FCC Partial Scope Test Report

(Unwanted Emissions - Radiated)

FOR

Verizon Telematics

Model Number: AT-155

GPS Navigation Device with CDMA2000 and Bluetooth

FCC ID: ZOQAT-155

47 CFR Part 2, 22, 24

TEST REPORT #: EMC_VERIT-007-15001_FCC22_24_AT-155

DATE: 2015-Jun-11

IC recognize# 3462B-1

***CETECOM* Inc.**

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CETECOM Inc. is a Delaware Corporation with Corporation number: 2905571

Table of Contents

1 Assessment

The following device was evaluated against the applicable criteria specified in FCC rules parts 2, 22 and 24 of Title 47 of the Code of Federal Regulations.

No deviations were ascertained during the course of the tests performed.

Company	Description	Model #
Verizon Telematics, Inc	**GPS Navigation Device with CDMA2000 and Bluetooth**	AT-155

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2015-06-11	Compliance	Franz Engert (Manager Compliance)	Digitally signed by Franz Engert DN: cn=Franz Engert, c=US, o=CETECOM, ou=Complience, email=franz.engert@cetecom.com Date: 2015.06.19 19:17:38 -07'00'

Responsible for the Report:

Date	Section	Name	Signature
2015-06-11	Compliance	Danh Le (EMC Engineer)	Digitally signed by Danh Le DN: cn=Danh Le, o=Cetecom, ou=Compliance, email=danh.le@cetecom.com, c=US Date: 2015.06.12 18:53:58 -07'00'

The test results of this test report relate exclusively to the test item specified in Section3.
CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Address:	411 Dixon Landing Road Milpitas, CA 95035 U.S.A.
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Compliance Manager:	Franz Engert
Test Engineer:	Danh Le

2.2 Identification of the Client

Applicant's Name:	Verizon Telematics, Inc.
Street Address:	2002 Summit Blvd., Suite 1800
City/Zip Code	Atlanta, GA 30319
Country	USA
Contact Person:	Bryant Elliot
Phone No.	404-573-5848
Fax:	---
e-mail:	Bryant.elliot@verizon.com

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as above
Manufacturers Address:	
City/Zip Code	
Country	

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name:	in-Drive Communicator AT-155
Model Number:	AT-155
FCC-ID :	ZOQAT-155
IC ID:	n/a
Product Description:	**GPS Navigation Device with CDMA2000 and Bluetooth**
Technology / Type(s) of Modulation:	CDMA2000 / BPSK/QPSK/HPSK
Integrated Module Info:	**Sierra Wireless SL3010T** -850/1900 MHz CDMA2000 radio module (FCC ID: N7NSL5011)
Operating Frequency Ranges (MHz) / Channels:	CDMA 850: 824.70-848.31 CDMA 1900: 1851.25- 1908.75
Antenna info:	Antenna Type: PIFA, dual band Max. Peak Gain: -1.7 dBi @ 850 MHz) Max. Peak Gain: 0.4 dBi @ 1900 MHz)
Rated Operating Voltage Range:	Vmin: 10 Vdc / Vnom: 12.5 Vdc / Vmax: 14.5 Vdc
Rated Operating Temperature Range:	Tmin: -40°C/ Tnom: 25°C / Tmax: 85°C
Other Radios:	1. GPS Receiver 2. Bluetooth v2.1 + EDR / LE 4.0 radio (Integrated BlueCore® CSR8811 Dual-mode)
Test Sample Status:	Prototype

3.2 Identification of the Equipment under Test (EUT)

EUT #	HW / SW Version	Sample	Serial Number
1	A0 / V1.0.0	Radiated	AT-150#13

3.3 Identification of Accessory equipment

AE #	Type	Manufacturer	Model	Serial Number/PN
1	J1962M to J1962F adaptor cable	OBD2cables.com	OBD II	144302

3.4 Environmental conditions during Test:

The following environmental conditions were maintained during the course of testing:
Ambient Temperature: 20°C - 25°C
Relative humidity: 25% - 27%

3.5 Dates of Testing:

2015/04/13

3.6 Inheriting Test Results from Incorporated Module Certification and Sister Model:

The EUT integrates the pre-certified Sierra Wireless SL3010T CDMA module with FCC ID: N7NSL5011. Conducted test results as documented in the related module test reports "SL5011 Test Report for FCC and IC Certifications", February 18, 2011 and Sierra Wireless "SL3010T Test Report for FCC", August 22, 2013 are declared to accurately represent the situation under the new conditions when the identified radio module is integrated in the identified host equipment.

FCC part 22/24 ERP/EIRP results are leveraged from the partial scope test report "EMC_VERIT-006-15001_FCC22_24_AT-150" issued by CETECOM Inc on March 25, 2015 for previous approval of the sister model AT-150, which is identical to the model AT-155 at hand, including antenna, except from a different Bluetooth radio portion.

Guidance from modular approval (and for integration of modules) as laid down in FCC KDB 996369 is followed.

3.7 Other Testing Notes:

n/a

3.8 Measurement Method:

Testing is performed according to the guidelines provided in FCC publication (KDB) 971168 D01, v02r02: Measurement Guidance for Certification of Licensed Digital Transmitters, 2014-10-17 and according to relevant parts of TIA-603C 2004 as detailed below.

4 Subject of Investigation

The objective of the measurements applied by CETECOM Inc. was to establish compliance of the EUT as described under Ch. 3 of this Test Report, with the applicable criteria specified in

- 47 CFR Part 2: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission Frequency allocations and radio treaty matters; general rules and regulations.
- 47 CFR Part 22: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission subchapter B- common carrier services; Part 22- Public mobile services
- 47 CFR Part 24: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission subchapter B- common carrier services; Part 24- Personal communication services

5 Summary of Measurement Results

CDMA 850MHz Band:

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046 §22.913 (a)	RF Output Power & ERP/EIRP	Nominal	CDMA 2000	☐	☐	☐	■	Note 1
§2.1055 §22.355	Frequency Stability	Nominal	CDMA 2000	☐	☐	☐	■	Note 1
§2.1049 §22.917(b)	Occupied Bandwidth	Nominal	CDMA 2000	☐	☐	☐	■	Note 1
§2.1051 §22.917	Band Edge Compliance	Nominal	CDMA 2000	☐	☐	☐	■	Note 1
§2.1051 §22.917	Conducted Spurious Emissions	Nominal	CDMA 2000	☐	☐	☐	■	Note 1
§2.1053 §22.917	Radiated Spurious Emissions	Nominal	CDMA 2000	■	☐	☐	☐	Complies

Note: NA= Not Applicable; NP= Not Performed.
Note 1: Leveraged from test reports of certification of the incorported CDMA 2000 module or the sister model AT-150

CDMA 1900MHz Band:

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046 §24.232 (a)	RF Output Power & ERP/EIRP	Nominal	CDMA 2000	☐	☐	☐	■	Note 1
§2.1055 §24.235	Frequency Stability	Nominal	CDMA 2000	☐	☐	☐	■	Note 1
§2.1049 §24.238(b)	Occupied Bandwidth	Nominal	CDMA 2000	☐	☐	☐	■	Note 1
§2.1051 §24.238	Band Edge Compliance	Nominal	CDMA 2000	☐	☐	☐	■	Note 1
§2.1051 §24.238	Conducted Spurious Emissions	Nominal	CDMA 2000	☐	☐	☐	■	Note 1
§2.1053 §24.238	Radiated Spurious Emissions	Nominal	CDMA 2000	■	☐	☐	☐	Complies

Note: NA= Not Applicable; NP= Not Performed
Note 1: Leveraged from test reports of certification of the incorported CDMA 2000 module or the sister model AT-150.

6 Measurements

6.1 Spurious Emissions Radiated

6.1.1 References

FCC: CFR Part 2.1053, CFR Part 22.917, CFR Part 24.238

6.1.2 Measurement requirements:

6.1.2.1 FCC 2.1053: Field strength of spurious radiation.

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission.

The different cellular operation modes of the EUT as required for testing are controlled through the link with the Digital Radio Communication Tester (R&S CMU200).

The EUT is tested on the low, mid and high channel of each of the supported cellular operation modes.

6.1.3 Limits:

(a) *Out of band emissions*. 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, where P is power in watt.
For all power levels +30dBm to 0dBm, this becomes a constant specification of -13dBm.

6.1.3.1 FCC 22.917 Emission limitations for cellular equipment.

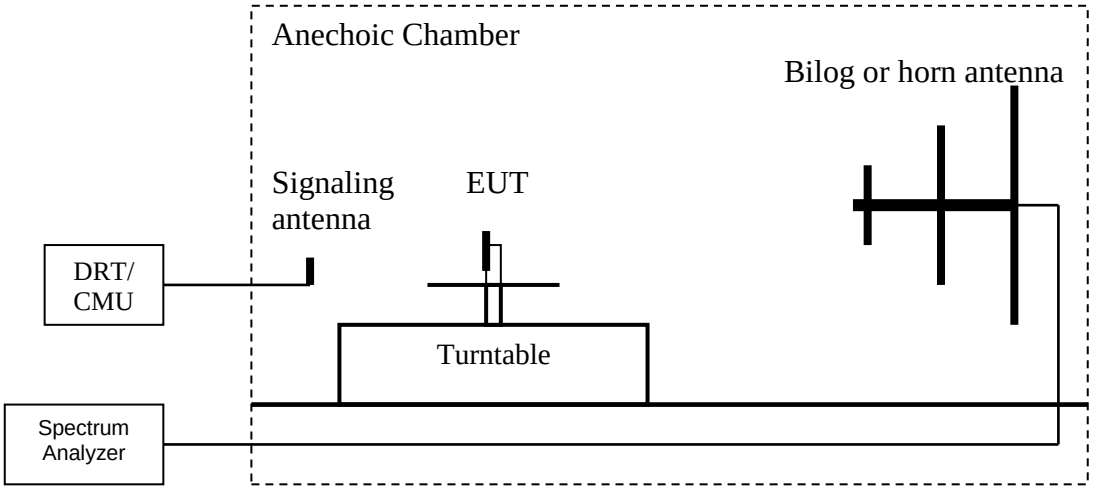
The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.
(b) *Measurement procedure.* Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands 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. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 100 kHz of 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

6.1.3.2 FCC 24.238 Emission limitations for Broadband PCS equipment.

The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.
(b) Measurement procedure. Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. 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. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 100 kHz of 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

6.1.4 Radiated out of band measurement procedure:

Ref: TIA-603C 2004- 2.2.12 Unwanted emissions: Radiated Spurious



1. Connect the equipment as shown in the above diagram with the EUT's antenna in a horizontal orientation.
2. Adjust the settings of the Digital Radio Communication Tester (DRT) to set the EUT to its maximum power at the required channel.
3. Set the spectrum analyzer to measure peak hold with the required settings.
4. Place the measurement antenna in a horizontal orientation. Rotate the EUT 360°. Raise the measurement antenna up to 4 meters in 0.5 meters increments and rotate the EUT 360° at each height to maximize all emissions. Measure and record all spurious emissions (**LVL**) up to the tenth harmonic of the carrier frequency.
5. Replace the EUT with a horizontally polarized half wave dipole or known gain antenna. The center of the antenna should be at the same location as the center of the EUT's antenna.
6. Connect the antenna to a signal generator with known output power and record the path loss in dB (**LOSS)**. **LOSS** = Generator Output Power (dBm) – Analyzer reading (dBm).
7. Determine the level of spurious emissions using the following equation:
   Spurious (dBm) = **LVL** (dBm) + **LOSS** (dB):
8. Repeat steps 4, 5 and 6 with all antennas vertically polarized.
9. Determine the level of spurious emissions using the following equation:
   Spurious (dBm) = **LVL** (dBm) + **LOSS** (dB):
10. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.
    (N**ote:** Steps 5 and 6 above are performed prior to testing and **LOSS** is recorded by test software. Steps 3, 4 and 7 above are performed with test software.)

6.1.5 Sample Calculations for Radiated Measurements

6.1.5.1 Power Measurements using Substitution Procedure:

The measurement on the Spectrum Analyzer is used as a basis for the Substitution procedure.
The EUT is replaced with a Signal Generator and an antenna. The setting on the Signal Generator is varied until the Spectrum Analyzer displays the original reading. EIRP is calculated as-

EIRP (dBm)= Signal Generator setting (dBm)- Cable Loss (dB)+ Antenna Gain (dBi)

Example:

Frequency (MHz)	Measured SA (dBµV)	Signal Generator setting (dBm)	Antenna Gain (dBi)	Dipole Gain (dBd)	Cable Loss (dB)	EIRP (dBm)
1000	95.5	24.5	6.5	0	3.5	27.5

6.1.6 Measurement Survey:

The site is constructed in accordance with ANSI C63.4 requirements and is recognized by the FCC to be in compliance for a 3m site. The spectrum is scanned from 30MHz to the 10th harmonic of the highest frequency generated by the EUT.
Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the 850 MHz and 1900 MHz bands of operation.
It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the CDMA 850 MHz and 1900 MHz band into any of the other blocks respectively. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

Radiated emission measurements were made in CDMA 1x modes.
Additional spot checks in mid channel of operation for all modes were performed with the slimmer battery option of the device.

For radiated measurements, all data in this report shows the worst case emissions data between H/V antenna polarizations and for all 3 orthogonal orientations of the EUT.

Unless mentioned otherwise, the emission signals above the limit line in the plots are from the carrier.

6.1.7 Test Conditions:

Tnom: 22^{o}C; Vnom: 12.5 V

6.1.8 Test Results:

6.1.8.1 Transmitter Spurious Emission Test Results in CDMA 850 mode:

Harmonic	Tx ch-1013 Freq. (MHz)	Level (dBm)	Tx ch-384 Freq. (MHz)	Level (dBm)	Tx ch-777 Freq. (MHz)	Level (dBm)
1	**824.7**	Fundamental	**836.52**	Fundamental	**848.31**	Fundamental
2	**1649.4**	-45.080	**1673.04**	-44.515	**1696.62**	-44.432
3	**2474.1**	NF	**2509.56**	NF	**2544.93**	NF
4	**3298.8**	NF	**3346.08**	NF	**3393.24**	NF
5	**4123.5**	NF	**4182.6**	NF	**4241.55**	NF
6	**4948.2**	NF	**5019.12**	NF	**5089.86**	NF
7	**5772.9**	NF	**5855.64**	NF	**5938.17**	NF
8	**6597.6**	NF	**6692.16**	NF	**6786.48**	NF
9	**7422.3**	NF	**7528.68**	NF	**7634.79**	NF
10	**8247**	NF	**8365.2**	NF	**8483.1**	NF
NF = Noise Floor Measurement Uncertainty: ±3dB						

6.1.8.2 Transmitter Spurious Emission Test Results in CDMA-1900 mode:

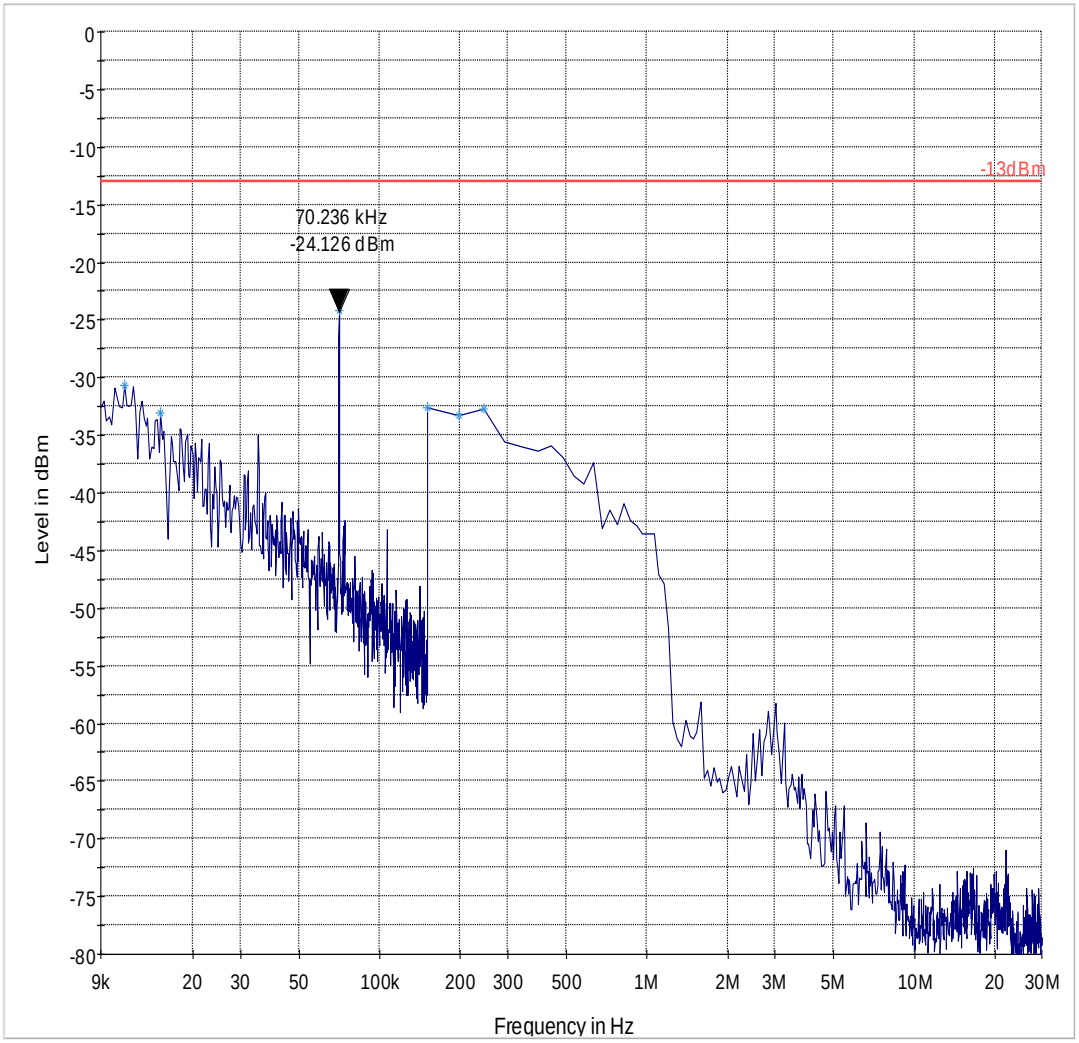
Harmonic	Tx ch-25 Freq.(MHz)	Level (dBm)	Tx ch-600 Freq. (MHz)	Level (dBm)	Tx ch-1175 Freq. (MHz)	Level (dBm)
1	**1851.25**	Fundamental	**1880.0**	Fundamental	**1908.75**	Fundamental
2	**3702.50**	-44.391	**3760**	NF	**3817.5**	-44.526
3	**5553.75**	NF	**5640**	NF	**5726.25**	NF
4	**7405.00**	NF	**7520**	NF	**7635**	NF
5	**9256.25**	NF	**9400**	NF	**9543.75**	NF
6	**11107.50**	NF	**11280**	NF	**11452.50**	NF
7	**12958.75**	NF	**13160**	NF	**13361.25**	NF
8	**14810**	NF	**15040**	NF	**15270**	NF
9	**16661.25**	NF	**16920**	NF	**17178.75**	NF
10	**18512.50**	NF	**18800**	NF	**19087.50**	NF
NF = Noise Floor Measurement Uncertainty: ±3dB						

Plots:

Radiated Spurious Emissions

CDMA 850 Band

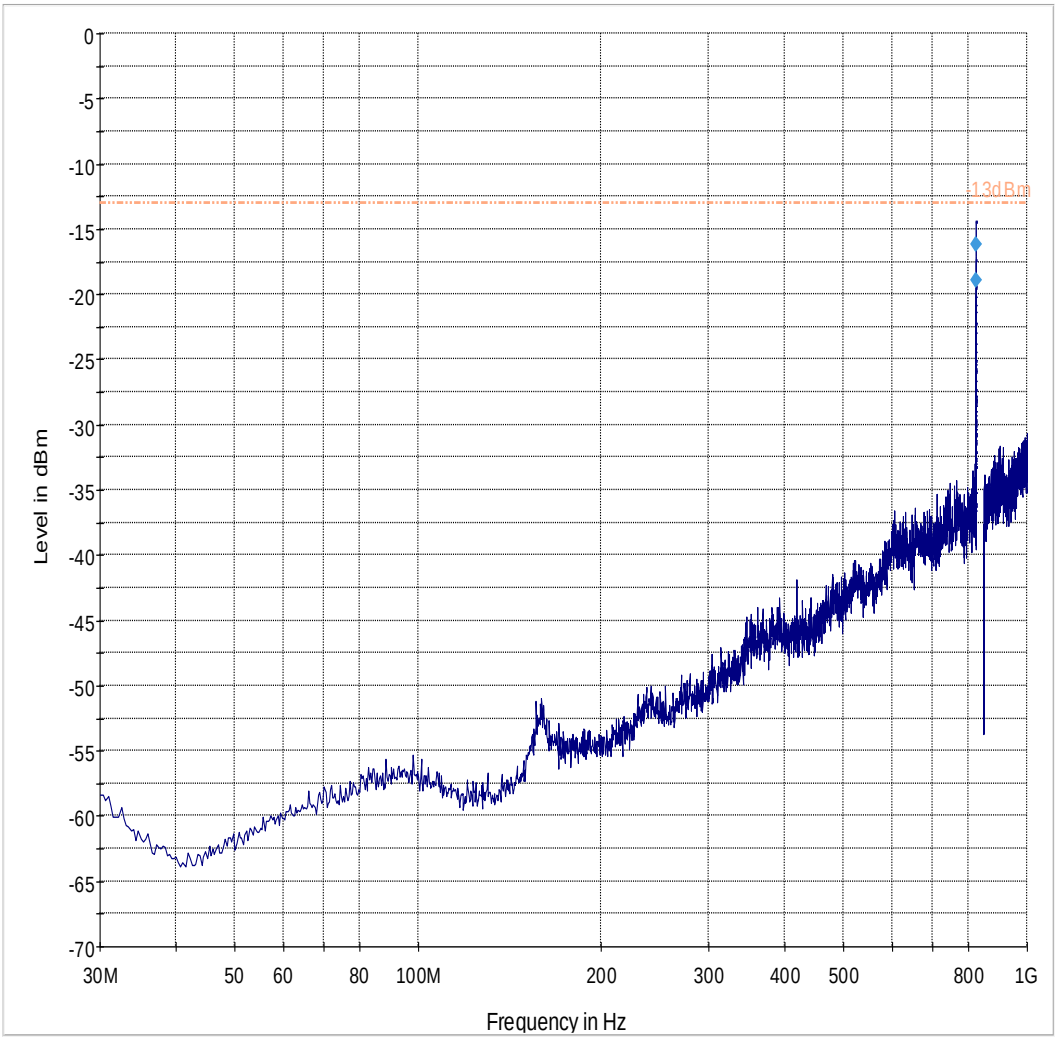
Measured Frequency Range: 9 kHz – 30 MHz –Operating Channel: Mid



Radiated Spurious Emissions

CDMA 850 Band

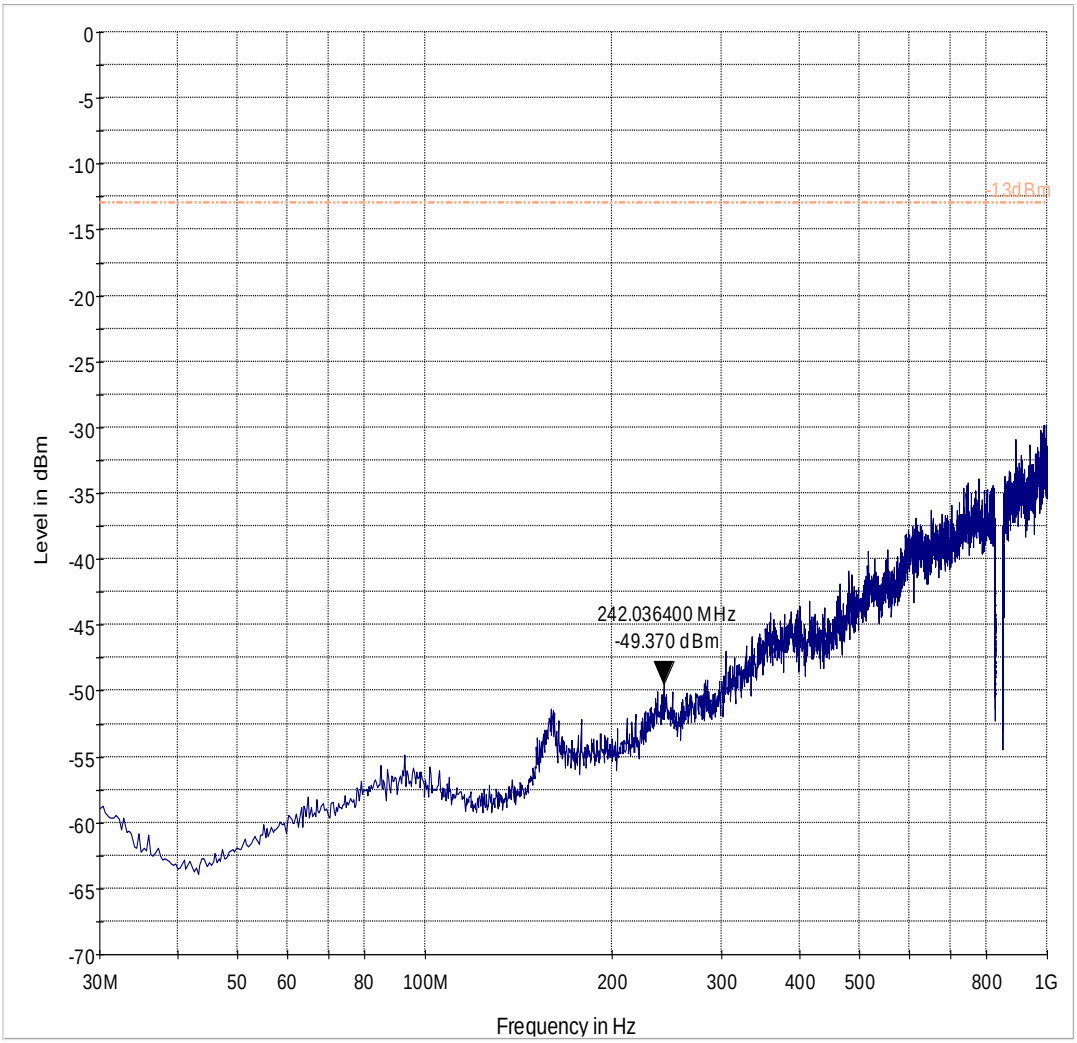
Measured Frequency Range: 30 MHz – 1 GHz –Operating Channel: Low



Radiated Spurious Emissions

CDMA 850 Cellular Band

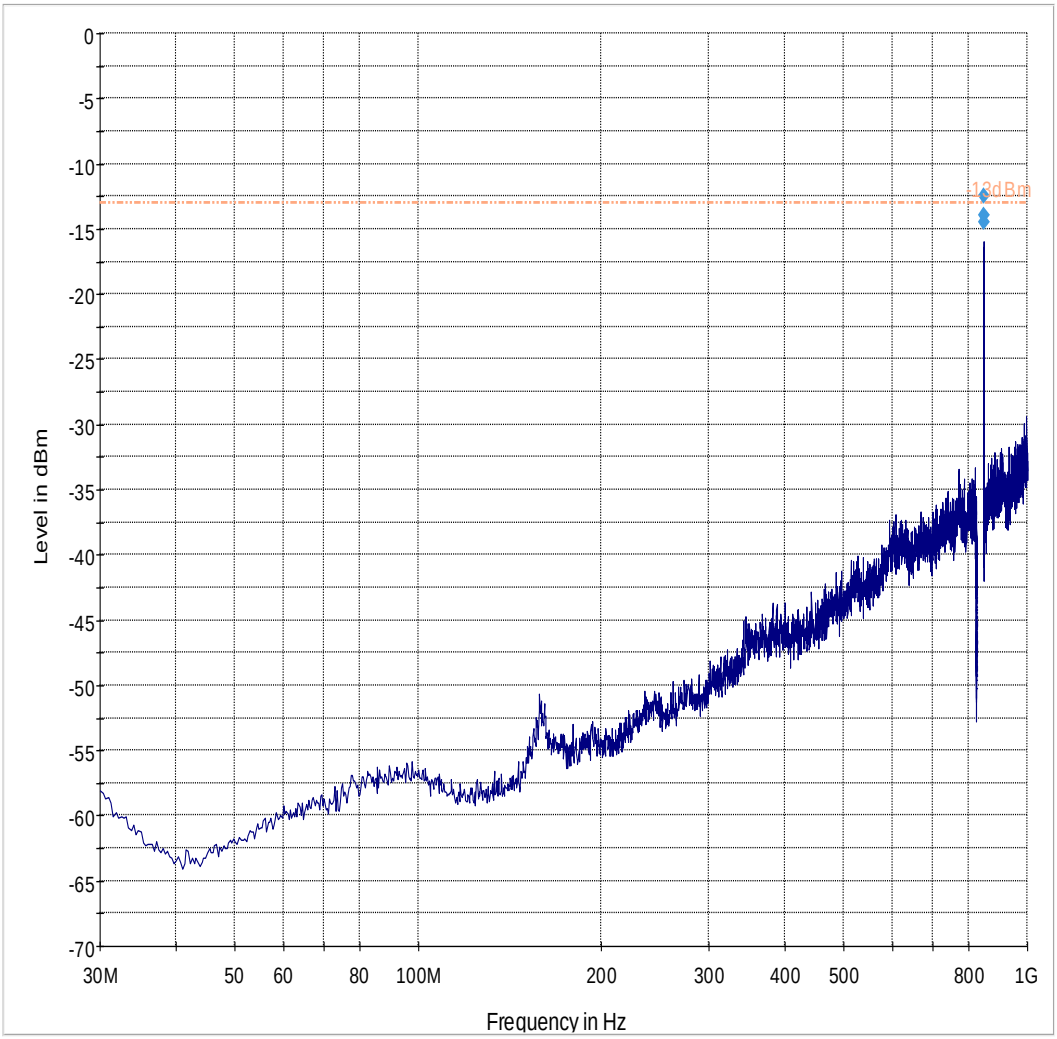
Measured Frequency Range: 30 MHz – 1 GHz –Operating Channel: Mid



Radiated Spurious Emissions

CDMA 850 Cellular Band

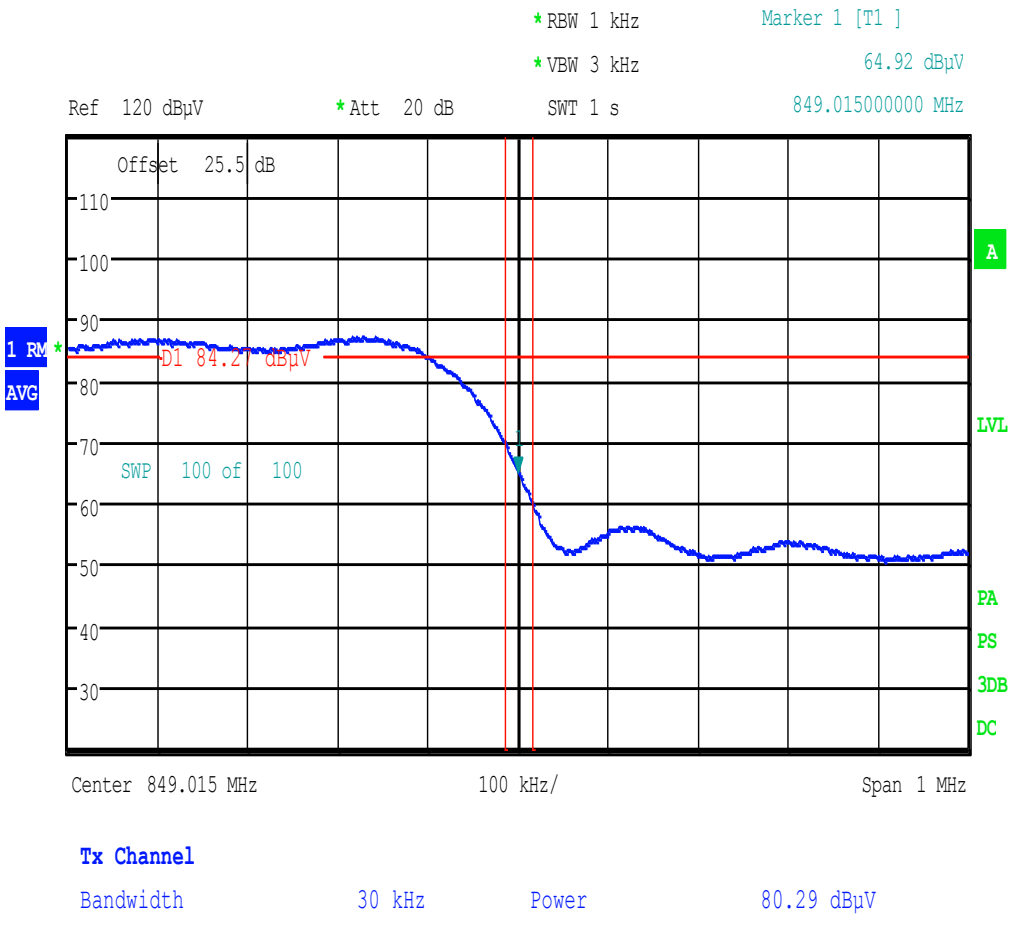
Measured Frequency Range: 30 MHz – 1 GHz –Operating Channel: High



Note: The above scan shows a peak at the upper band edge when EUT is operating directly at the band edge. The method used applies to spurious domain and is worst case for the band edge. Refer to next page for band edge result.

CDMA 850 Cellular Band

Measured Frequency Range: 30 MHz – 1 GHz –Operating Channel: High



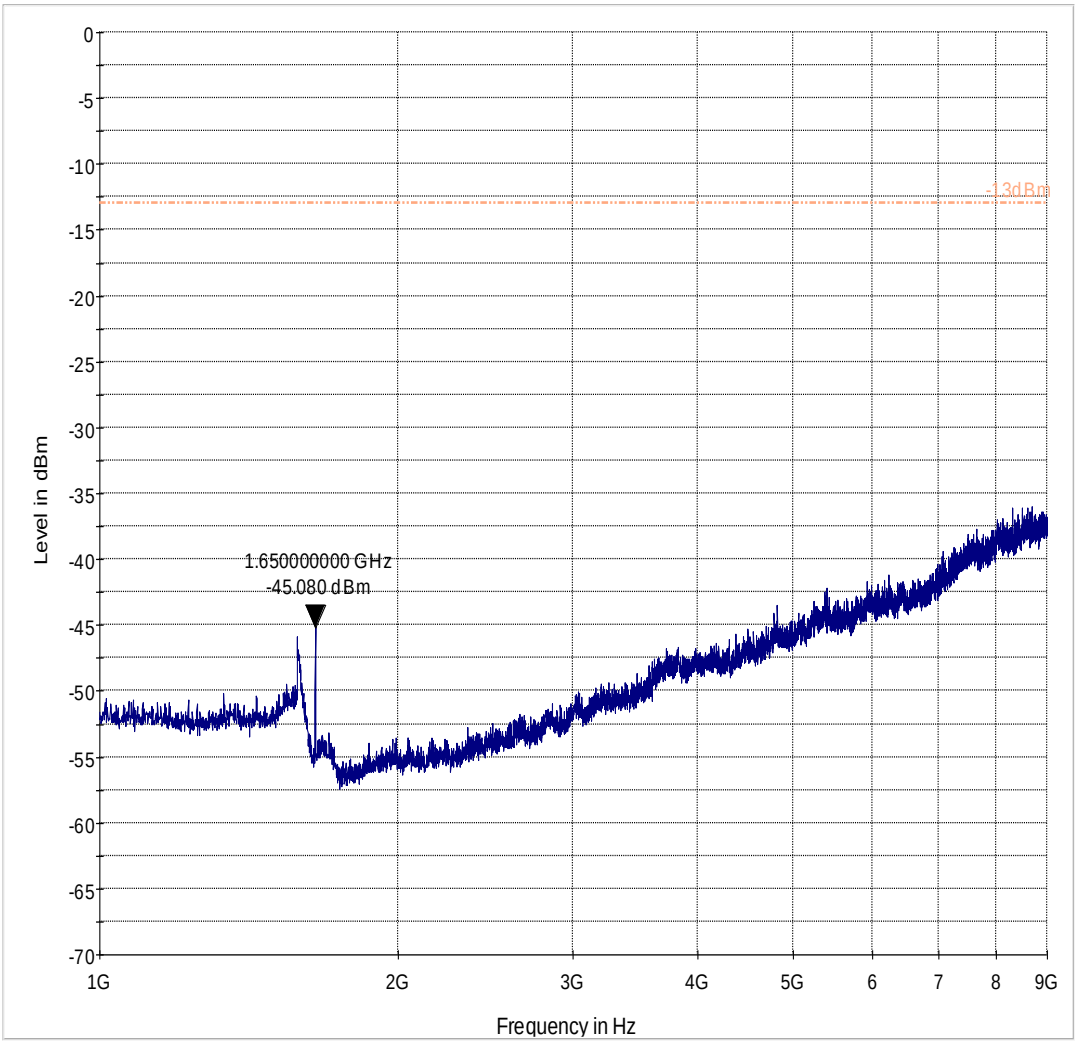
Frequency (MHz)	Correction Factors (CF) (dB)	Measured Field Strength (mFS) (dBµV/m)	Calculated Field Strength (cFS) (V/M)	Calculated ERP @3M (mW)	Calculated ERP @3M (dBm)	Limit (dBm)	Result
849.015	25	64.92	0.00176	0.000582	-32.35	-13	Pass

Correction Factors = Cable loss @ 850 MHz + Ant. Factor @ 850 MHz = 3 dB + 22.0 dB = 25 dB

Radiated Spurious Emissions

CDMA 850 Cellular Band

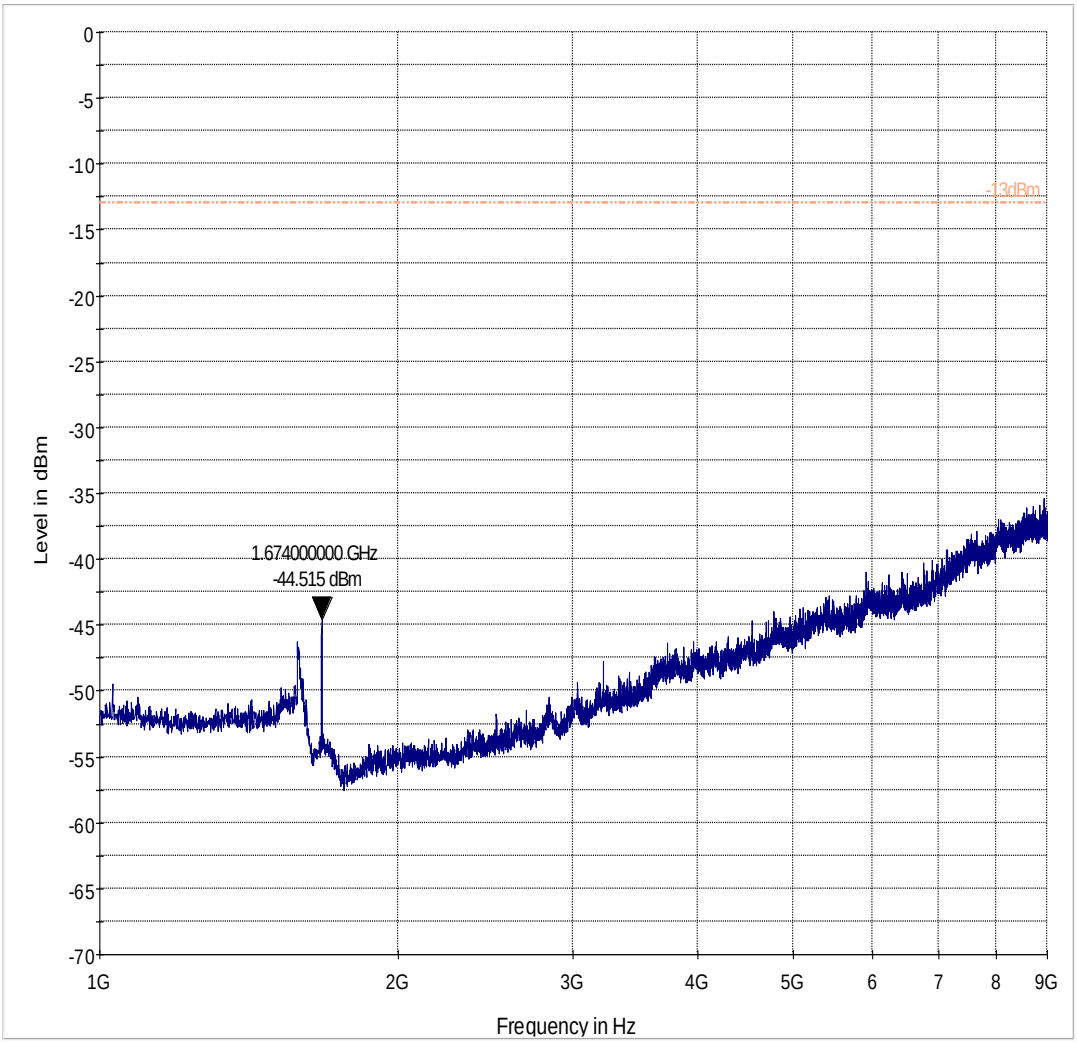
Measured Frequency Range: 1 GHz – 9 GHz –Operating Channel: Low



Radiated Spurious Emissions

CDMA 850 Cellular Band

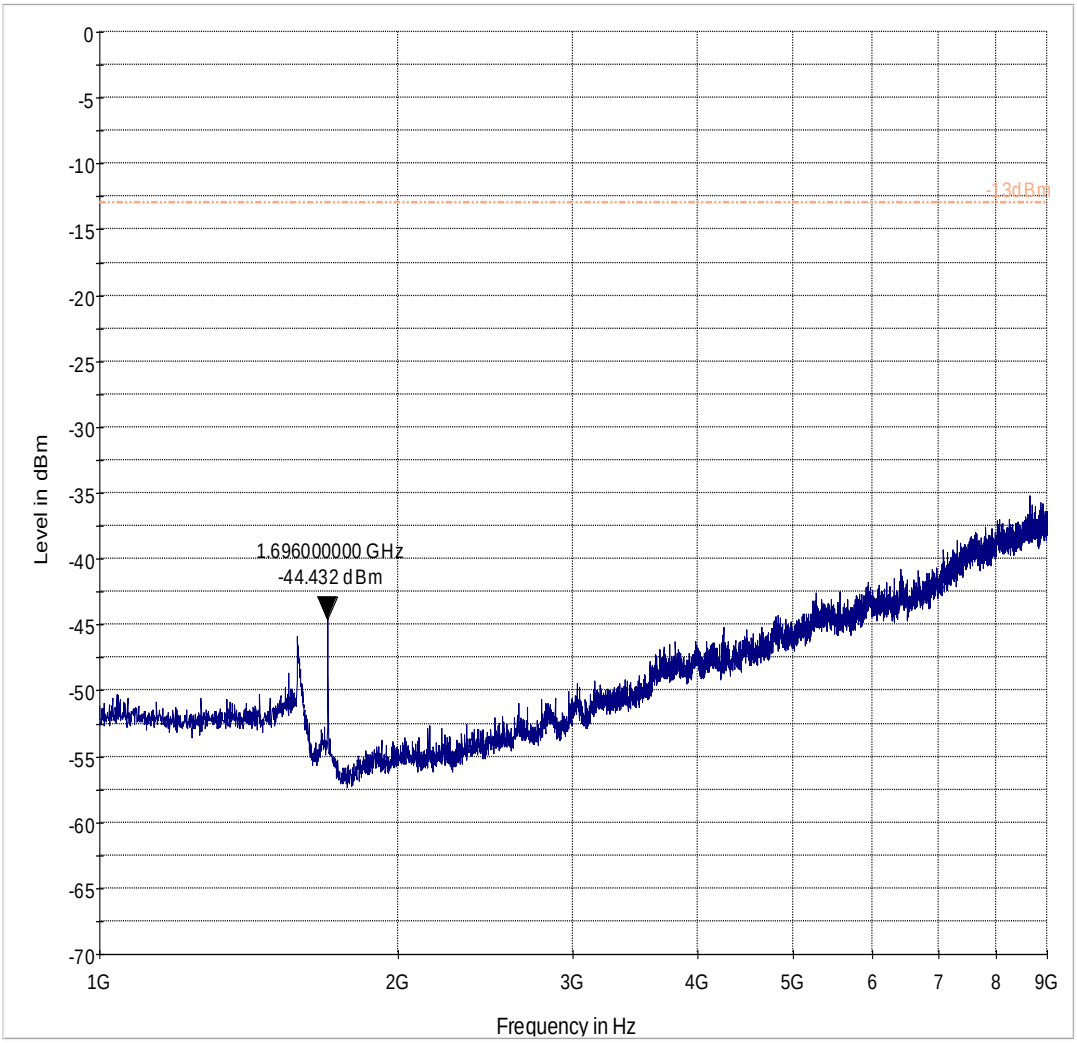
Measured Frequency Range: 1 GHz – 9 GHz –Operating Channel: Mid



Radiated Spurious Emissions

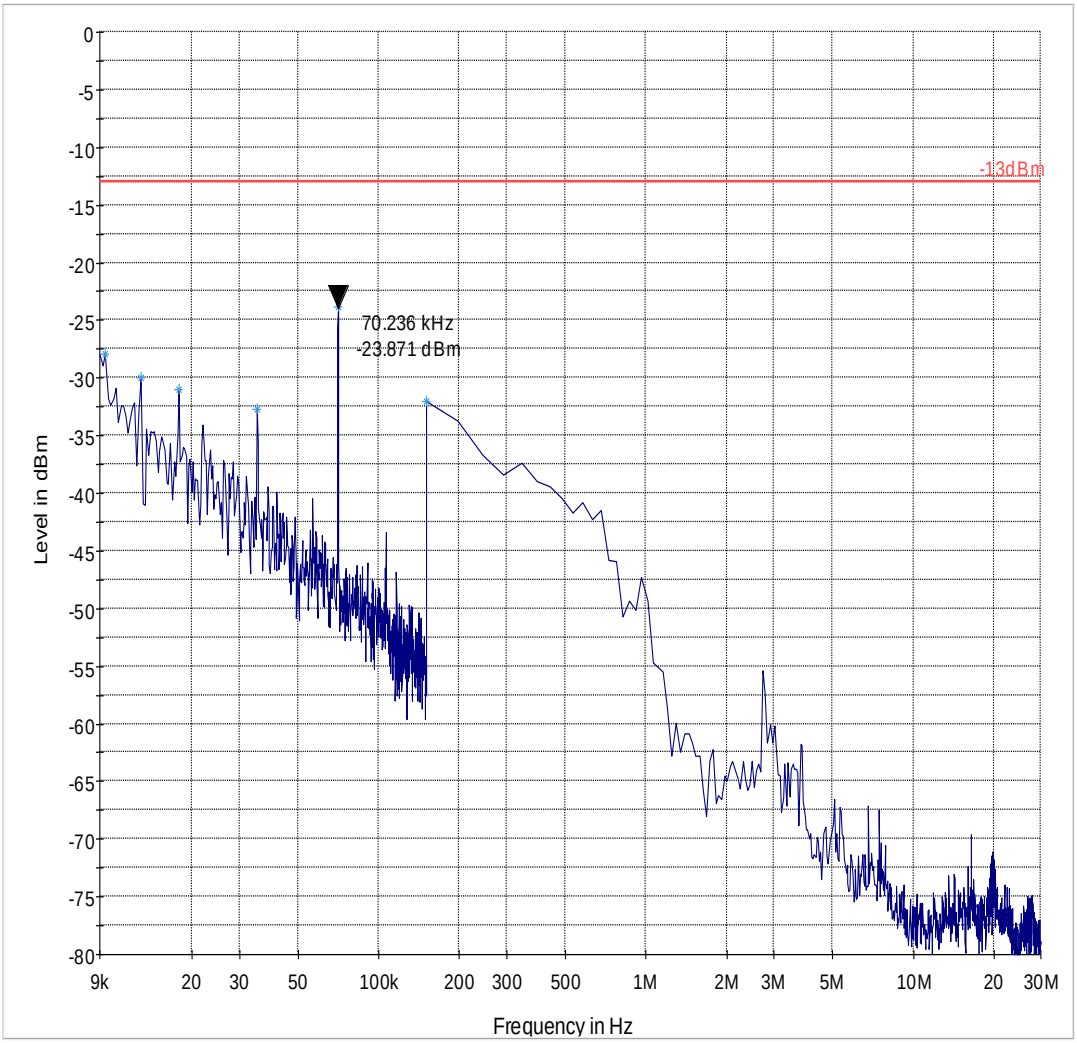
CDMA 850 Cellular Band

Measured Frequency Range: 1 GHz – 9 GHz –Operating Channel: High



Radiated Spurious Emissions

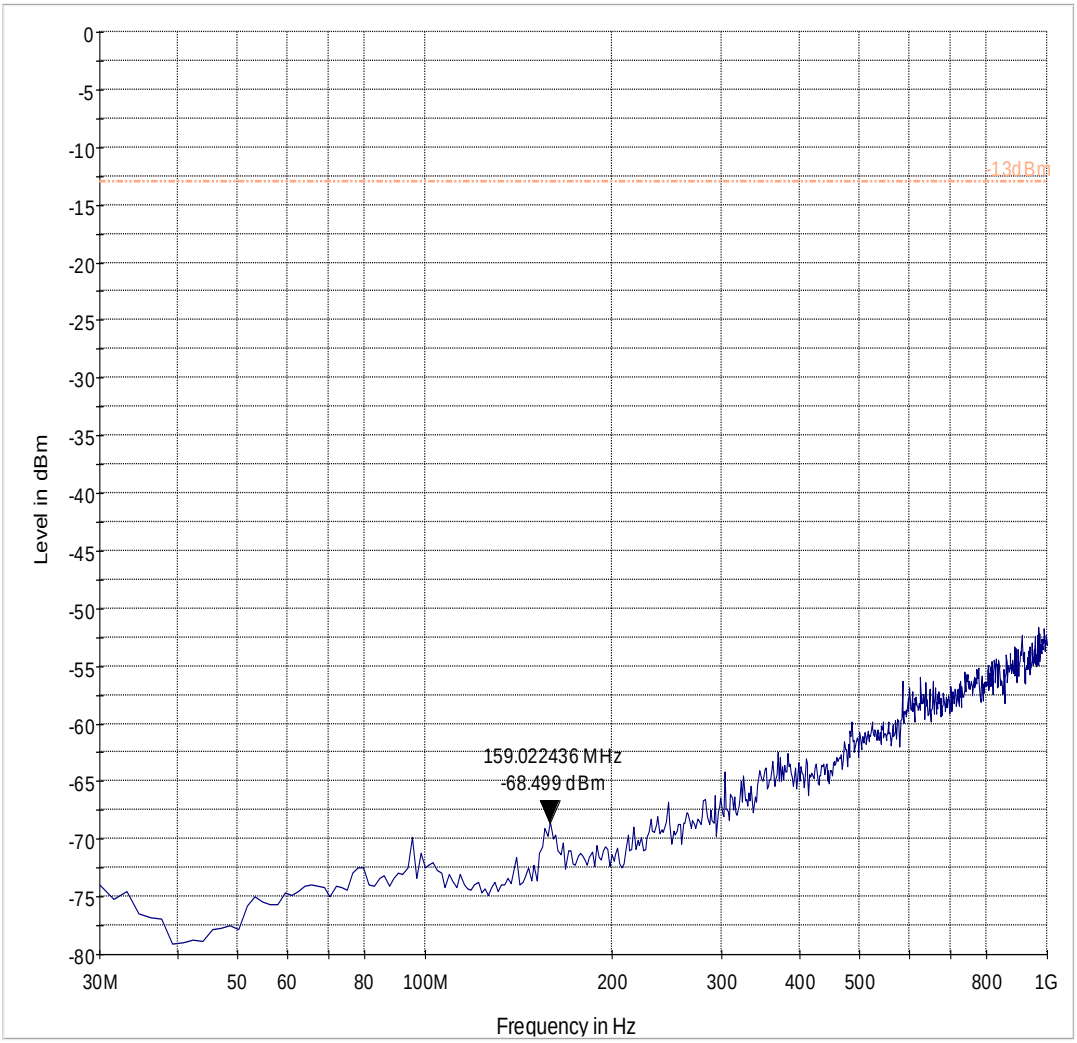
CDMA 1900 PCS Band
Measured Frequency Range: 9 kHz – 30 MHz –Operating Channel: Mid



Radiated Spurious Emissions

CDMA 1900 PCS Band

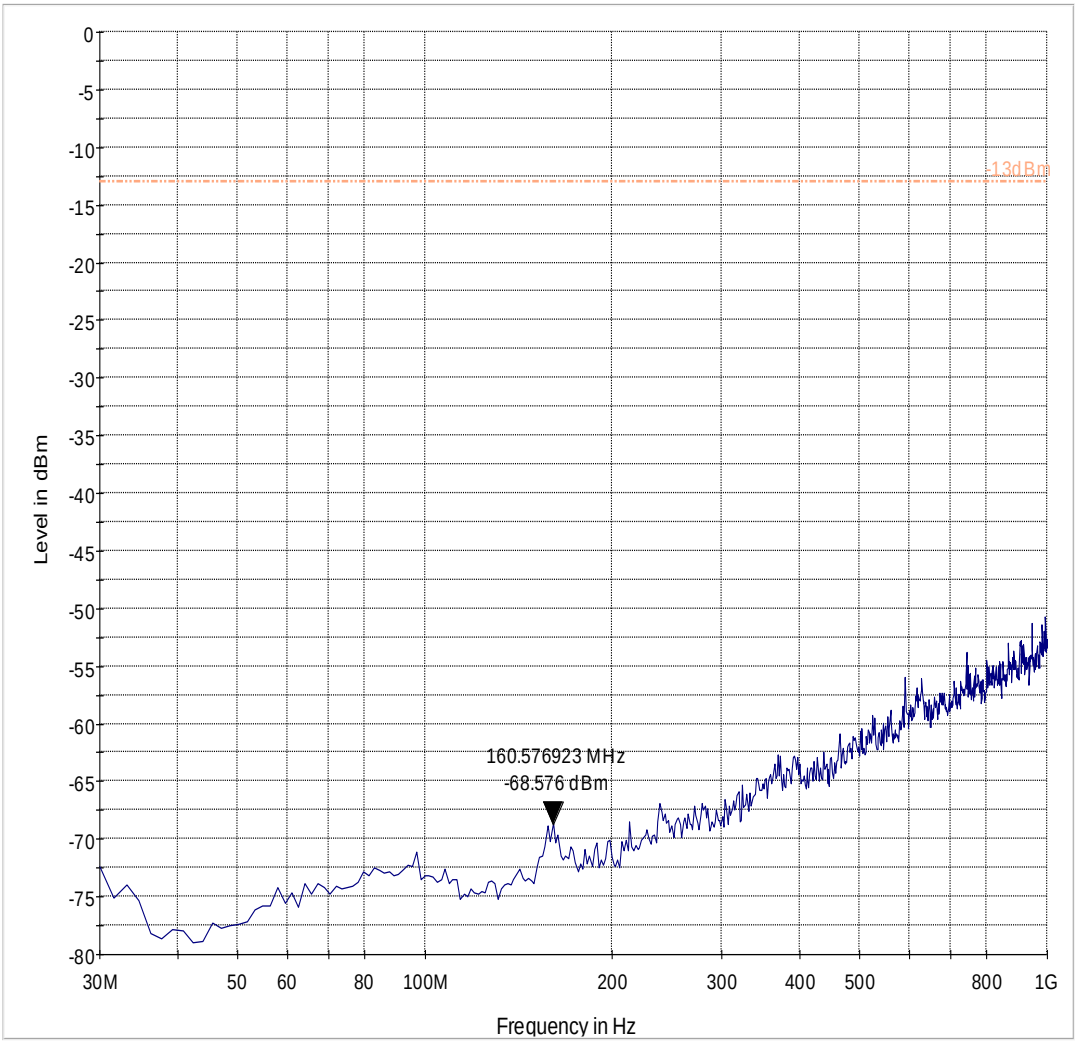
Measured Frequency Range: 30 MHz – 1 GHz –Operating Channel: Low



Radiated Spurious Emissions

CDMA 1900 PCS Band

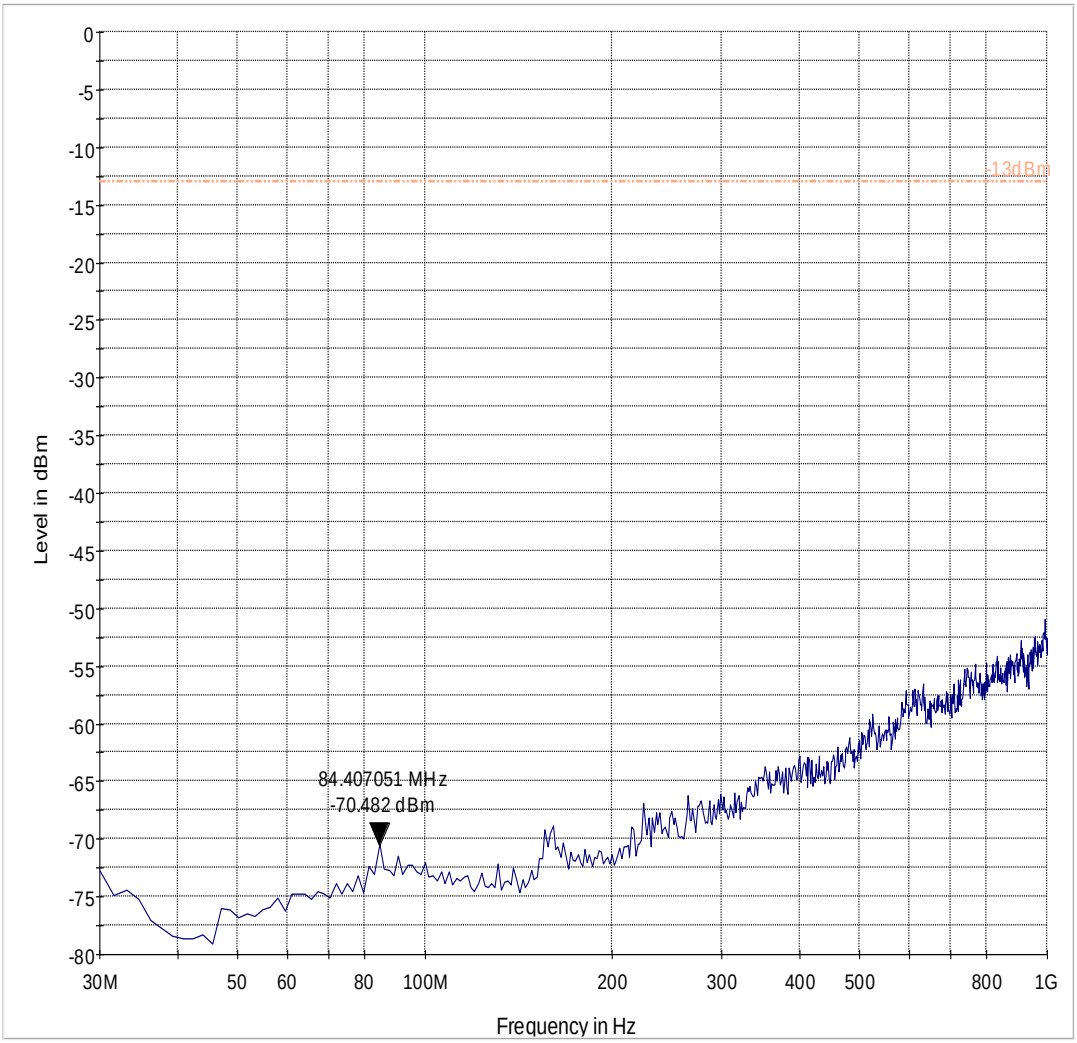
Measured Frequency Range: 30 MHz – 1 GHz –Operating Channel: Mid



Radiated Spurious Emissions

CDMA 1900 PCS Band

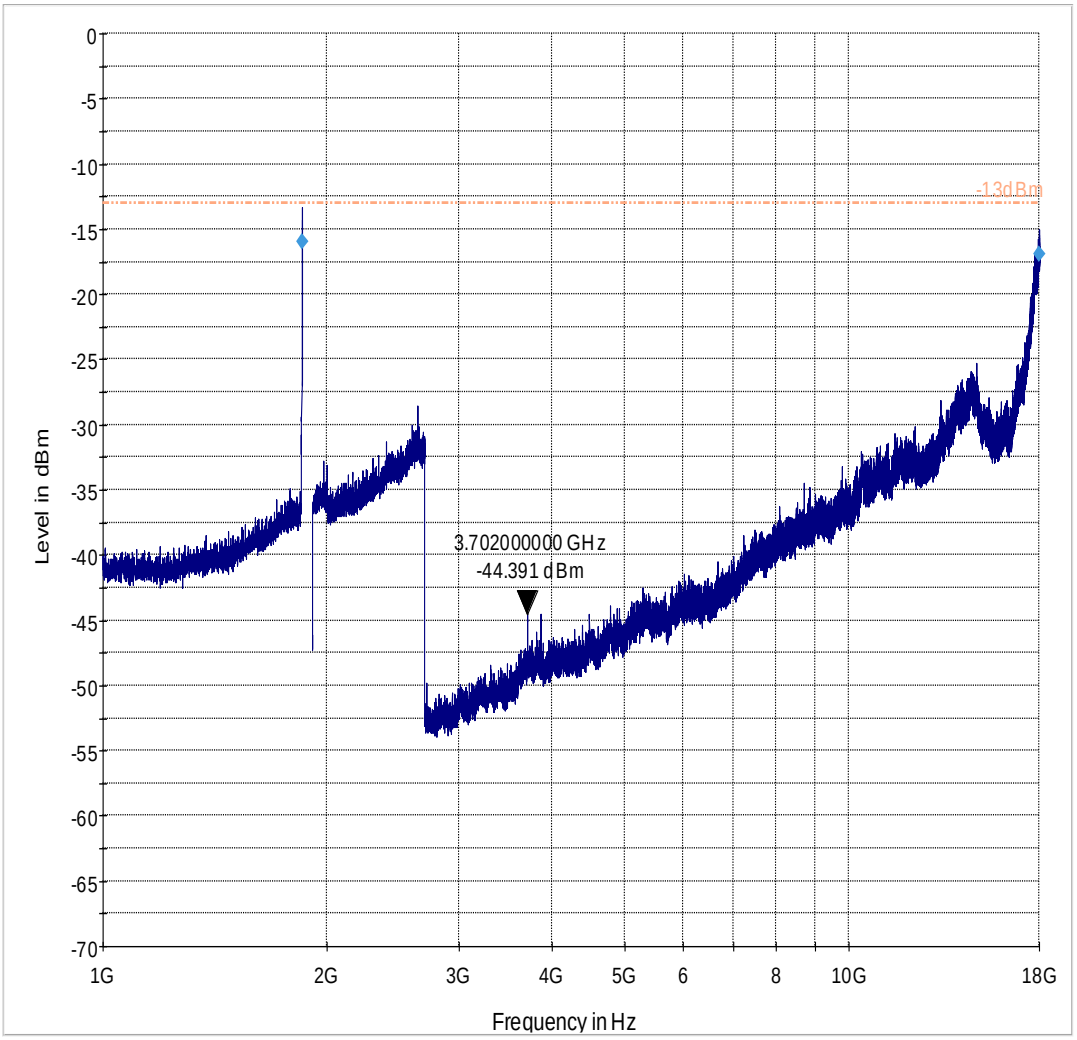
Measured Frequency Range: 30 MHz – 1 GHz –Operating Channel: High



Radiated Spurious Emissions

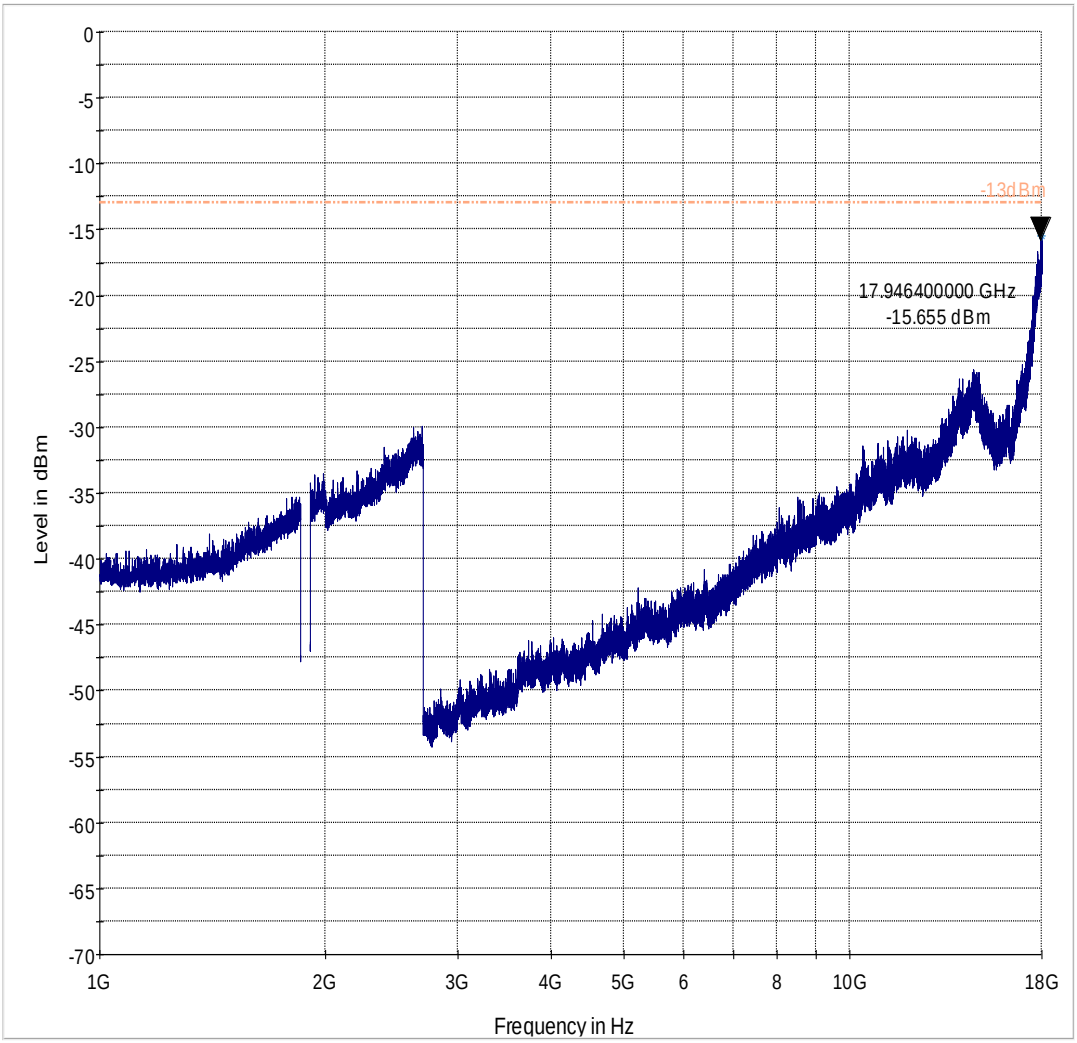
CDMA 1900 PCS Band

Measured Frequency Range: 1 GHz – 18 GHz –Operating Channel: Low



Radiated Spurious Emissions

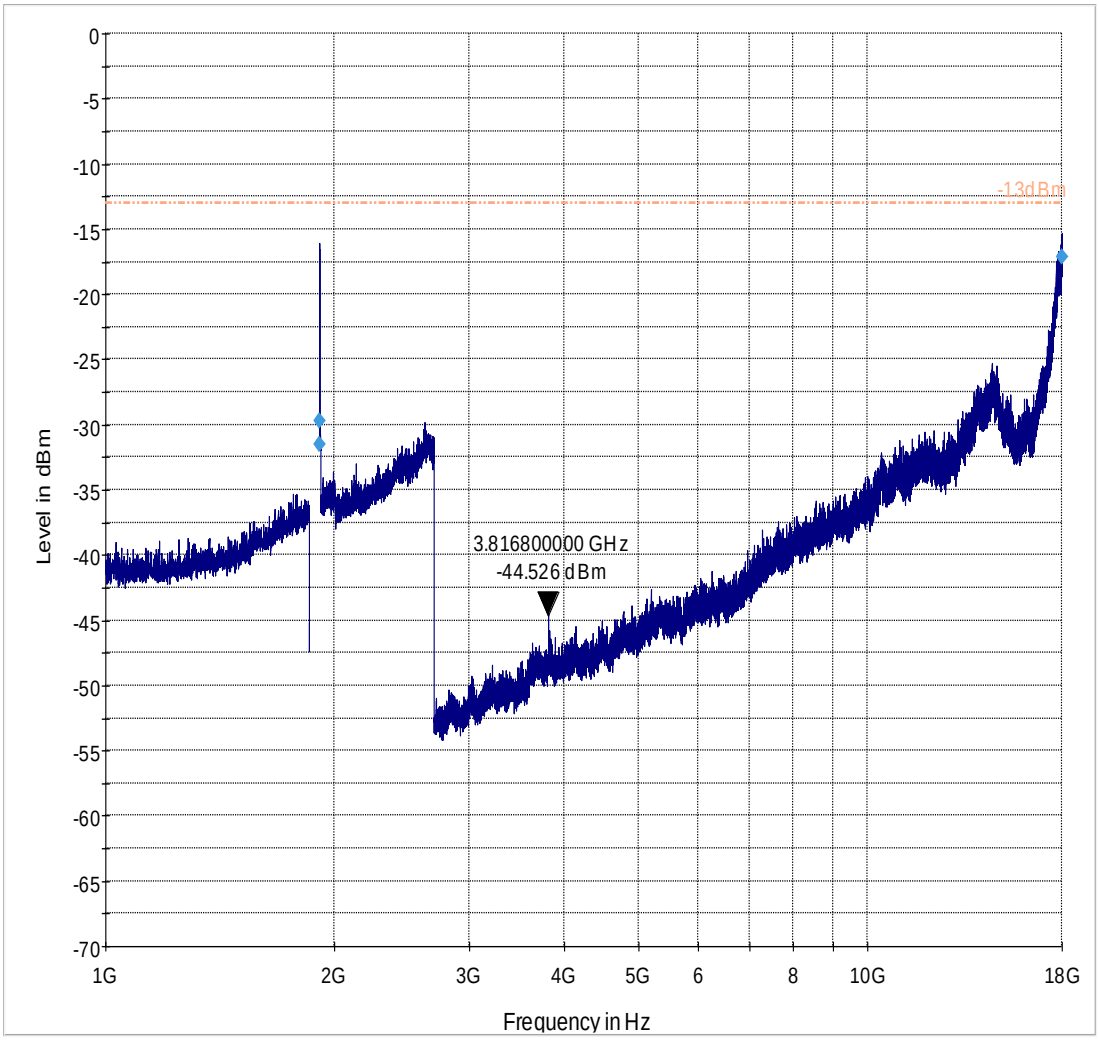
CDMA 1900 PCS Band
Measured Frequency Range: 1 GHz – 18 GHz –Operating Channel: Mid



Radiated Spurious Emissions

CDMA 1900 PCS Band

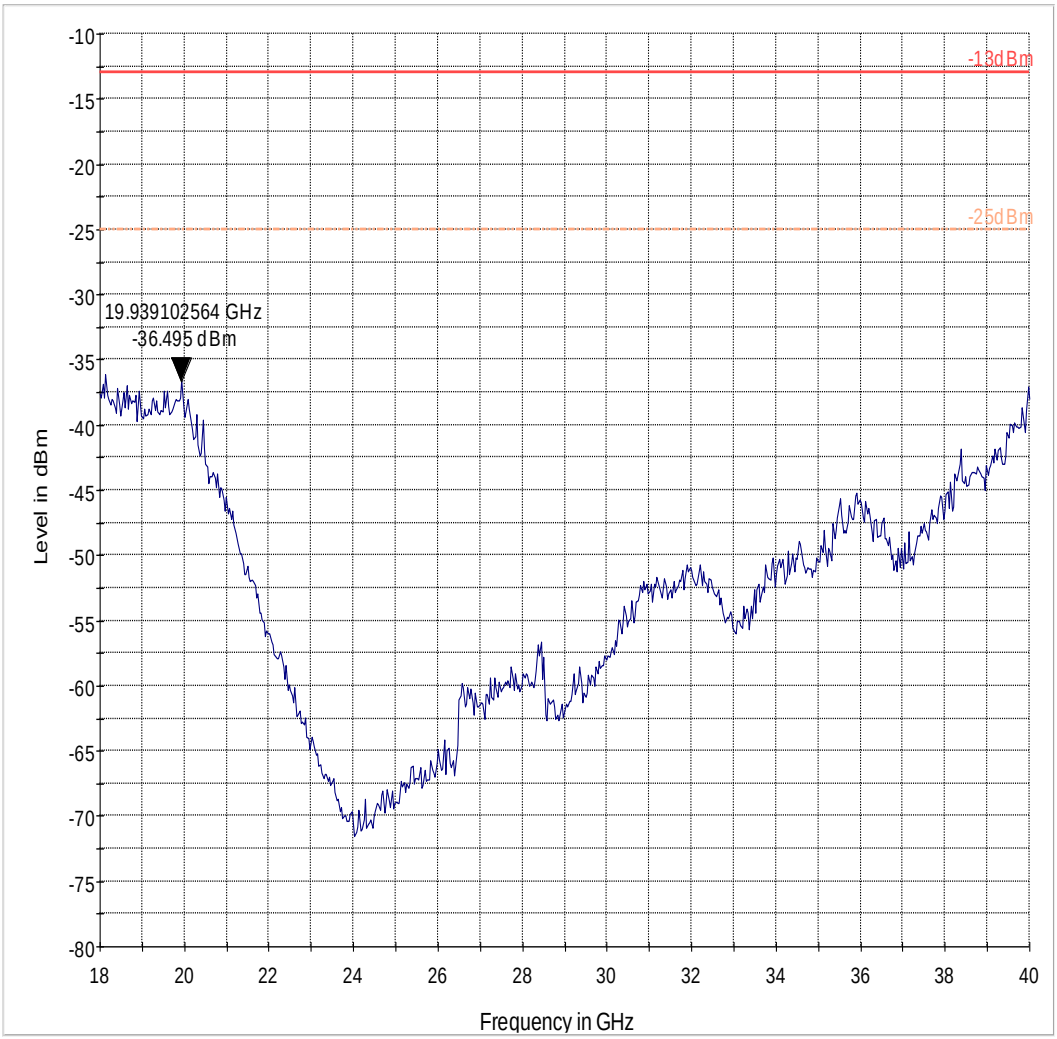
Measured Frequency Range: 1 GHz – 18 GHz –Operating Channel: High



Radiated Spurious Emissions

CDMA 1900 PCS Band

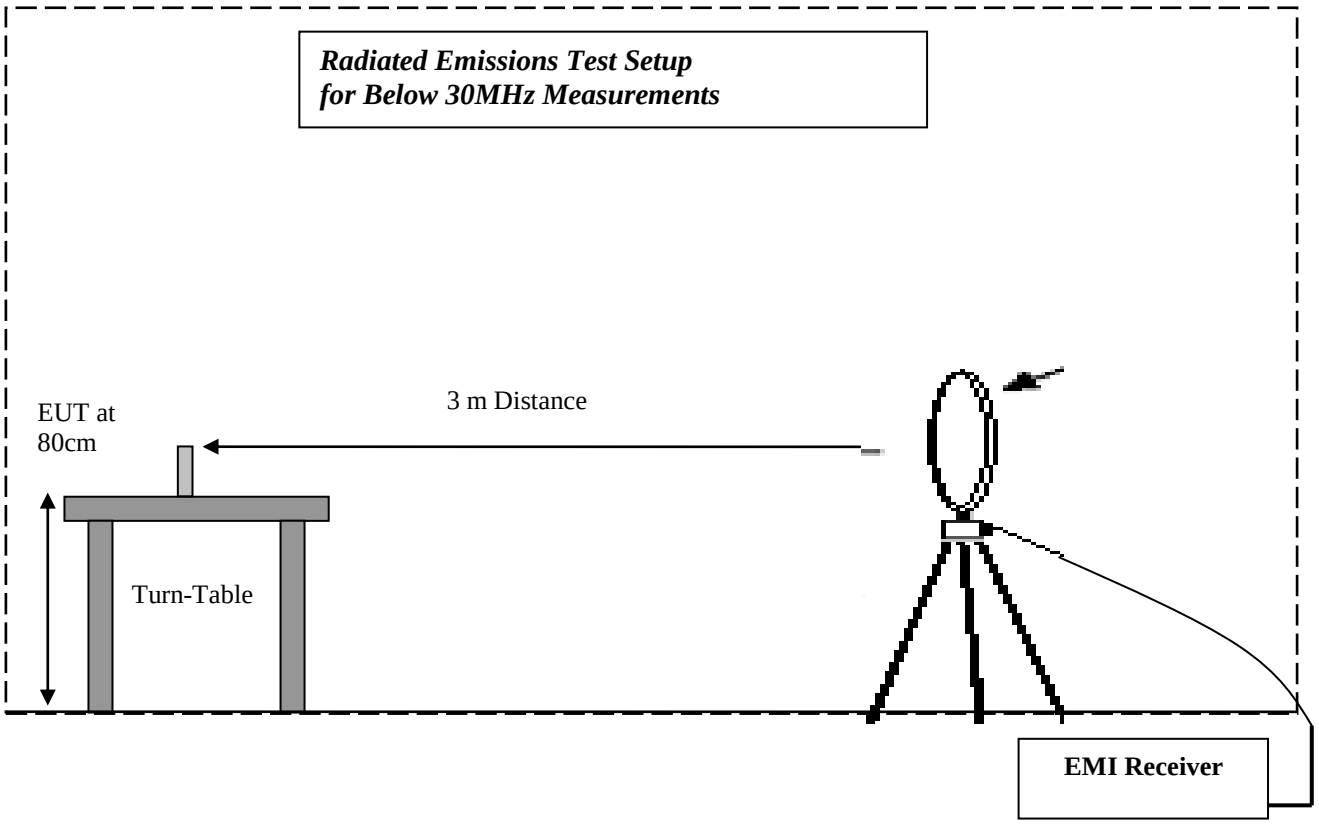
Measured Frequency Range: 18 GHz – 40 GHz –Operating Channel: Mid

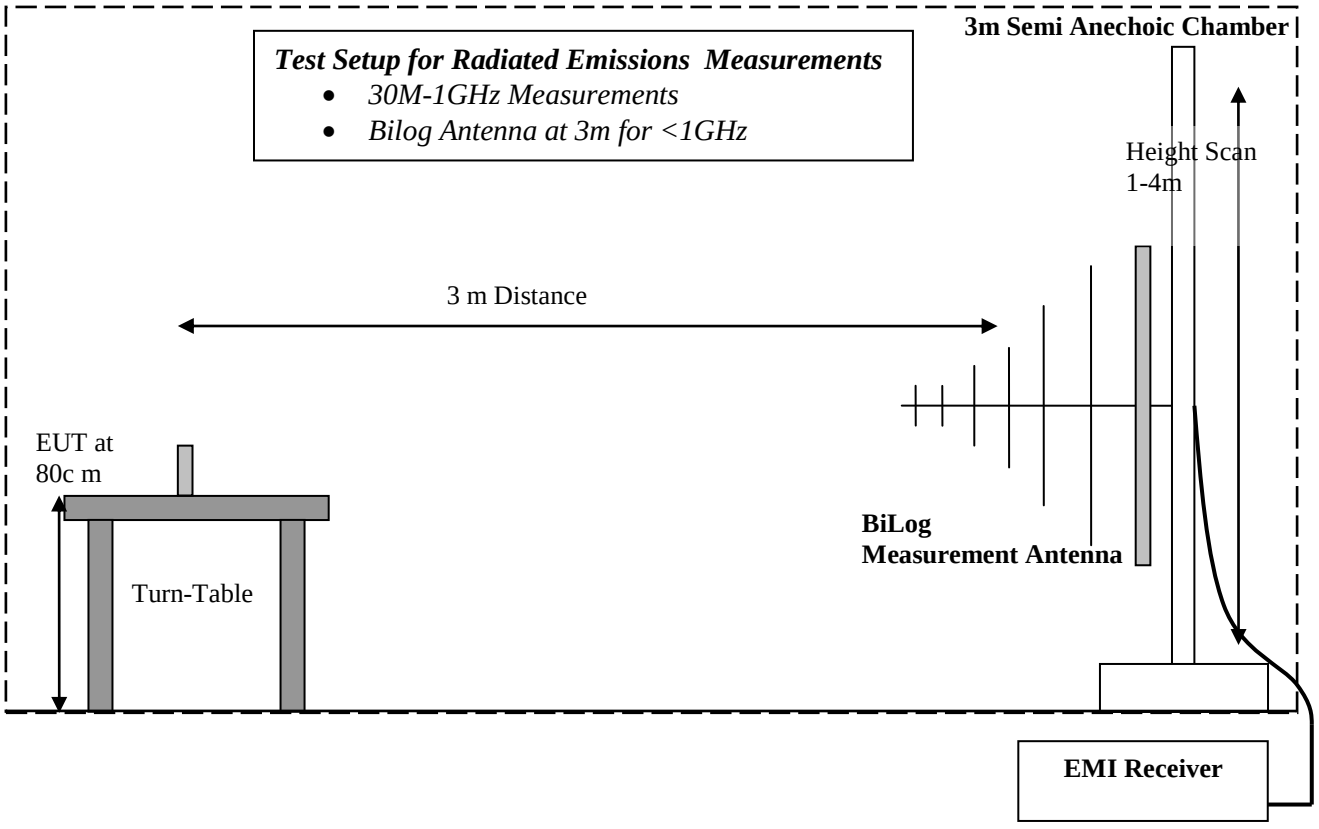


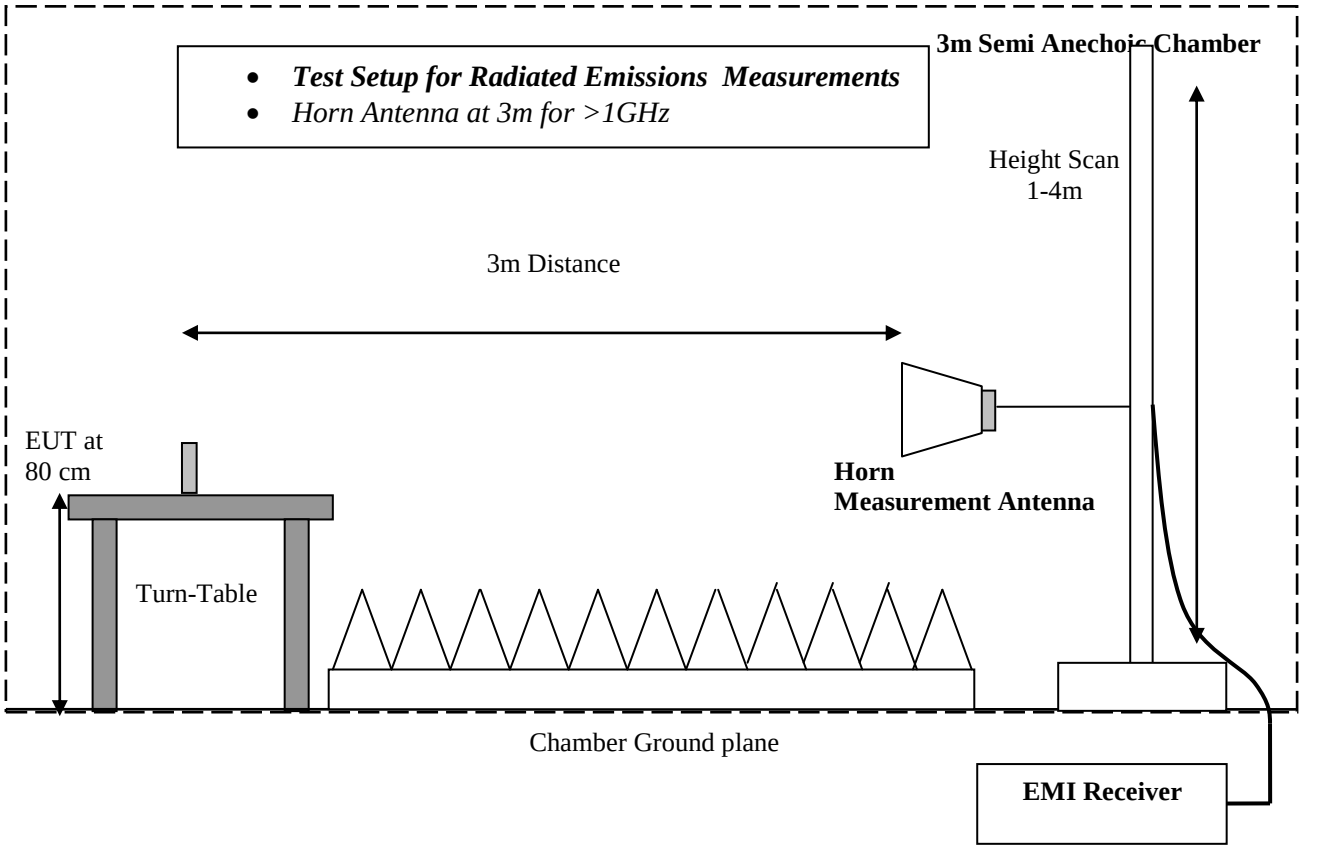
7 Test Equipment and Ancillaries used for tests

No.	Equipment Name	Manufacturer	Type/model	Serial No.	Cal Date	Cal Interval
3m Semi- Anechoic Chamber:						
	Turn table	EMCO	2075	N/A	N/A	N/A
	MAPS Position Controller	ETS Lindgren	2092	0004-1510	N/A	N/A
	Antenna Mast	EMCO	2075	N/A	N/A	N/A
	Relay Switch Unit	Rohde&Schwarz	RSU	338964/001	N/A	N/A
	EMI Receiver/Analyzer	Rohde&Schwarz	ESU 40	100251	Sept 2013	2 Years
	Spectrum Analyzer	Rohde&Schwarz	FSU	200302	Jun 2013	2 Years
	Universal Radio Communication Tester	Rohde&Schwarz	CMU 200	101821	Jun 2013	2 Years
	1500MHz HP Filter	Filtek	HP12/1700	14c48	N/A	N/A
	2800 MHz HP Filter	Filtek	HP12/2800	14C47	N/A	N/A
	High Pass Filter	Mini-Circuits	SHP-1200+	RUU11201224	Part of the system calibration	
	High Pass Filter	Wainwright Instr.	WHKX 3.0/18	109	Part of the system calibration	
	Pre-Amplifier	Miteq	JS40010260	340125	N/A	N/A
	Loop Antenna	EMCO	6512	00049838	Apr 2012	3 years
	Binconilog Antenna	EMCO	3141	0005-1186	Apr 2012	3 Years
	Horn Antenna	EMCO	3115	35111	Apr 2012	3 Years
	Multimeter	Fluke	115 True RMS	21752138	Mar/2014	2 years
	DC Power Supply	GW Instek	GPS-1850D	EM845907	N/A	N/A

8 Test Setup Diagrams




3m Semi Anechoic Chamber
Test Setup for Radiated Emissions Measurements
30M-1GHz Measurements
Bilog Antenna at 3m for <1GHz
Height Scan
1-4m
3 m Distance
EUT at
80c m
Turn-Table
BiLog
Measurement Antenna
EMI Receiver


3m Semi Anechoic Chamber
Test Setup for Radiated Emissions Measurements
Horn Antenna at 3m for >1GHz
Height Scan
1-4m
3m Distance
EUT at
80 cm
Turn-Table
Horn
Measurement Antenna
Chamber Ground plane
EMI Receiver

9 Revision History

Date	Report Name	Changes to report	Report prepared by
2015-06-11	EMC_VERIT-007-15001_FCC22_24_AT-155	First Version	Danh Le