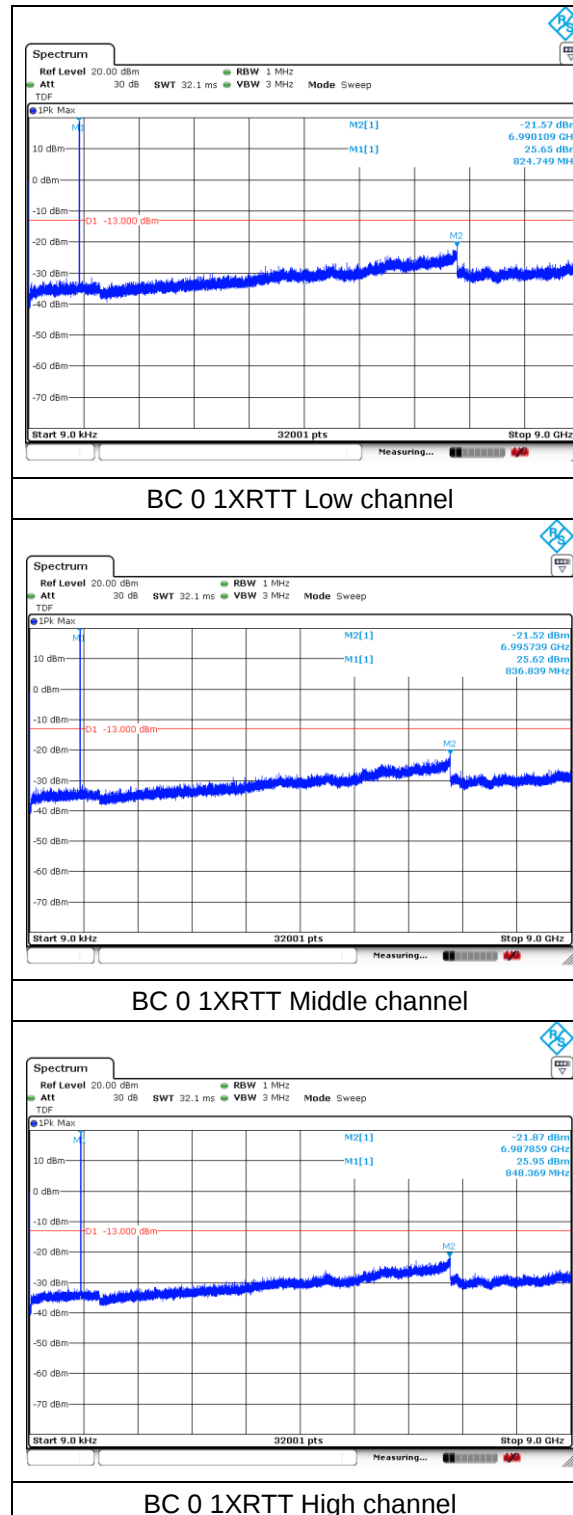
Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for frequencies less than 1 GHz and frequencies greater than 1 GHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two point, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

6.3. Test Results

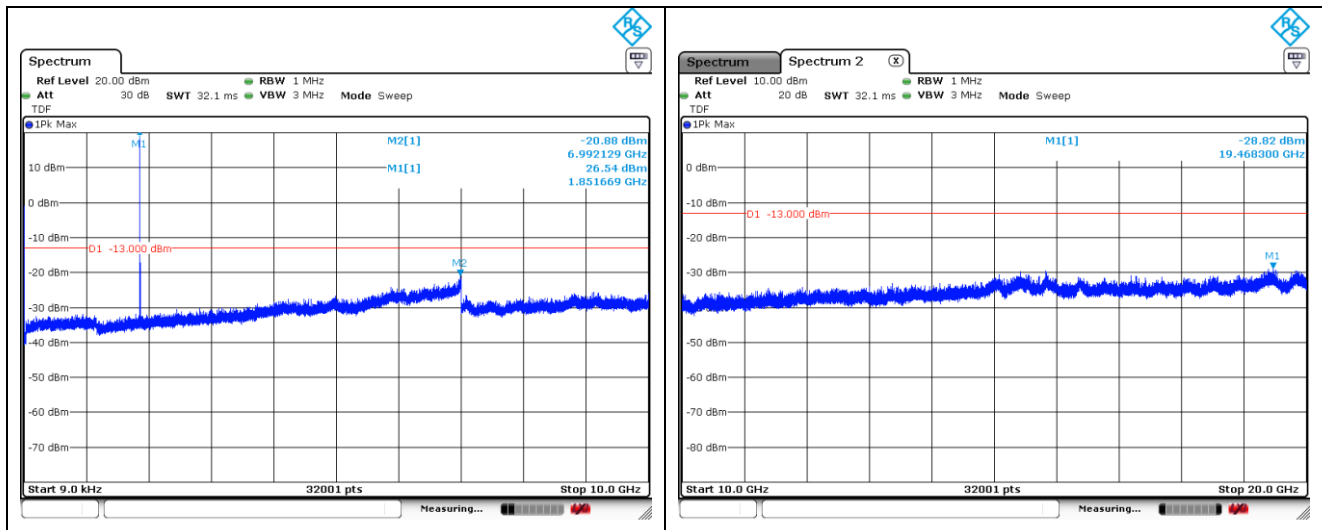
Ambient temperature : (23 ± 1) °C
 Relative humidity : 47 % R.H.

- Test plots

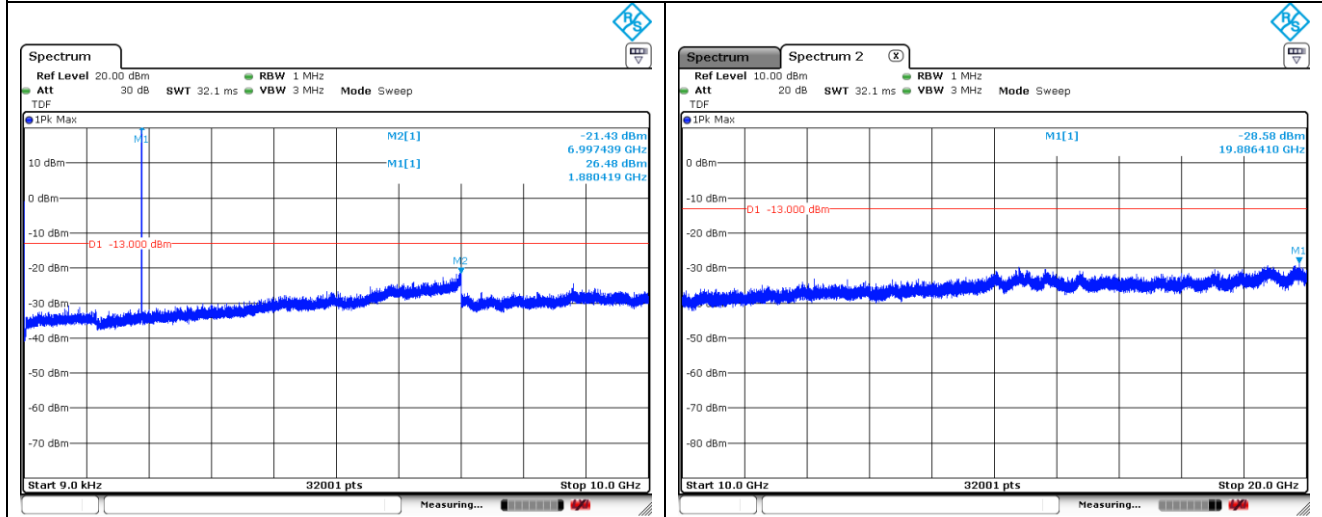
CDMA BC 0



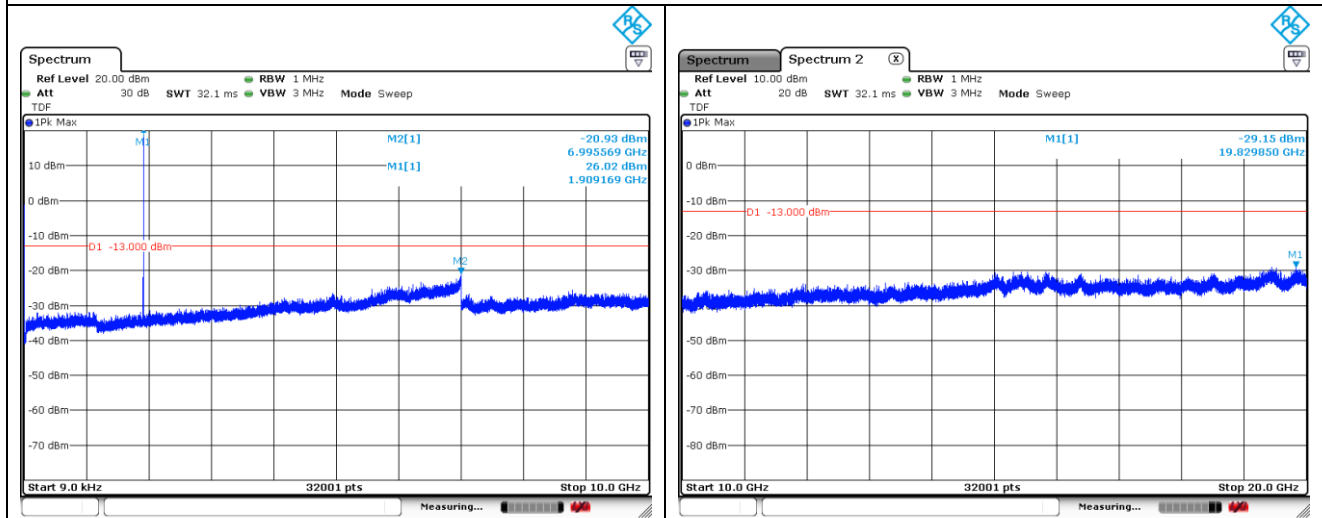
CDMA BC 1



BC 1 1XRTT Low Channel



BC 1 1XRTT Middle Channel



BC 1 1XRTT High Channel

7. Band Edge

7.1. Limit

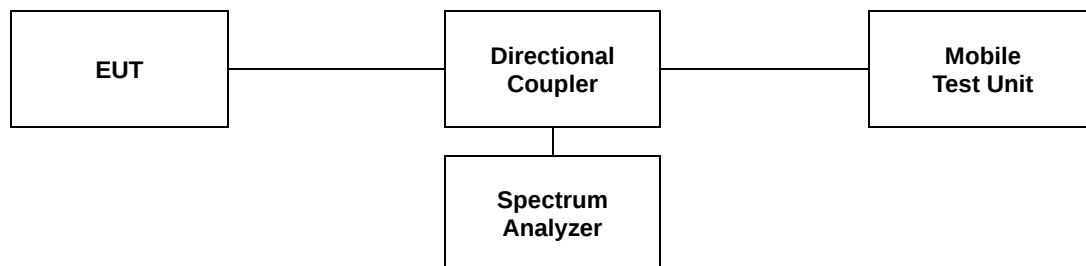
- §22.917(a), the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10\log(P)$ dB.

- §24.238(a), the power of any emission 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.

7.2. Test Procedure

The test follows section 5.7 of ANSI C63.26-2015.

- a. Span was set large enough so as to capture all out of band emissions near the band edge.
- b. RBW ≥ 1 % of OBW
- c. VBW $\geq 3 \times$ RBW.
- d. Detector = RMS.
- e. Trace mode = Average.
- f. Sweep time = Auto.
- g. The trace was allowed to stabilize.
- h. All path loss of frequency range was investigated and compensated to spectrum analyzer as TDF function.

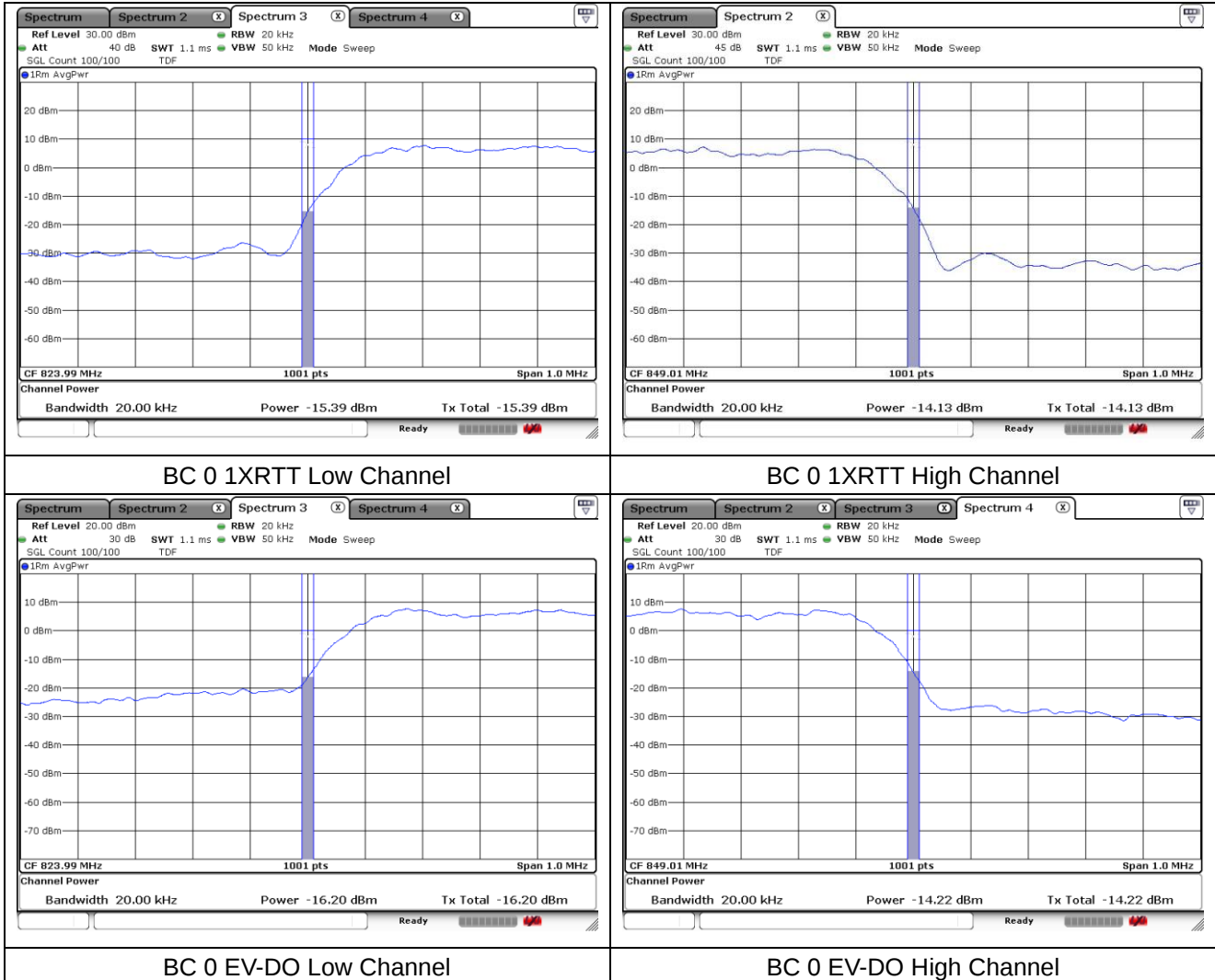


7.3. Test Results

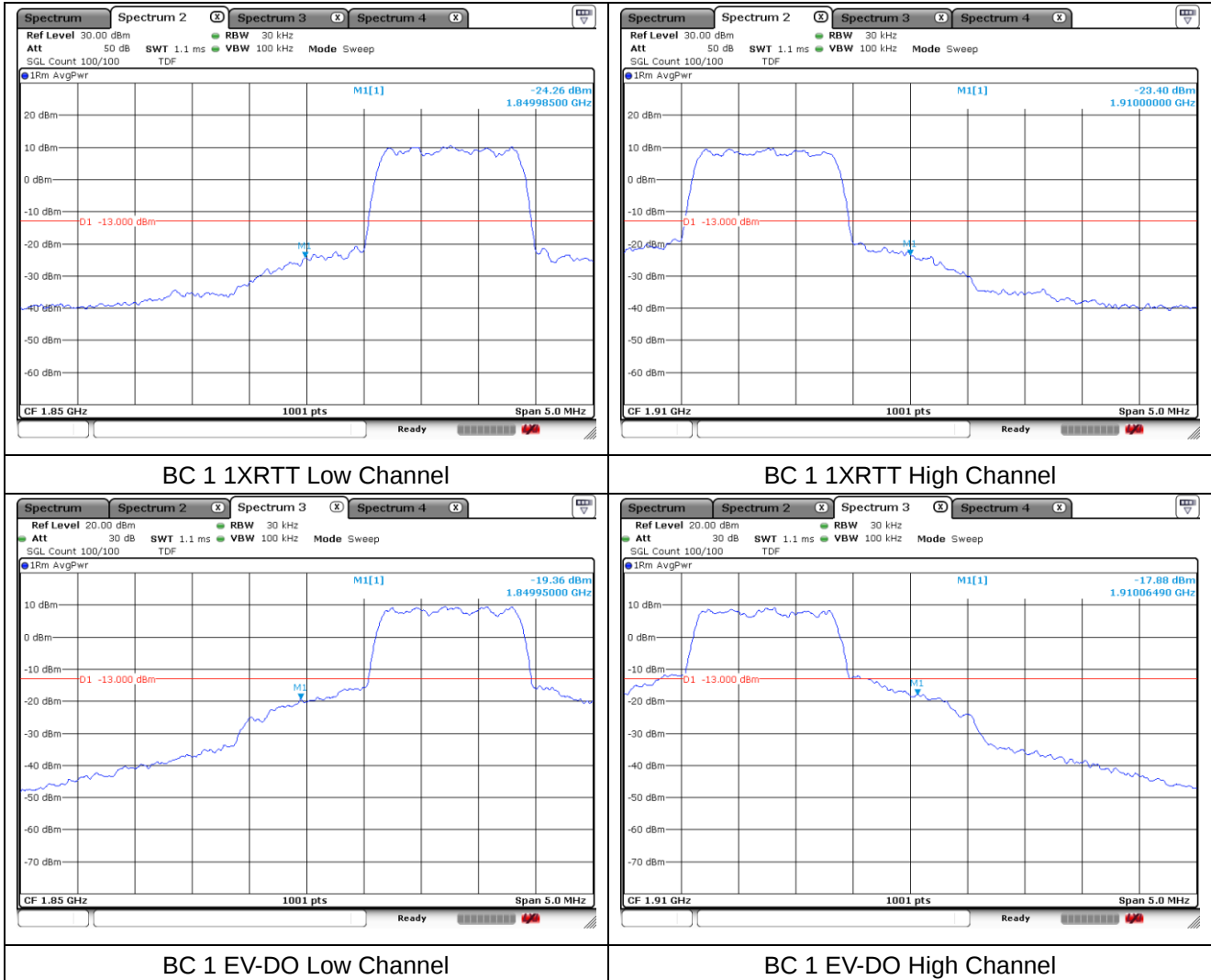
Ambient temperature : $(23 \pm 1) ^\circ\text{C}$
Relative humidity : 47 % R.H.

- Test plots

CDMA BC 0



CDMA BC 1



8. Frequency Stability

8.1. Limit

- § 2.1055 (a), § 2.1055 (d) & following:

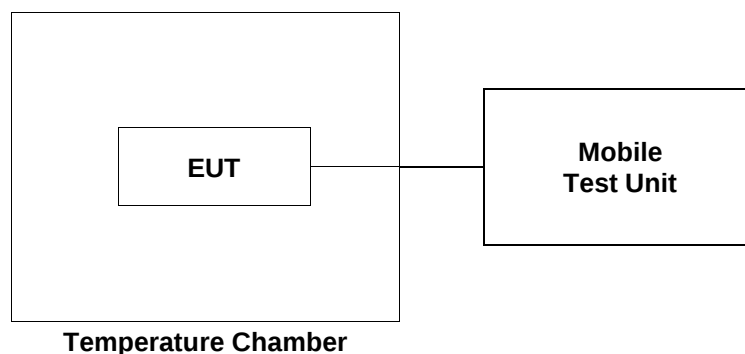
- §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table of this section.

For Mobile devices operating in the 824 to 849 MHz band at a power level less than or equal to 3 Watts, the limit specified in Table C-1 is +/- 2.5 ppm.

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

8.2. Test Procedure

1. Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to a Mobile Test Unit via feed-through attenuators.
2. The EUT was placed inside the temperature chamber.
3. After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from Mobile Test Unit.



8.3. Test Results

Ambient temperature : (23 ± 1) °C
 Relative humidity : 47 % R.H.

CDMA BC 0 mode at middle channel

Reference Frequency: 836.52 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	4.00	-3.40	0.000 96
40		-2.50	0.002 03
30		-3.40	0.000 96
20(Ref.)		-4.20	-
10		-6.40	-0.002 63
0		-5.00	-0.000 96
-10		-4.60	-0.000 48
-20		-4.90	-0.000 84
-30		-7.40	-0.003 83
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	3.40 (85%)	-4.10	0.000 12
	4.60 (115%)	-3.50	0.000 84

CDMA BC 1 mode at middle channel

Reference Frequency: 1 880 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	4.00	2.20	-0.001 38
40		3.50	-0.000 69
30		2.60	-0.001 17
20(Ref.)		4.80	-
10		1.90	-0.001 54
0		-2.40	-0.003 83
-10		-3.10	-0.004 20
-20		-4.80	-0.005 11
-30		-6.50	-0.006 01
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	3.40 (85%)	4.60	-0.000 11
	4.60 (115%)	4.50	-0.000 16

- End of the Test Report -