



HYUNDAI CALIBRATION & CERTIFICATION TECH. CO., LTD.

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CERTIFICATE OF COMPLIANCE (ERM EVALUATION)

Manufacture: GSTeletech Co., Ltd.

1385-14, Juan-Dong, Nam-Ku, Incheon, 402-200 Korea

Date of Issue : April 27, 2007

Test Report No.: HCT-R07-012

Test Site: HYUNDAI CALIBRATION & CERTIFICATION
TECHNOLOGIES CO., LTD.

FCC ID

:

U88GSTR1924DT-SPR

APPLICANT

:

GSTeletech Co., Ltd.

EUT Type:

CDMA Inbuilding RF Repeater

MODEL :

GSTR-1924DT-SPR (WITH MODEM AND CCD)

GSTR-1924DC-SPR (WITH CCD ONLY)

GSTR-1924DM-SPR (WITH MODEM ONLY)

Frequency Ranges:

Uplink : 1851.25 – 1913.75 MHz

Downlink : 1931.25 – 1993.75 MHz

RF Output Power:

Downlink : 24.0 dBm

Uplink : 24.0 dBm

FCC Rules Part(s):

CFR 47, Part 24, Subpart E

Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 24 Subpart E of the FCC Rules under normal use and maintenance.

You Seok Jung
Report prepared by
: Youn Seok Jung
Test engineer of RF Part

Sang Jun Lee
Approved by
: Sang Jun Lee
Manager of RF Part



HCT CO., LTD.



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1. CLIENT INFORMATION

The EUT has been tested by request of

Company	GSTeletech Co., Ltd
Contact Point	1385-14, Juan-Dong, Nam-Ku, Incheon,,402-200 Korea

- **EUT Type:** CDMA Inbuilding RF Repeater
- **FCC ID:** U88GSTR1924DT-SPR
- **Frequency Ranges:** Uplink : 1851.25 – 1913.75 MHz
Downlink : 1931.25 – 1993.75 MHz
- **RF Output Power:** Downlink : 24.0 dBm
Uplink : 24.0 dBm
- **FCC Rules Part(s):** CFR Title 47 Part 24 Subpart E
- **Emission Designators:** F9W

2. TEST SPECIFICATIONS

2.1 Standards

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance With Part 24 Subpart E.

Reference	Description	Results
Part 15 Subpart B §15.107(a)	Conducted Emissions	Compliant
Part 15 Subpart B §15.109(a)	Radiated Emissions	Compliant
§2.1046; §24.232	RF Power Output	Compliant
§2.1047	Modulation Characteristics	N/A
§2.1049	Occupied Bandwidth	Compliant
§2.1051; §24.238	Spurious Emissions at Antenna Terminals	Compliant
§2.1053; §24.238	Radiated Spurious Emissions	Compliant
§2.1055; §24.135	Frequency Stability	Compliant

3. STANDARDS ENVIRONMENTAL TEST CONDITIONS

Temperature :	+ 15 °C to + 35 °C
Relative humidity:	30 % to 60 %
Air pressure	860 mbar to 1060 mbar

4. TEST SUMMARY

The results in this report apply only to sample tested

<u>Test Case</u>	<u>Applied standard</u>	<u>Result</u>
Conducted Emissions	Part 15 Subpart B §15.107(a)	Compliant
Radiated Emissions	Part 15 Subpart B §15.109(a)	Compliant
RF Power Output	§2.1046; §24.232	Compliant
Occupied Bandwidth	§2.1049	Compliant
Spurious Emissions at Antenna Terminals	§2.1051; §24.238	Compliant
Radiated Spurious Emissions	§2.1053; §24.238	Compliant
Frequency Stability	§2.1055; §24.135	Compliant

5. TEST EQUIPMENT

Manufacturer	Model / Equipment	Cal Interval	Calibration Due	Serial No.
Agilent	E4438C /Signal Generator	Annual	01/22/2008	MY42082646
Agilent	E4416A /Power Meter	Annual	01/22/2008	GB41291412
WEINSCHEL	67-30-33/ATTENUATOR	Annual	05/02/2008	BR0530
Korea Eng	KR-1005L/ Temperature and Humidity Chamber	Annual	03/30/2008	KRAC05063-3CH
Agilent	E7405A /EMC Analyzer	Annual	12/29/2007	US40240290
Schwarzbeck	VULB 9160/ TRILOG Antenna	Annual	01/24/2008	9160-3150
HD	MA240/ Antenna Position Tower	N/A	N/A	556
EMCO	1050/ Turn Table	N/A	N/A	114
HD GmbH	HD 100/ Controller	N/A	N/A	13
HD GmbH	KMS 560/ SlideBar	N/A	N/A	12
MITEQ	AMF-60-0010 1800-35-20P	Annual	01/24/2008	1200937
MITEQ	AMF-6D-01180-35-20P	Annual	02/24/2008	990893
Schwarzbeck	BBHA 9120D/ Horn Antenna	Annual	03/30/2008	147
Schwarzbeck	BBHA 9120D/ Horn Antenna	Annual	03/30/2008	296
Schwarzbeck	BBHA9170/SHF-EHF Horn Antenna	Annual	03/20/2008	BBHA9170342
Rohde & Schwarz	HFH2-Z2/Loop Antenna	Annual	01/10/2008	881056/070
ADVANTEST	R3273/Spectrum Analyzer	Annual	05/02/2008	J004821

6. RF OUTPUT POWER

6.1 Test Procedure

Test Requirements:

§ 2.1046 Measurements required: RF power output:

§ 2.1046 (a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

§ 2.1046 (b) For single sideband, independent sideband, and single channel, controlled carrier radiotelephone transmitters, the procedure specified in paragraph (a) of this section shall be employed and, in addition, the transmitter shall be modulated during the test as specified and as applicable in § 2.1046 (b) (1-5). In all tests, the input level of the modulating signal shall be such as to develop rated peak envelope power or carrier power, as appropriate, for the transmitter.

§ 2.1046 (c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

§ 24.232 Power and antenna height limits.

§ 24.232 (b): Mobile/portable stations are limited to 2 watts EIRP peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

Test Procedures:

As required by 47 CFR 2.1046, RF power output measurements were made at the RF output terminals using an attenuator and spectrum analyzer or power meter. This test was performed in all applicable modulations.



Block Diagram 1. RF Power Output Test Setup

6.3.1 Test Results

(Downlink)

DownLink		
Carrier Channel	Frequency (MHz)	Measured Average Output Power dBm (mW)
Low	1931.25	23.55(226.4)
Mid	1962.50	23.92(246.6)
High	1993.75	23.97(249.4)

6.3.2 Test Results

(Uplink)

UpLink		
Carrier Channel	Frequency (MHz)	Measured Average Output Power dBm (mW)
Low	1851.25	23.92(246.6)
Mid	1882.50	24.00(251.2)
High	1913.75	23.39(218.2)

7. OCCUPIED BANDWIDTH

7.1 Test Procedure

Test Requirement(s): § 2.1049 Measurements required: Occupied bandwidth:

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the specified conditions of § 2.1049 (a) through (i) as applicable.

Test Procedures: As required by 47 CFR 2.1049, *occupied bandwidth measurements* were made with a Spectrum Analyzer connected to the RF ports for both Uplink and Downlink

The modulation characteristics of signal generator's carrier was measured first at a maximum RF level prescribed by the OEM. The signal generator was then connected to either the Uplink or Downlink input at the appropriate RF level. The resulting modulated signal through the EUT was measured and compared against the original signal.

Test Results: The EUT complies with the requirements of this section.

NOTE: The EUT is a band selective repeater. The test was performed using all selective bands and there was not much difference between them. The test result is reported using the widest bands.

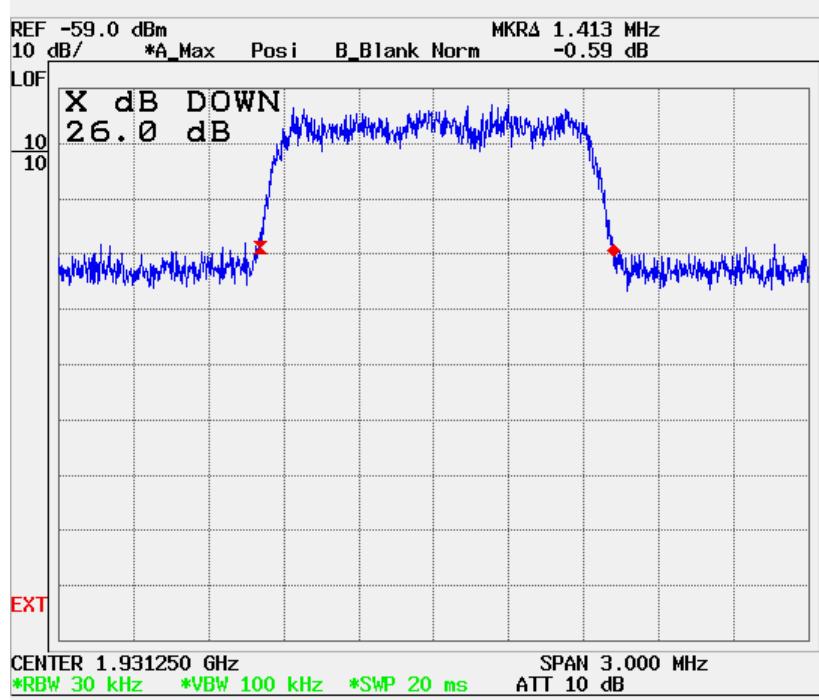
(Downlink)

DownLink		
Carrier Channel	Frequency (MHz)	26dB Bandwidth(MHz)
Low	1931.25	1.398
Mid	1962.50	1.404
High	1993.75	1.386

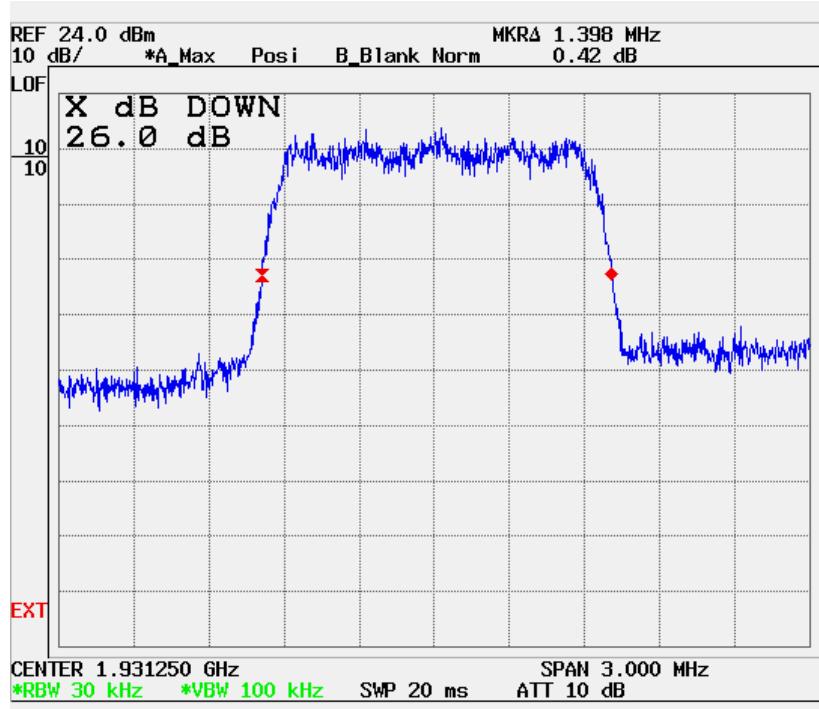
(Uplink)

UpLink		
Carrier Channel	Frequency (MHz)	26dB Bandwidth(MHz)
Low	1851.25	1.383
Mid	1882.50	1.407
High	1913.75	1.392

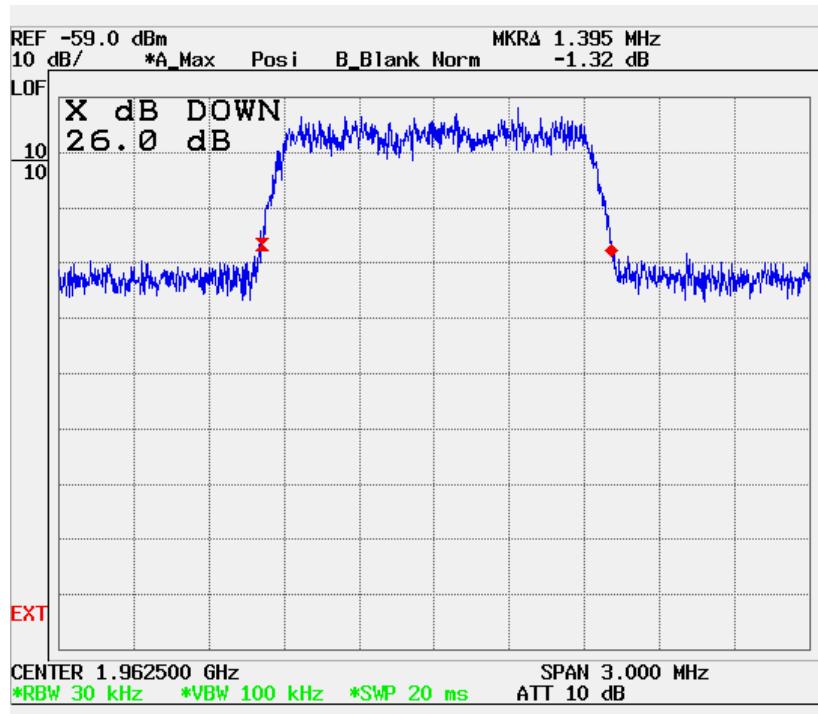
Plots of Occupied Bandwidth



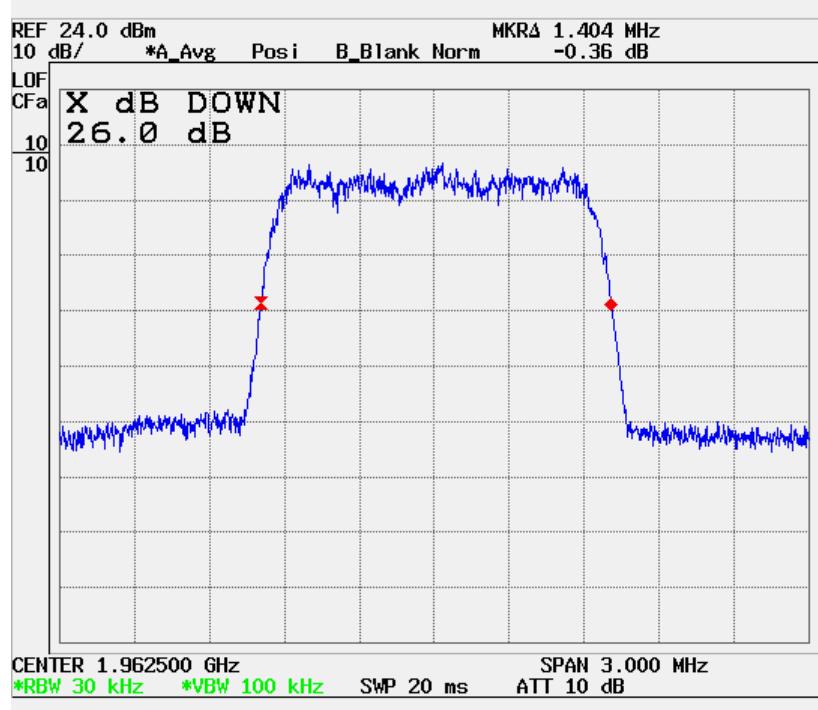
CDMA Downlink Low CH Input



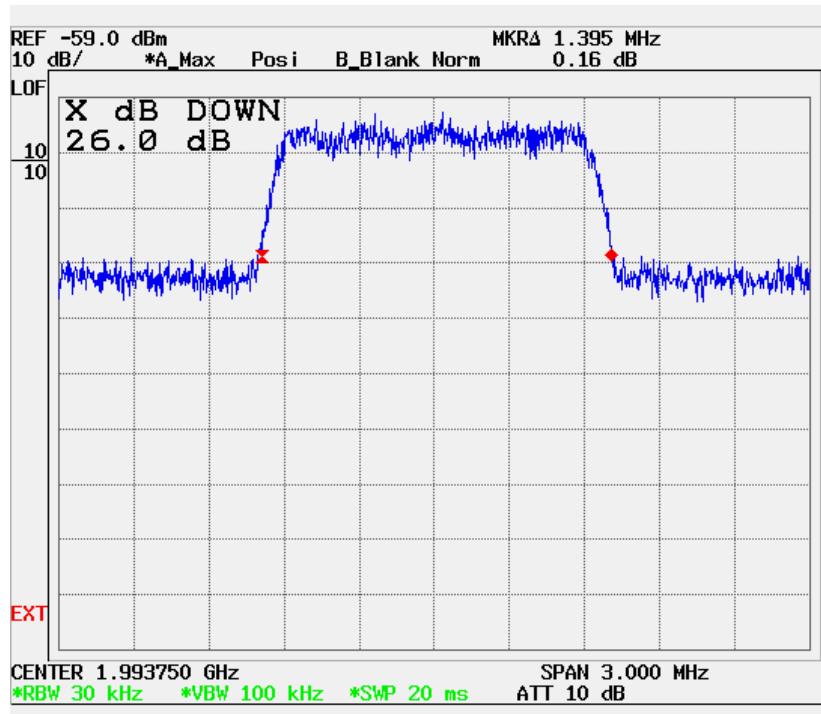
CDMA Downlink Low CH Output



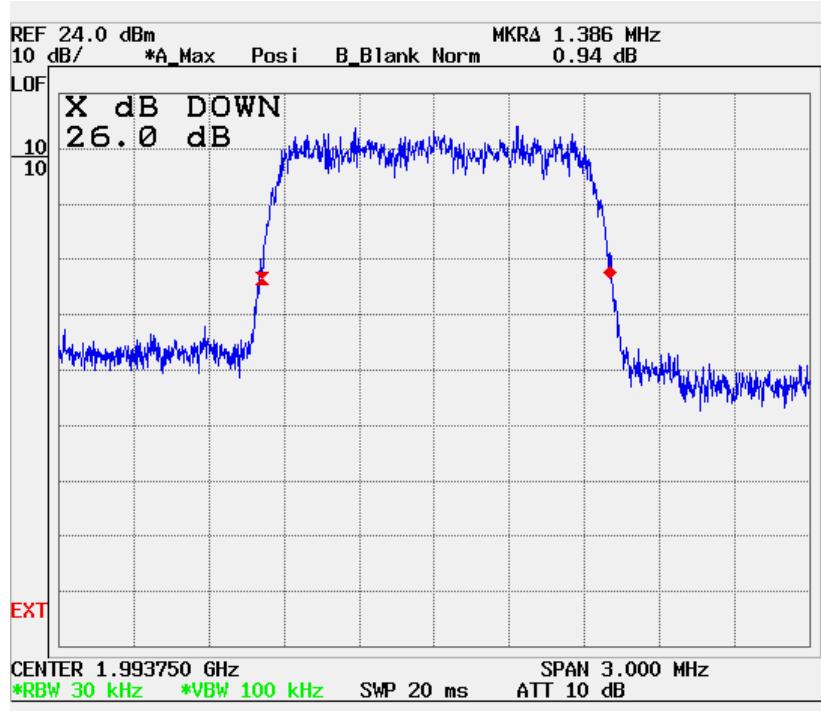
CDMA Downlink Mid CH Input



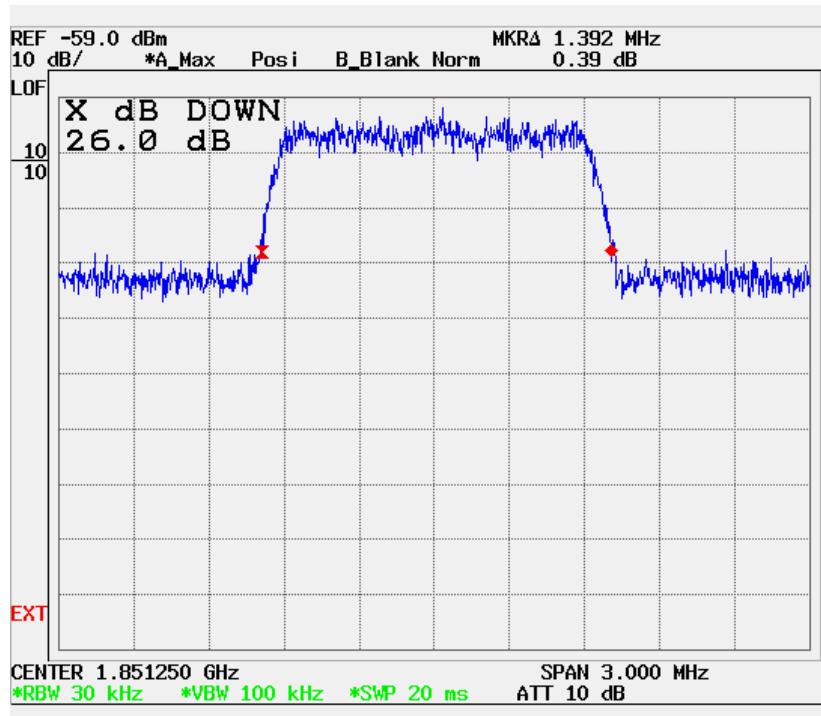
CDMA Downlink Mid CH Output



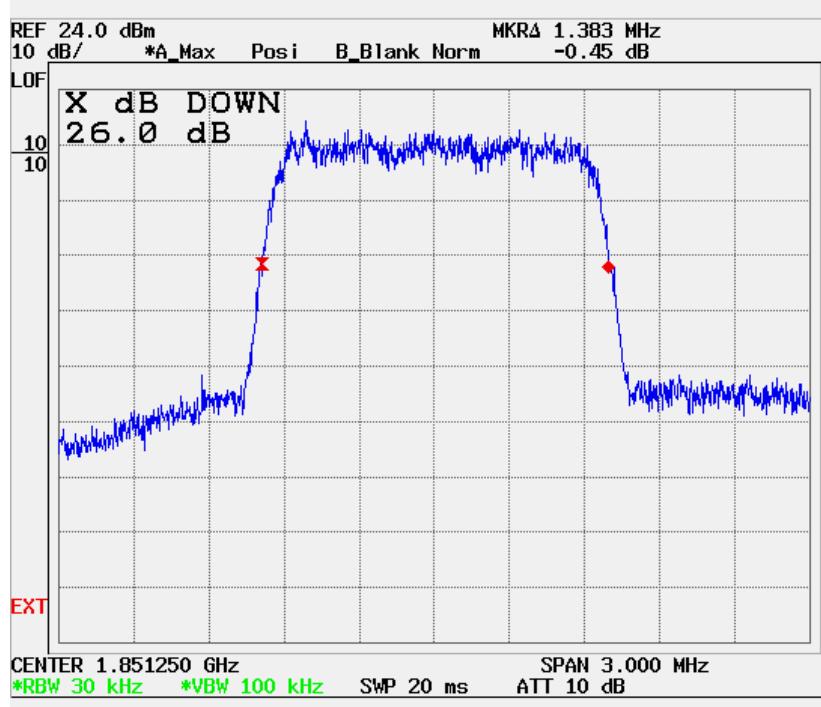
CDMA Downlink High CH Input



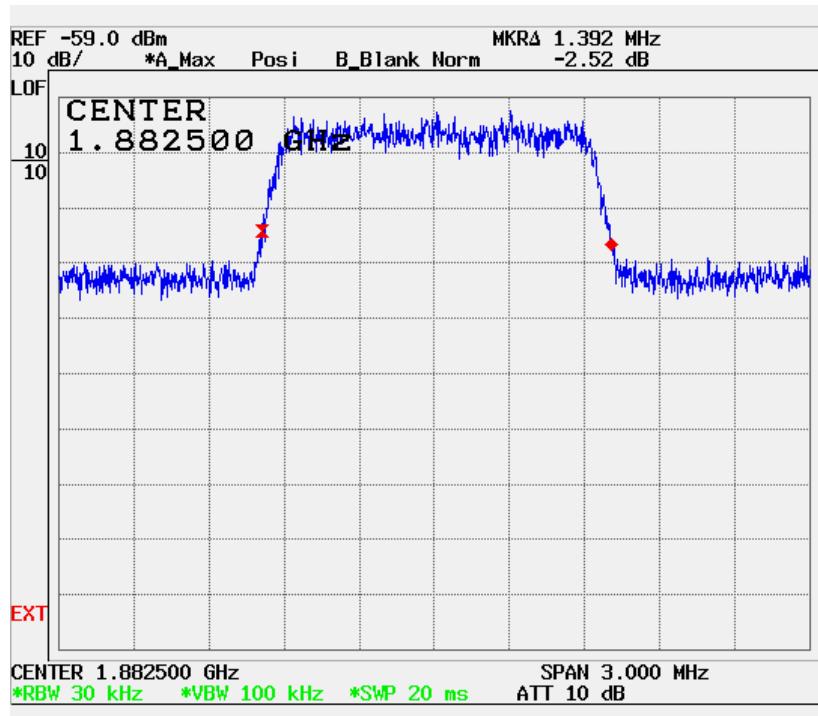
CDMA Downlink High CH Output



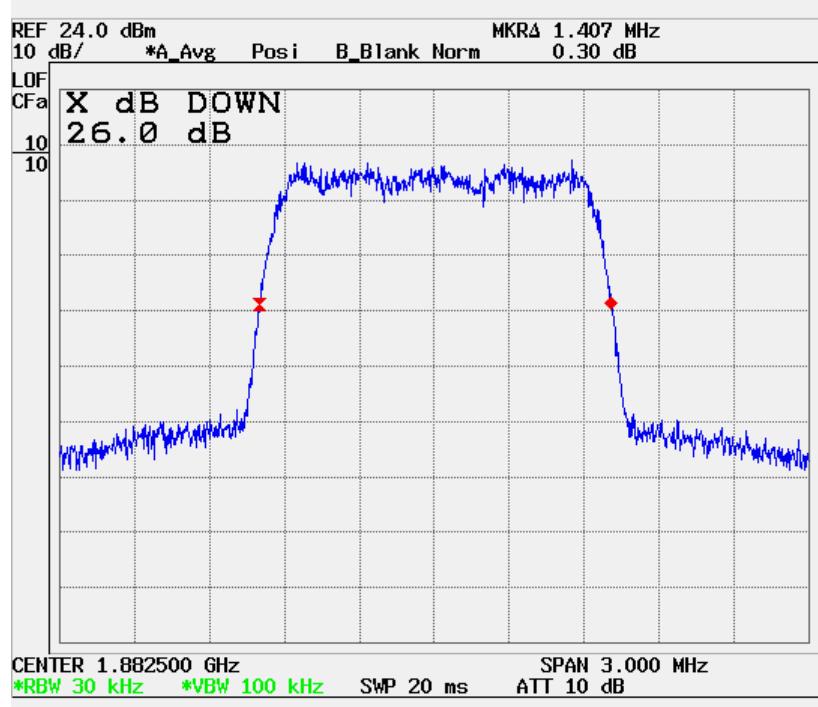
CDMA Uplink Low CH Input



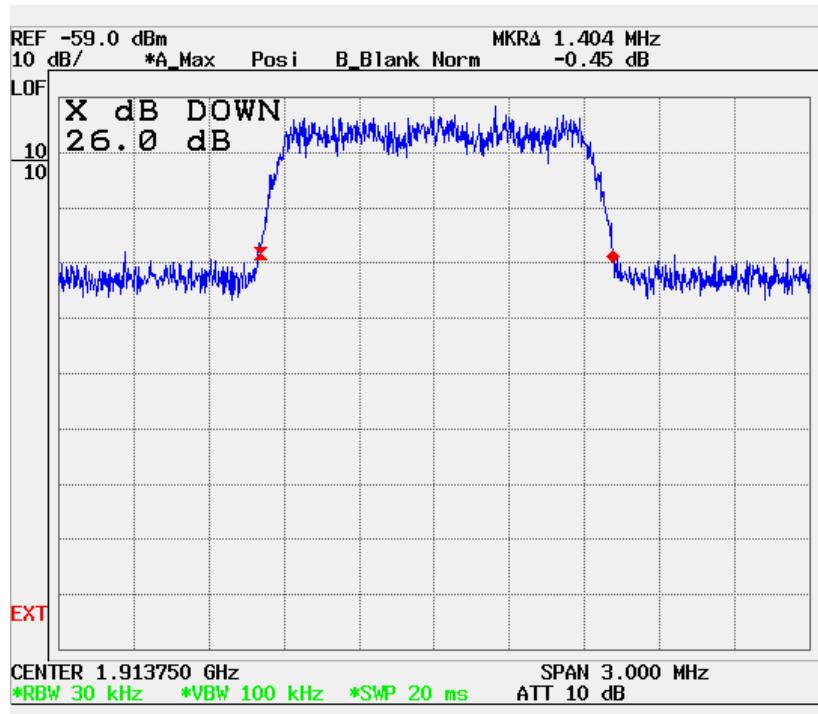
CDMA Uplink Low CH Output



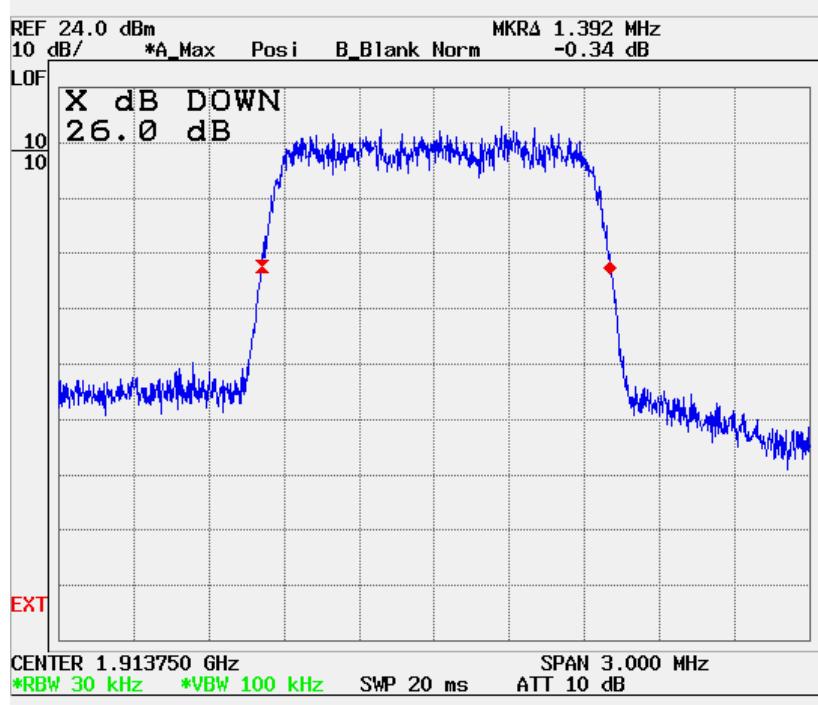
CDMA Uplink Mid CH Input



CDMA Uplink MidCH Output



CDMA Uplink High CH Input



CDMA Uplink High CH Output

8. SPURIOUS AND HARMONIC EMISSION AT ANTENNA TERMINAL

Test Requirement(s): § 2.1051 Measurements required: Spurious emissions at antenna terminals:

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in § 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

§ 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.

§ 24.238 (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.

Test Procedures:

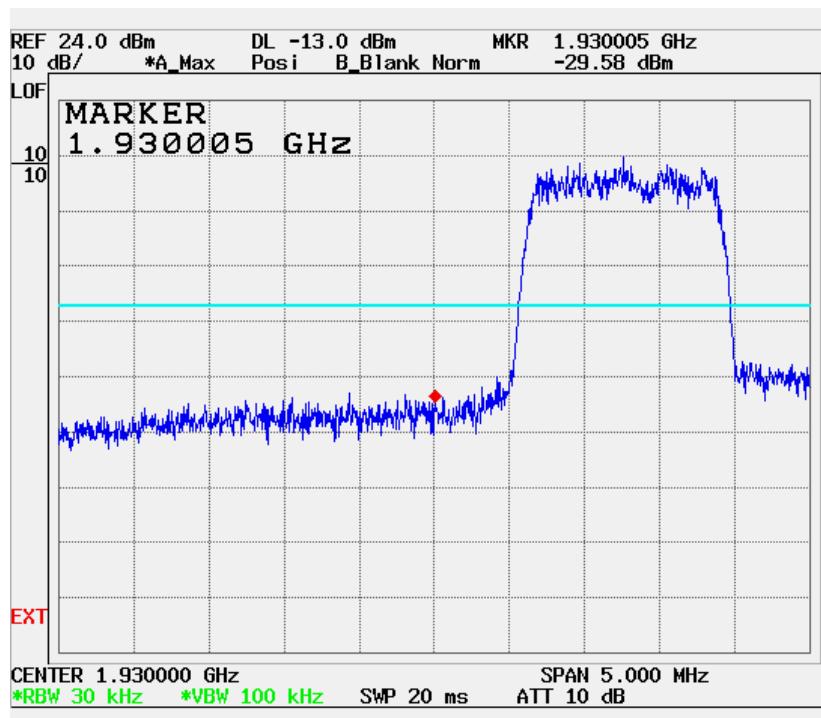
A modulated carrier generated by the signal generator carrier was connected to either the Uplink or Downlink RF port at a maximum level as determined by the OEM A spectrum analyzer was connected to either the Uplink or Downlink port depending on the circuitry being measured. The spectrum analyzer was set to 1MHz RBW and 3MHz VBW. The spectrum was investigated from 30MHz to the 10th harmonic of the carrier. The inter-modulation requirements were performed in a similar manner as described above. The spectrum analyzer was set to 100KHz RBW and 300KHz VBW. Two modulated carriers were injected into the EUT. One carrier was set at the band edge of either the Uplink or Downlink band and the other at carrier set at 6MHz deviation from the first carrier. The in band spurious emissions were investigated.

Test Results:

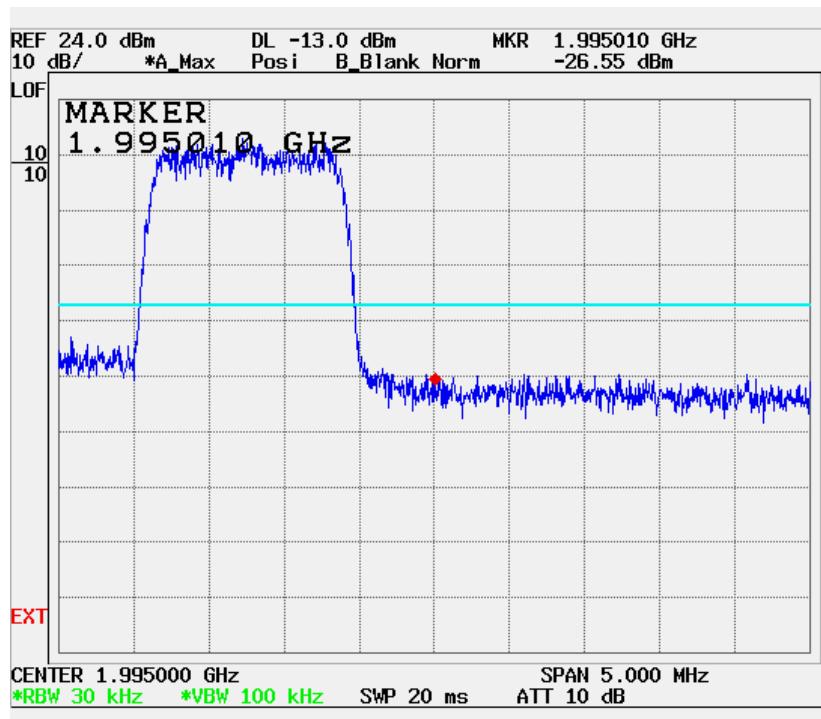
The EUT complies with the requirements of this section. There were no detectable spurious emissions for this EUT.

NOTE: The EUT is a band selective repeater. The test was performed using all selective bands and there was not much difference between them. The test result is reported using the widest bands.

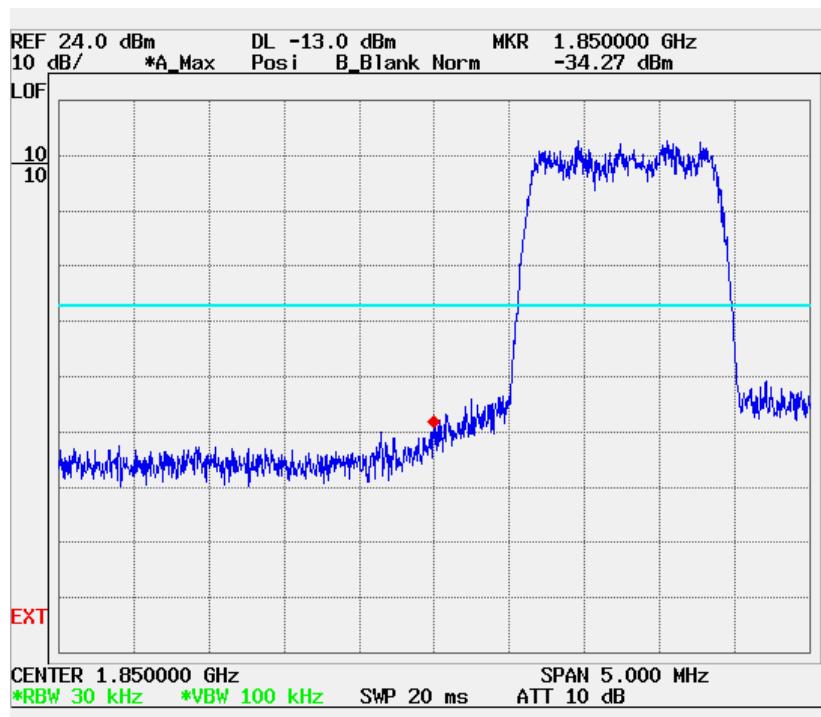
Plots of BAND EDGE



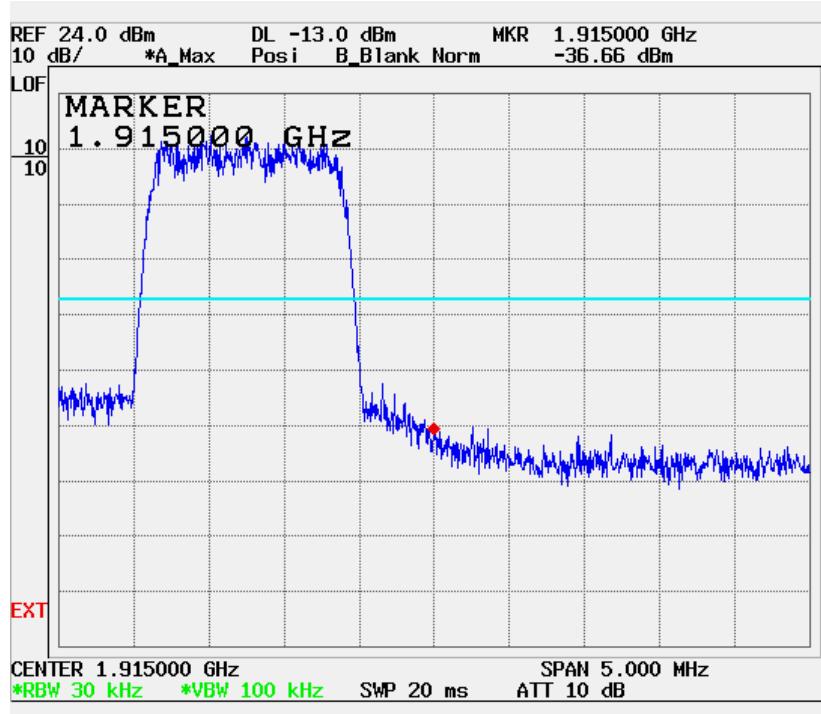
(CDMA Downlink Low CH)



(CDMA Downlink High CH)

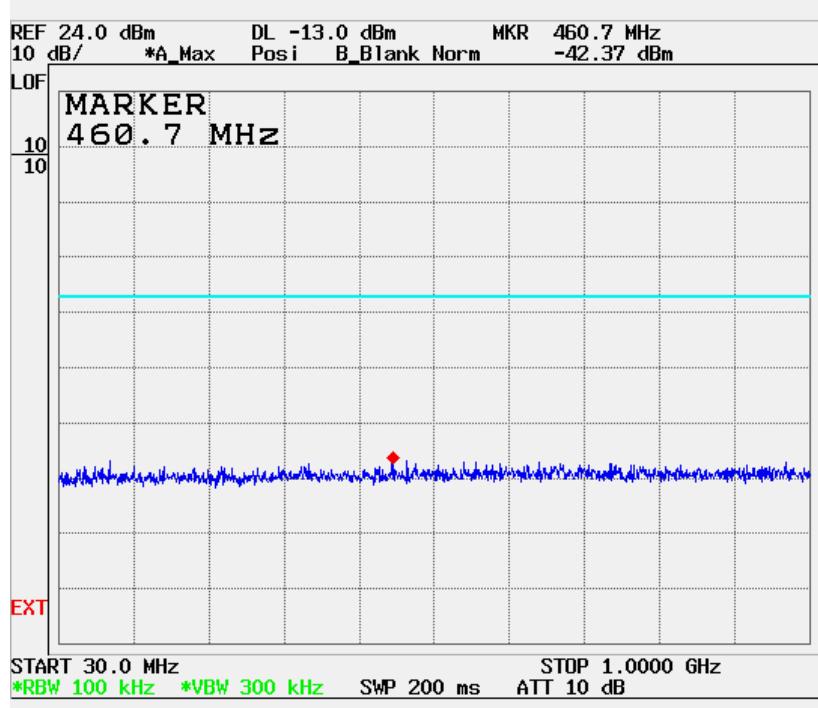


(CDMA Uplink Low CH)

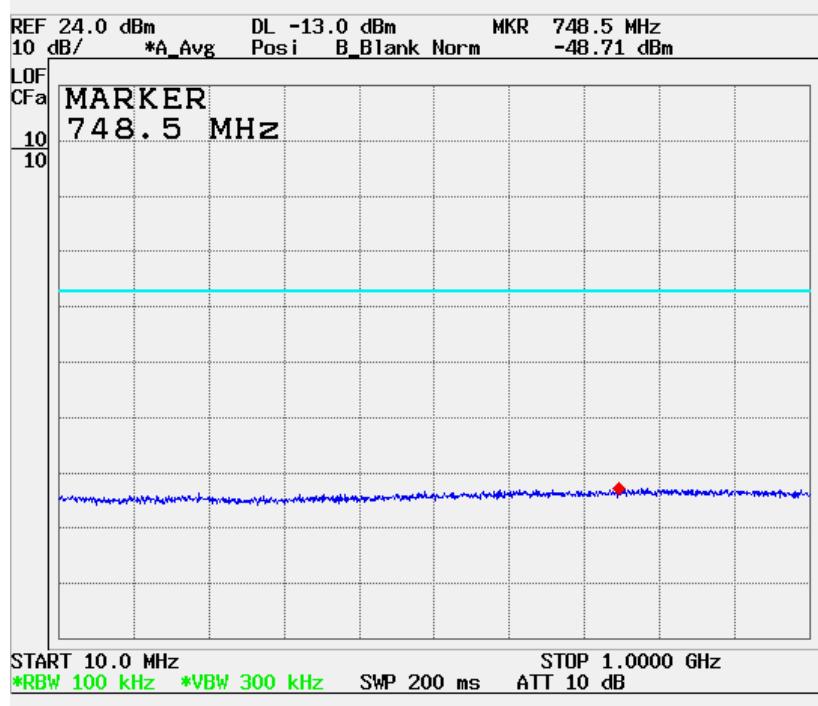


(CDMA Uplink High CH)

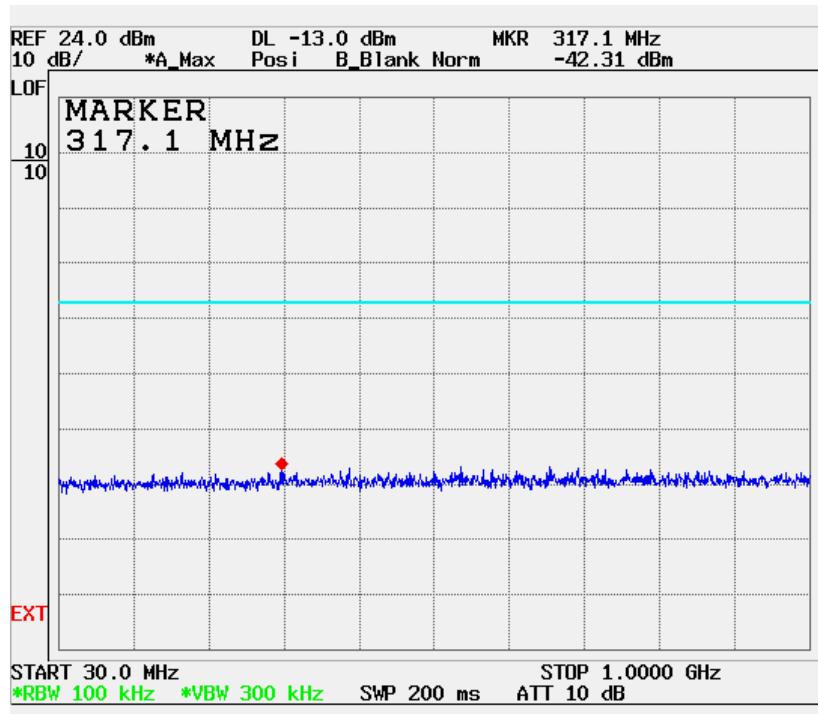
Plots of Spurious Emission



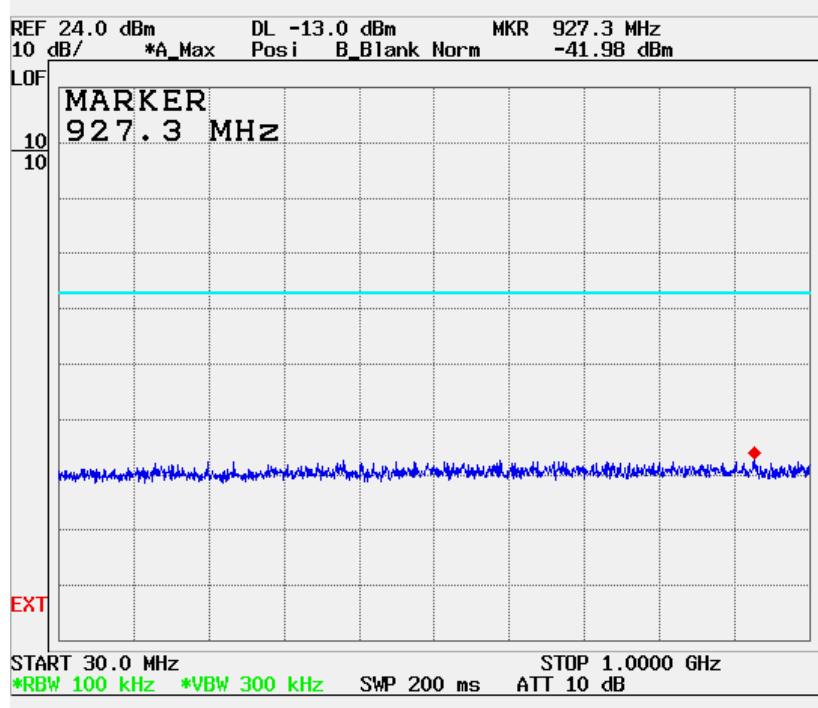
Conducted Spurious Emissions Downlink Low CH (30 MHz – 1 GHz)



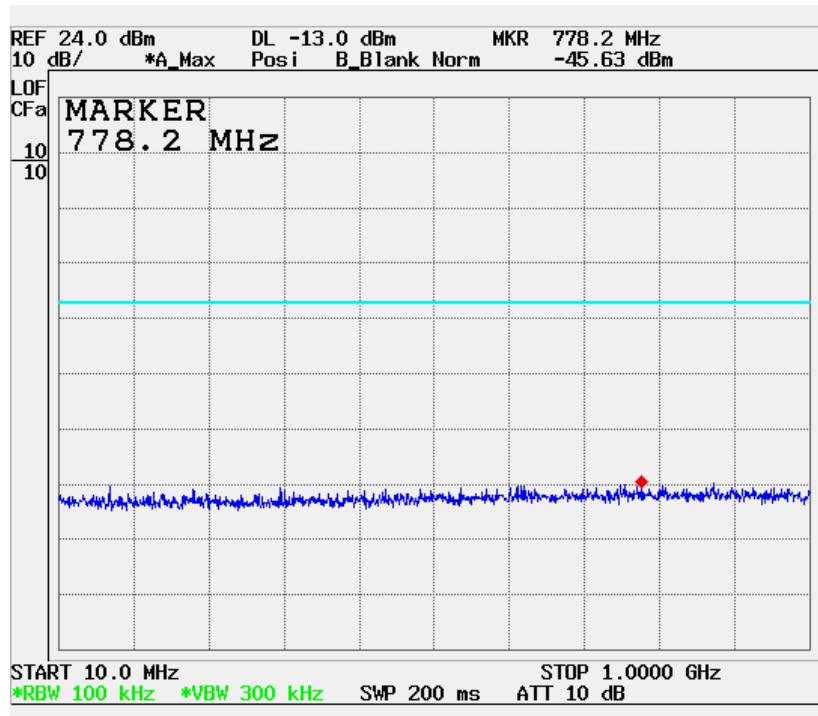
Conducted Spurious Emissions Downlink Mid CH (10 MHz – 1 GHz)



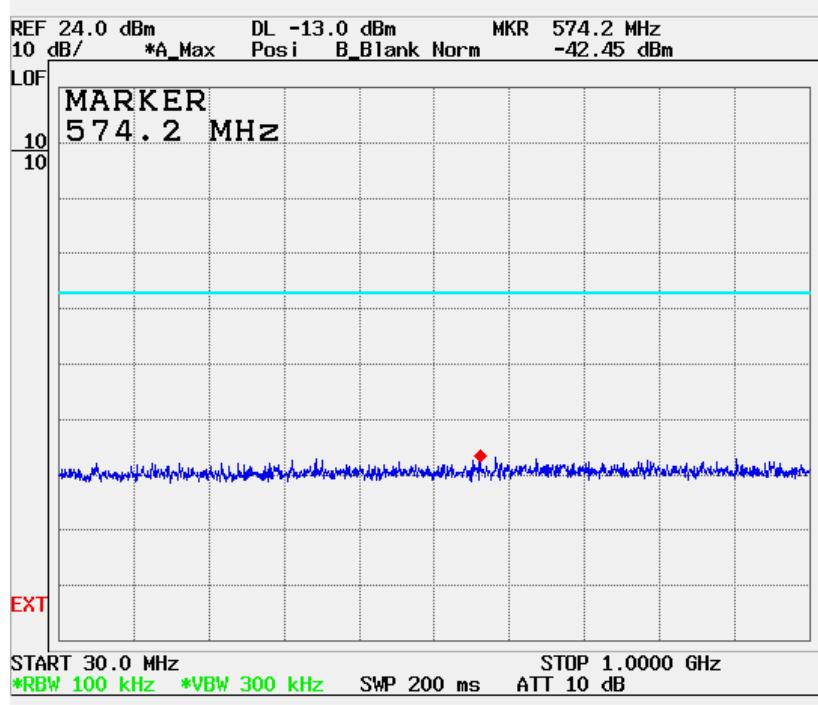
Conducted Spurious Emissions Downlink High CH (30 MHz – 1 GHz)



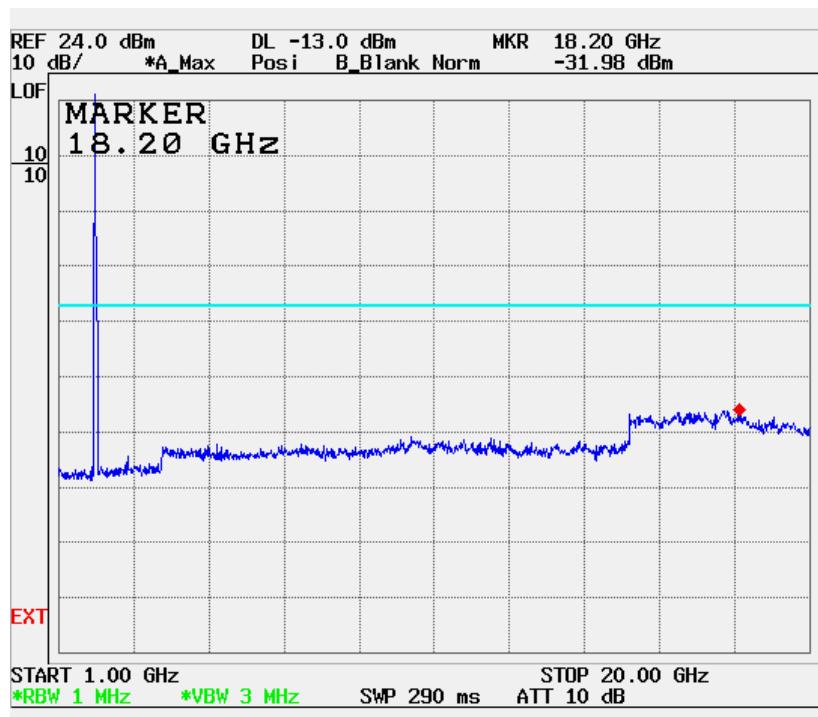
Conducted Spurious Emissions Uplink Low CH (30 MHz – 1 GHz)



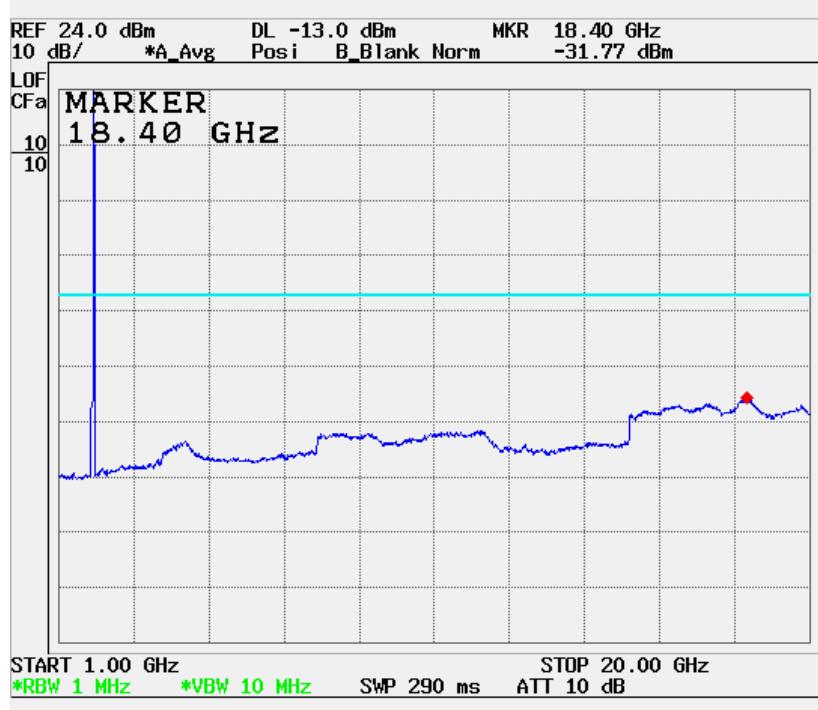
Conducted Spurious Emissions Uplink Mid CH (10 MHz – 1 GHz)



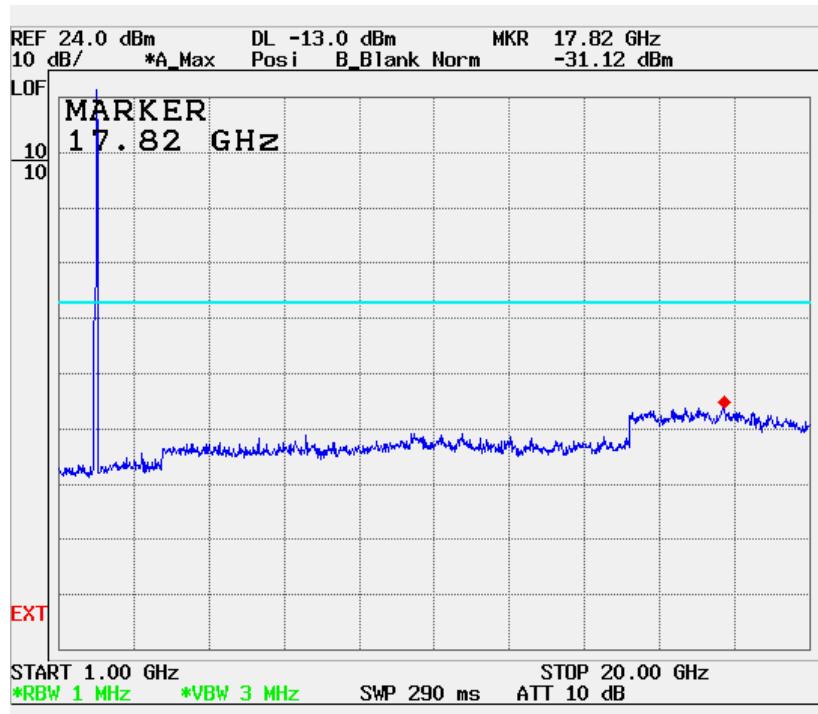
Conducted Spurious Emissions Uplink High CH (30 MHz – 1 GHz)



Conducted Spurious Emissions Downlink Low CH (1 GHz – 20 GHz)



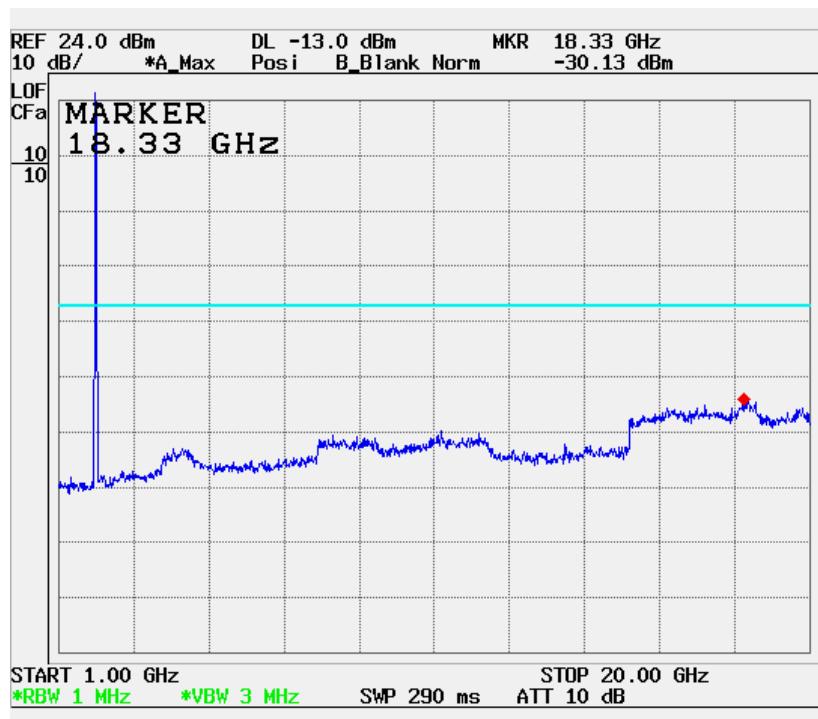
Conducted Spurious Emissions Downlink Mid CH (1 GHz – 20 GHz)



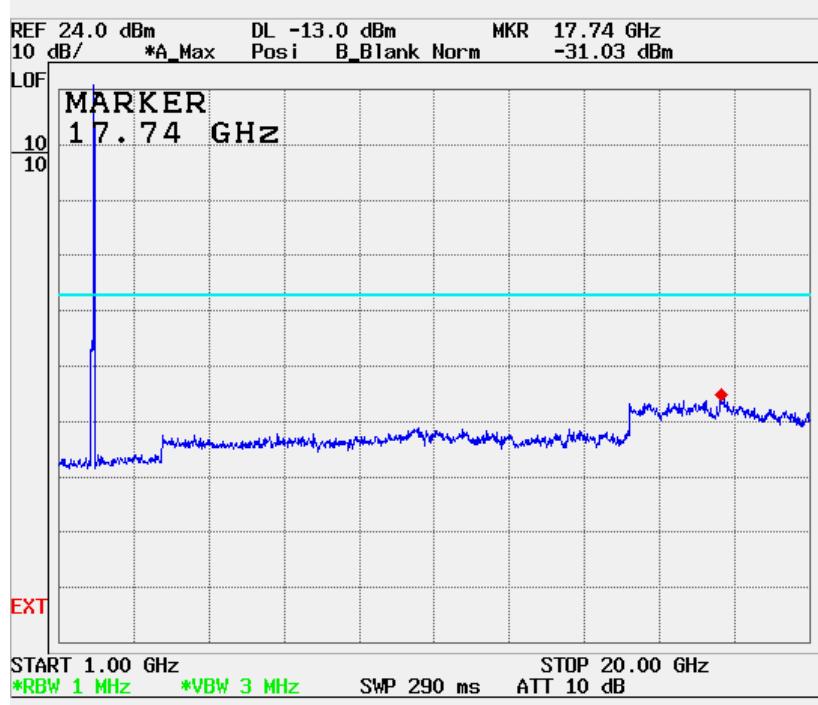
Conducted Spurious Emissions Downlink High CH (1 GHz – 20 GHz)



Conducted Spurious Emissions Uplink Low CH (1 GHz – 20 GHz)

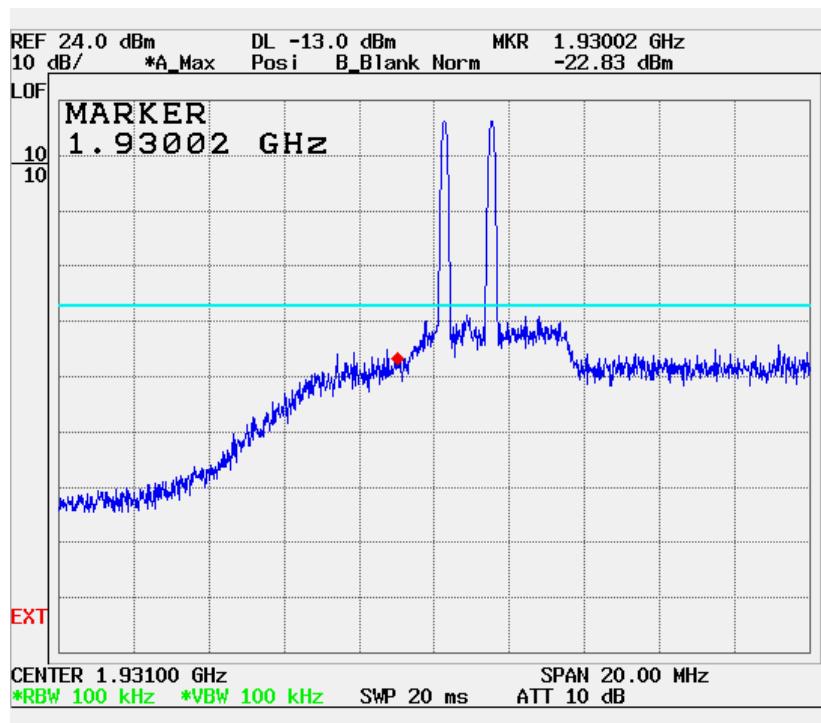


Conducted Spurious Emissions Uplink Mid CH (1 GHz – 20 GHz)

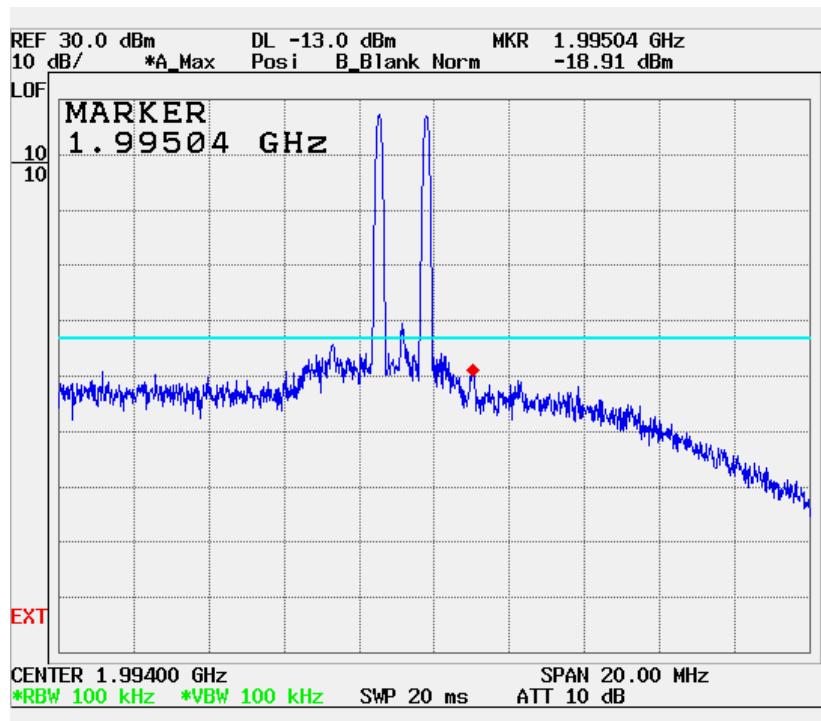


Conducted Spurious Emissions Uplink High CH (1 GHz – 20 GHz)

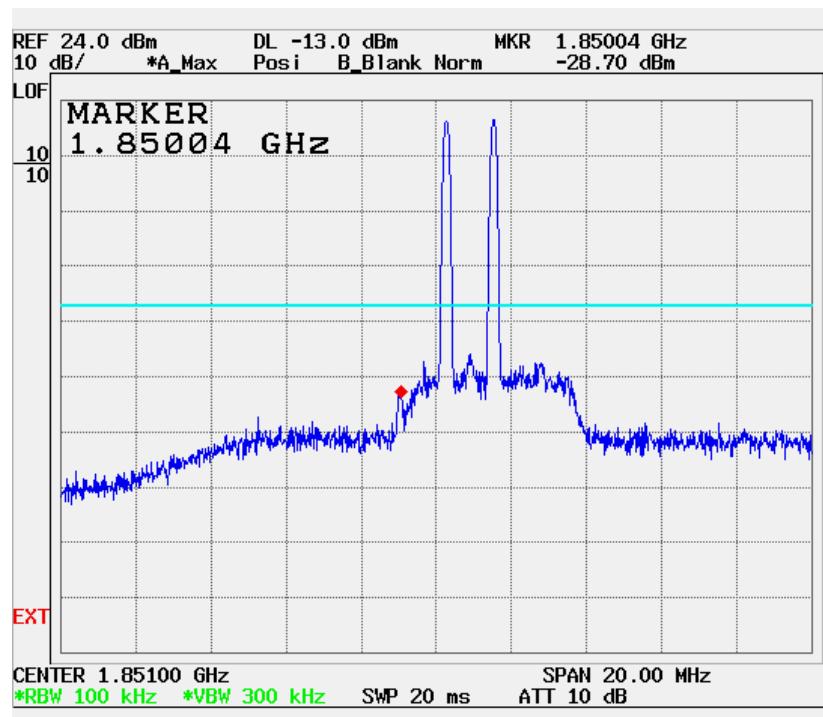
Plots of Two Tone Intermodulation



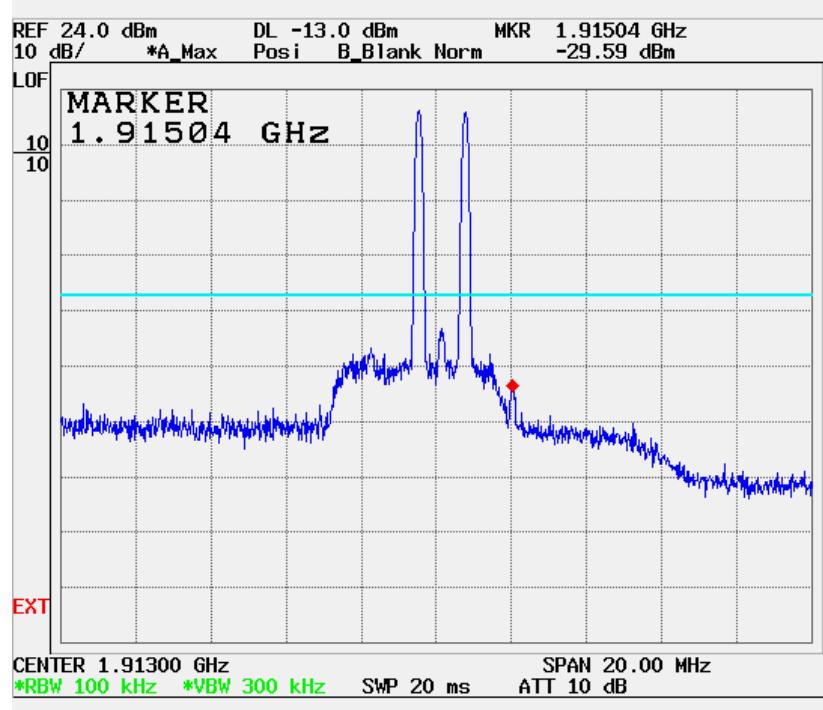
Two Tone Downlink Low End Intermodulation



Two Tone Downlink High End Intermodulation



Two Tone Uplink Low End Intermodulation



Two Tone Uplink High End Intermodulation

9. FIELD STRENGTH OF SPURIOUS RADIATION

Test Requirement(s): § 2.1053 Measurements required: Field strength of spurious radiation.

§ 2.1053 (a) 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. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of § 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.

§ 2.1053 (b): The measurements specified in paragraph (a) of this section shall be made for the following equipment:

- (1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.
- (2) All equipment operating on frequencies higher than 25 MHz.
- (3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
- (4) Other types of equipment as required, when deemed necessary by the Commission.

§ 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.

§ 24.238 (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 $43 + 10 \log(P)$.

Test Procedures: As required by 47 CFR 2.1053, *field strength of radiated spurious measurements* were

made in accordance with the procedures of TIA/EIA-603-A-2001 "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards".

Radiated emission measurements were performed inside a 10 meter semi-anechoic chamber.

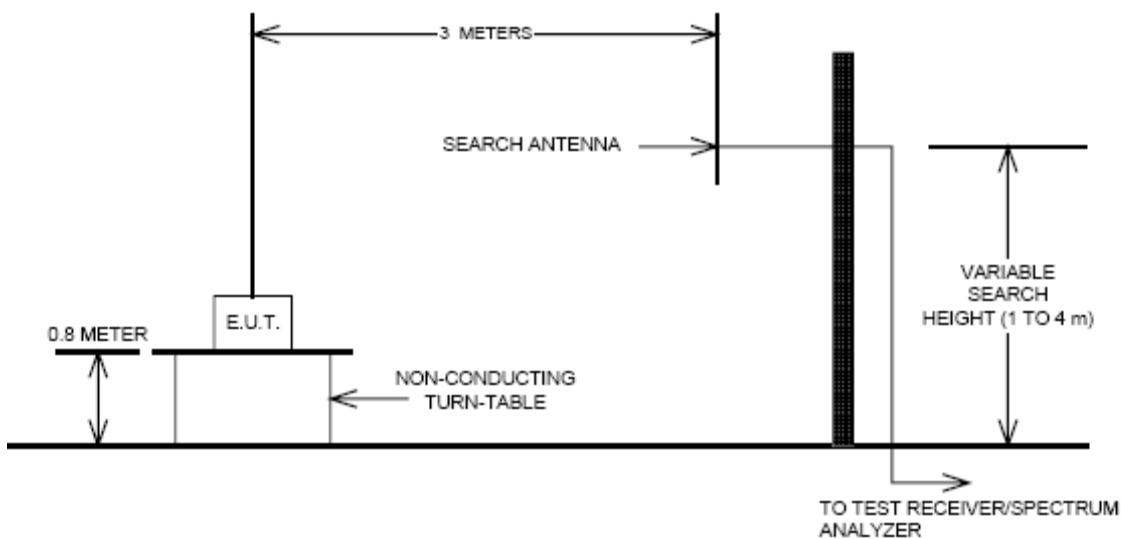
The EUT was set at a distance of 3m from the receiving antenna. The EUT's RF ports were terminated to 50ohm load. The EUT was set to transmit at the low, mid and high channels of the transmitter frequency range at its maximum power level. The EUT was rotated about 360°

and the receiving antenna scanned from 1-4m in order to capture the maximum emission. A calibrated antenna source was positioned in place of the EUT and the previously recorded signal was duplicated. The maximum EIRP of the emission was calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps were carried out with the receiving antenna in both vertical and horizontal polarization. Harmonic emissions up to the 10th or 40GHz, whichever was the lesser, were investigated.

Test Results: There were no emissions detected above the noise floor which was at least 20 dB below the limit.

NOTE: The EUT is a band selective repeater. The test was performed using all selective bands and there was not much difference between them. The test result is reported using the widest bands.

Radiated Spurious Emissions Test Setup



10. FREQUENCY STABILITY OVER TEMPERATURE AND VOLTAGE VARIATIONS

Test Requirement(s):

§2.1055(a)(1) §90.213

Test Procedures:

As required by 47 CFR 2.1055, *Frequency Stability measurements* were made at the RF output terminals using a Spectrum Analyzer.

The EUT was placed in the Environmental Chamber.

A CW signal was injected into the EUT at the appropriate RF level. The frequency counter option

on the Spectrum Analyzer was used to measure frequency deviations.

The frequency drift was investigated for every 10 °C increment until the unit is stabilized then recorded the reading in tabular format with the temperature range of -30 to 50 °C.

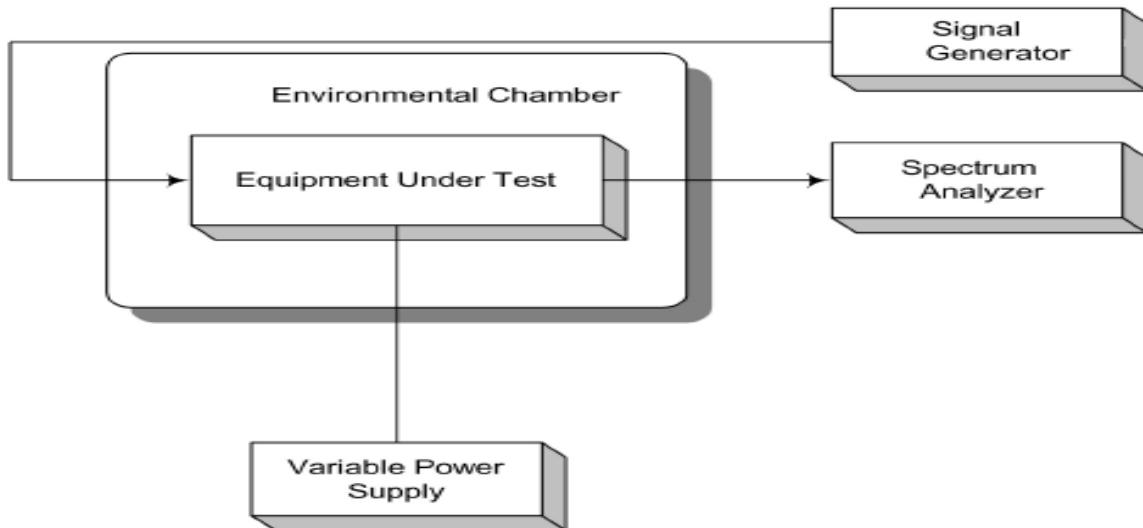
Voltage supplied to EUT is 120 Vac reference temperature was done at 20°C. The voltage was varied by $\pm 15\%$ of nominal

Test Results:

The E.U.T was found in compliance for Frequency Stability and Voltage Test

NOTE: The EUT is a band selective repeater. The test was performed using all selective bands and there was not much difference between them. The test result is reported using the widest bands.

Test Setup:



Frequency Stability and Voltage Test Results

Reference: 120 Vac at 20°C **Freq.** = 1882.500005 MHz

Temperature (Celsius)	Measured Freq (MHz)	Drift ppm
50	1882.500013	0.000008
40	1882.500011	0.000006
30	1882.500009	0.000004
20	Reference	
10	1882.500004	- 0.000001
0	1882.500007	0.000002
-10	1882.500015	0.000010
-20	1882.500023	0.000017
-30	1882.500021	0.000016

Reference: 120 Vac at 20°C **Freq.** = 1882.50005 MHz

Voltage(dc) +/-15% Ref	Measured Freq (MHz)	Drift (Hz)
102	1882.50004	-0.00001
138	1882.50011	0.00006

Uplink Mid CH

Reference: 120 Vac at 20°C **Freq.** = 1962.499995 MHz

Temperature (Celsius)	Measured Freq (MHz)	Drift Ppm
50	1962.499992	-0.000003
40	1962.499987	-0.000008
30	1962.499985	-0.000010

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- 30 /32-

Reference		
20		
10	1962.499998	0.000003
0	1962.500003	0.000008
-10	1962.500010	0.000010
-20	1962.500013	0.000018
-30	1962.500021	0.000026

Reference: 120 Vac at 20°C Freq. = 1962.49995 MHz

Voltage(dc)	Measured	Drift
+/-15% Ref	Freq (MHz)	(Hz)
102	1962.500011	0.000016
138	1962.500009	0.000014

Downlink Mid CH