

ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LICENSED TRANSMITTER

Test Report No. : E143R-052

AGR No. : A143A-053

Applicant : SAMSUNG Electronics Co., Ltd.

Address : (Maetan-dong) 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 443-742,
Republic of Korea

Manufacturer : SAMSUNG Electronics Co., Ltd

Address : (Maetan-dong) 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 443-742,
Republic of Korea

Type of Equipment : Verizon Wireless Network Extender

FCC ID. : A3LSCS-2UAAAA

Model Name : SCS-2U01

Multiple Model Name : SCS-2U3100

Serial number : N/A

Total page of Report : 68 pages (including this page)

Date of Incoming : March 03, 2014

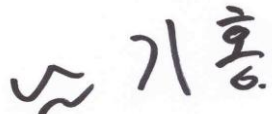
Date of issue : March 17, 2014

SUMMARY

The equipment complies with the regulation; **FCC Part 22 Subpart H and FCC Part 24 Subpart E.**

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

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ONETECH Corp.

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Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
E143R-052	March 17, 2014	Initial Issue	All

1. VERIFICATION OF COMPLIANCE

APPLICANT : SAMSUNG Electronics Co., Ltd.
 ADDRESS : (Maetan-dong) 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 443-742,
 Republic of Korea
 CONTACT PERSON : Duk-Hun Kim / Senior Research Engineer
 TELEPHONE NO : +82-31-279-3509
 FCC ID : A3LSCS-2UAAAA
 MODEL NAME : SCS-2U01
 MULTIPLE MODEL NAME : SCS-2U3100
 SERIAL NUMBER : N/A
 DATE : March 17, 2014

EQUIPMENT CLASS	PCS Licensed Transmitter(PCB)
EQUIPMENT DESCRIPTION	Verizon Wireless Network Extender
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	TIA-603-D-2010
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC Part 22 Subpart H and FCC Part 24 Subpart E
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	No
FINAL TEST WAS CONDUCTED ON	10 m semi anechoic chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

2. TEST SUMMARY

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
2.1046(a), 22.913(a), 24.232	RF Power Output at Antenna Terminals	Met the Limit / PASS
2.1049, 24.238	Occupied Bandwidth, Bandwidth Limitation	Met the Limit / PASS
2.1049, 22.917	Band Edge	Met the Limit / PASS
2.1051, 22.917, 24.238	Spurious Emissions at Antenna Terminals	Met the Limit / PASS
2.1053, 22.917, 24.238	Field strength of Spurious Radiation	Met the Limit / PASS
2.1055, 22.355, 24.235	Frequency Stability with Temperature variation	Met the requirement / PASS
2.1055, 22.355, 24.235	Frequency stability with primary voltage variation	Met the requirement / PASS
1.1307(b)	RF Safety	Met the Limit / PASS

2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

2.3 Related Submittal(s) / Grant(s)

Original Grant

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in section 2.1.

2.5 Test Methodology

Radiated testing was performed according to the procedures in TIA-603-D: 2010 and was performed at a distance of 10 m and 3 m from EUT to the antenna.

2.6 Test Facility

The open area test site is located at 307-51 Daessangryung-ri, Chowol-eup, Gwangju-si, Gyeonggi-do and 10 m Semi Anechoic Chamber (SAC) and conducted measurement facilities are located at 301-14, Daessangryung-ri, Chowol-eup, Gwangju-si, Gyeonggi-do, 464-862, Korea. The Onetech Corp. has been accredited as a Conformity Assessment Body (CAB) with designation number KR0013 under APEC TEL MAR between the RRA and the FCC.

3. GENERAL INFORMATION

3.1 Product Description

The SAMSUNG Electronics Co., Ltd., Models SCS-2U01(referred to as the EUT in this report) are Verizon Wireless Network Extender.

The Verizon Wireless Network Extender transmits/receives radio signals to/from the UE and processes the modulation and demodulation of packet traffic signals. The Verizon Wireless Network Extender is also responsible for packet scheduling and radio bandwidth allocation and performs handover via interface with the EPC

The Verizon Wireless Network Extender can be installed vertically or horizontally; and it can be installed on the wall, pole or rack by using the installation brackets. The Verizon Wireless Network Extender is an all-in-one unit. If a fault occurs, the unit must be replaced with new one.

The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE		Verizon Wireless Network Extender
LIST OF EACH OSC. or CRY. FREQ.(FREQ. >= 1 MHz)		16.368 MHz, ,19.2 MHz, 25 MHz, 30.72 MHz, 33,33 MHz
EMISSION DESIGNATOR		BPSK, QPSK, 16QAM
OPERATING FREQUENCY	CDMA	869.70 MHz ~ 893.31 MHz
	PCS	1 931.25 MHz ~ 1 988.75 MHz
RF OUTPUT POWER	CDMA	13.74 dBm(1X) / 13.79 dBm(DO)
	PCS	13.27 dBm(1X) / 13.62 dBm(DO)
Type of Antenna		Dipole Antenna
Antenna Gain	CDMA	1.378 dBi
	PCS	2.584 dBi
POWER REQUIREMENT		DC 12 V , 1.5A from AC/DC adapter
ELECTRICAL RATING		AC 110 V

3.2 Alternative type(s)/model(s); also covered by this test report.

The following lists consist of the added model and their differences.

Model Name	Differences	Tested
SCS-2U01	Basic Model	☒
SCS-2U3100	These models are identical to basic model except for the model name only.	☐

Note: 1. Applicant consigns only basic model to test. Therefore this test report just guarantees the units, which have been tested.

2. The Applicant/manufacture is responsible for the compliance of all variants.

3.3 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

Model	Manufacturer	FCC ID	Description	Connected to
SCS-2U01	SAMSUNG Electronics Co., Ltd	A3LSCS-2UAAAA	Verizon Wireless Network Extender (EUT)	Notebook PC
LGR51	LG	N/A	Notebook PC	EUT

3.4 Mode of operation during the test

The EUT was operated in a manner representative of the typical usage of the equipment. During all testing, system components were manipulated within the confines of typical usage to maximize each emission. All Modulation (1X RTT and DO RTT) modes were tested.

For the above testing, following frequencies per channel were selected for each modulation.

1. Coverage band : CDMA

Modulation	Channel	Frequency(MHz)	Modulation	Channel	Frequency(MHz)
1X RTT	Low	869.70	DO RTT	Low	869.70
	Middle	881.52		Middle	881.52
	High	893.31		High	893.31

2. Coverage band: PCS

Modulation	Channel	Frequency(MHz)	Modulation	Channel	Frequency(MHz)
1X RTT	Low	1 931.25	DO RTT	Low	1 931.25
	Middle	1 960.00		Middle	1 960.00
	High	1 988.75		High	1 988.75

4. EUT MODIFICATIONS

-. None

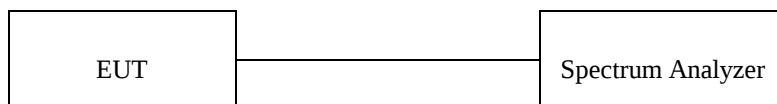
5. RF POWER OUTPUT at ANTENNA TERMINAL

5.1 Operating environment

Temperature : 25 °C
Relative humidity : 45 % R.H.

5.2 Test set-up

The test was performed at three frequencies (low, middle, and high channels) at each band using all applicable modulation. RF output power was measured by the spectrum analyzer with Average detector mode. The conducted emission level is measured at antenna port.



5.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV30	R/S	FSV30 Signal Analyzer	101372	May 20, 2013 (1Y)

All test equipment used is calibrated on a regular basis.

5.4 Test data

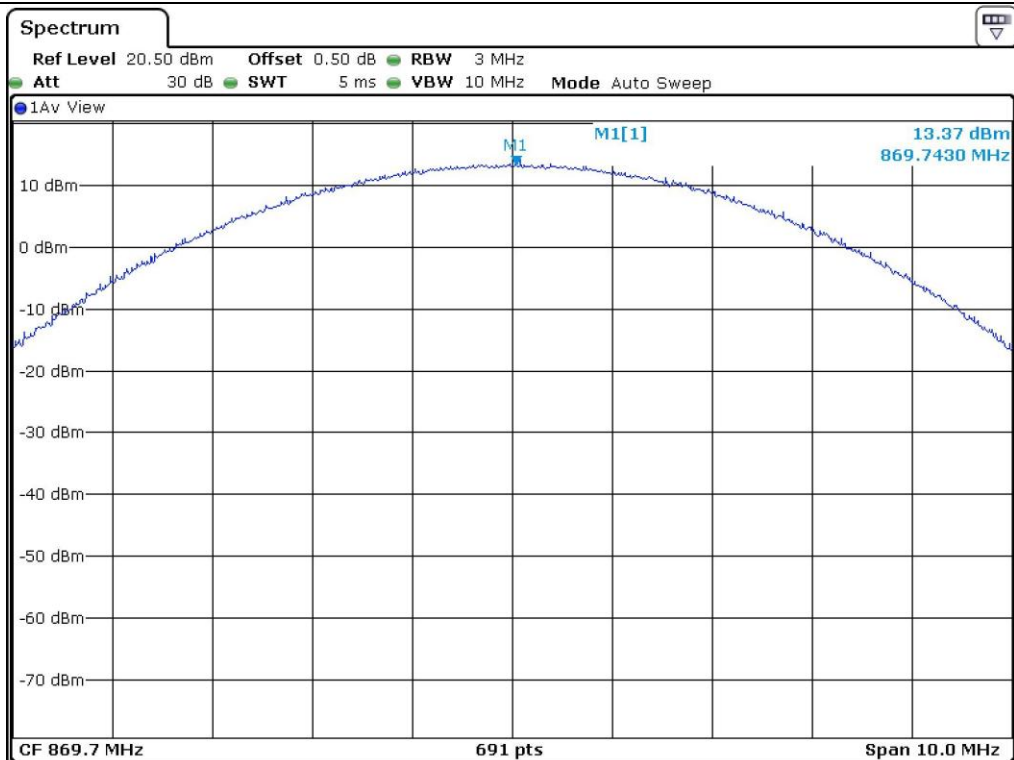
5.4.1 Test Result for Part 22 H (CDMA)

-. Test Date : March 05, 2014
-. Detector Mode : Average detector
-. Test Result : Pass

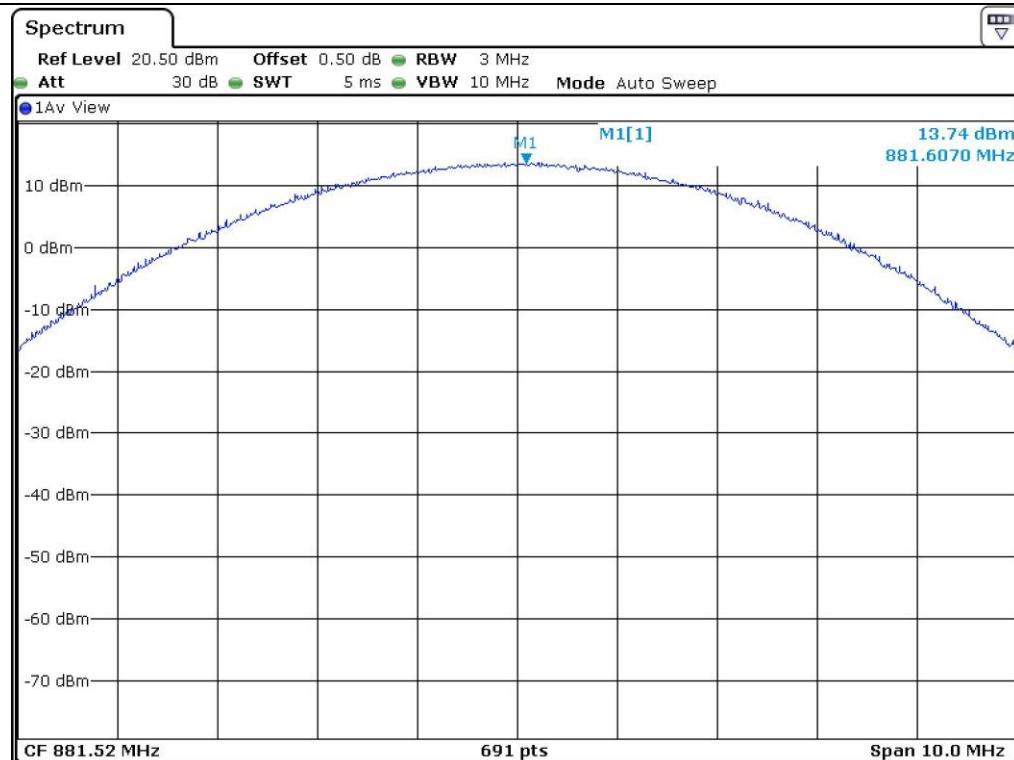
Modulation	Channel	Frequency (MHz)	Output Power (dBm)		Output Power (W)		Limit (W)
			RC1	RC3	RC1	RC3	
			SO2	SO9	SO2	SO9	
1X RTT	Low	869.70	13.37	12.48	0.021 727	0.017 701	500.00
	Middle	881.52	13.74	13.05	0.023 659	0.020 184	
	High	893.31	13.25	13.41	0.021 135	0.021 928	
DO RTT	Low	869.70	13.39	12.68	0.021 827	0.018 535	
	Middle	881.52	13.79	13.01	0.023 933	0.019 999	
	High	893.31	13.69	12.71	0.023 388	0.018 664	



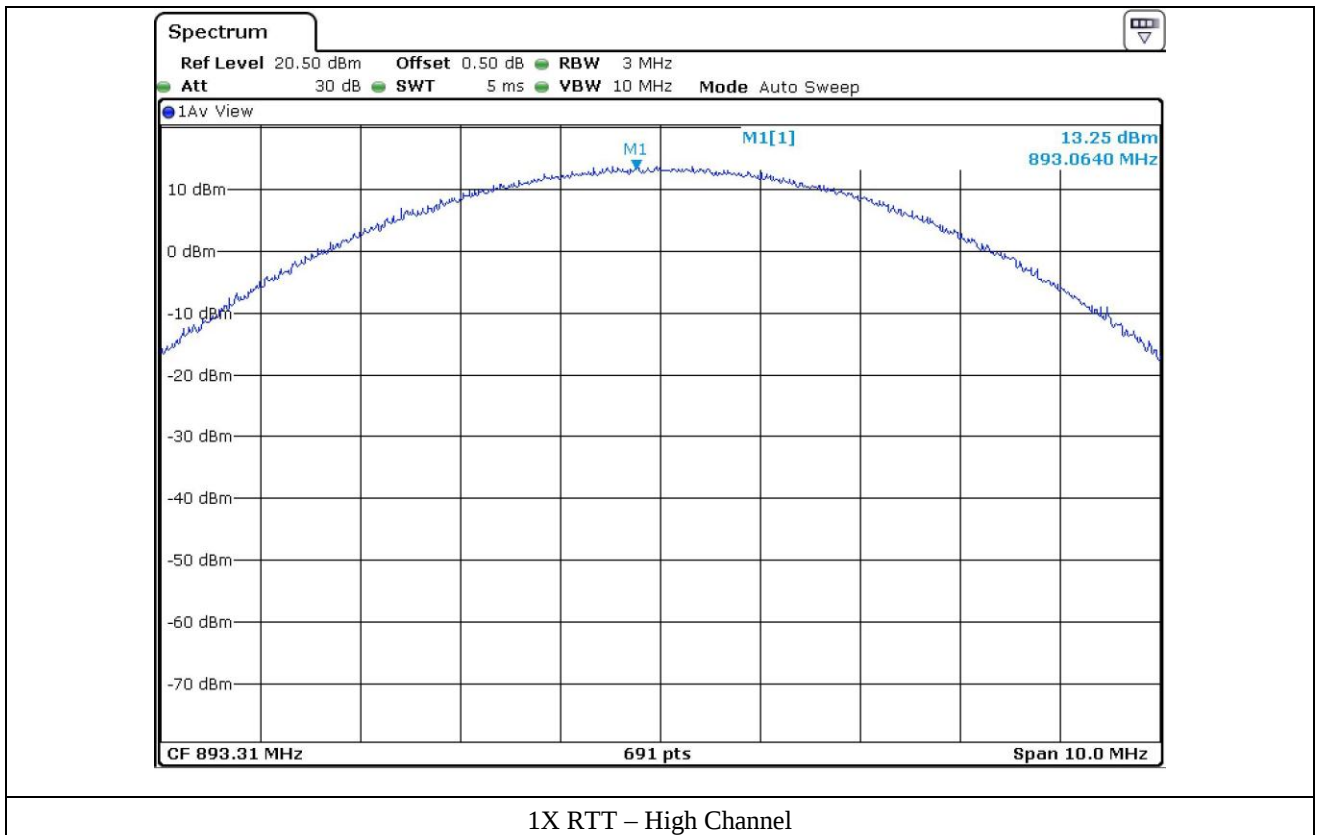
Tested by: Hong-Kyu, Lee/ Engineer

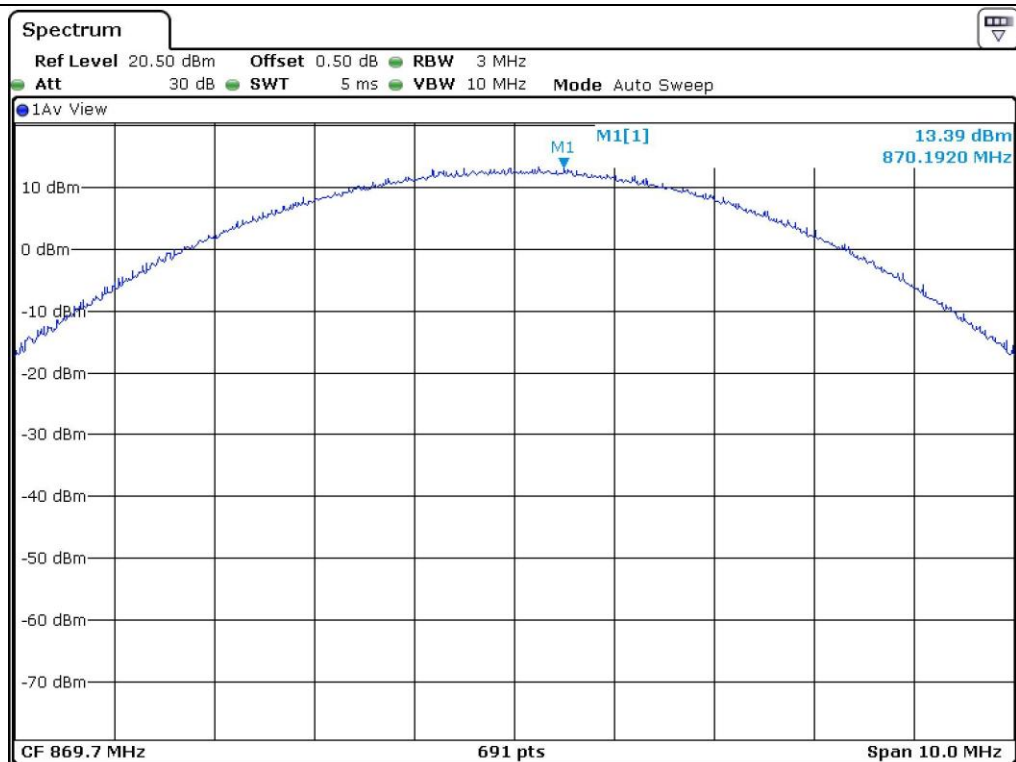


1X RTT – Low Channel

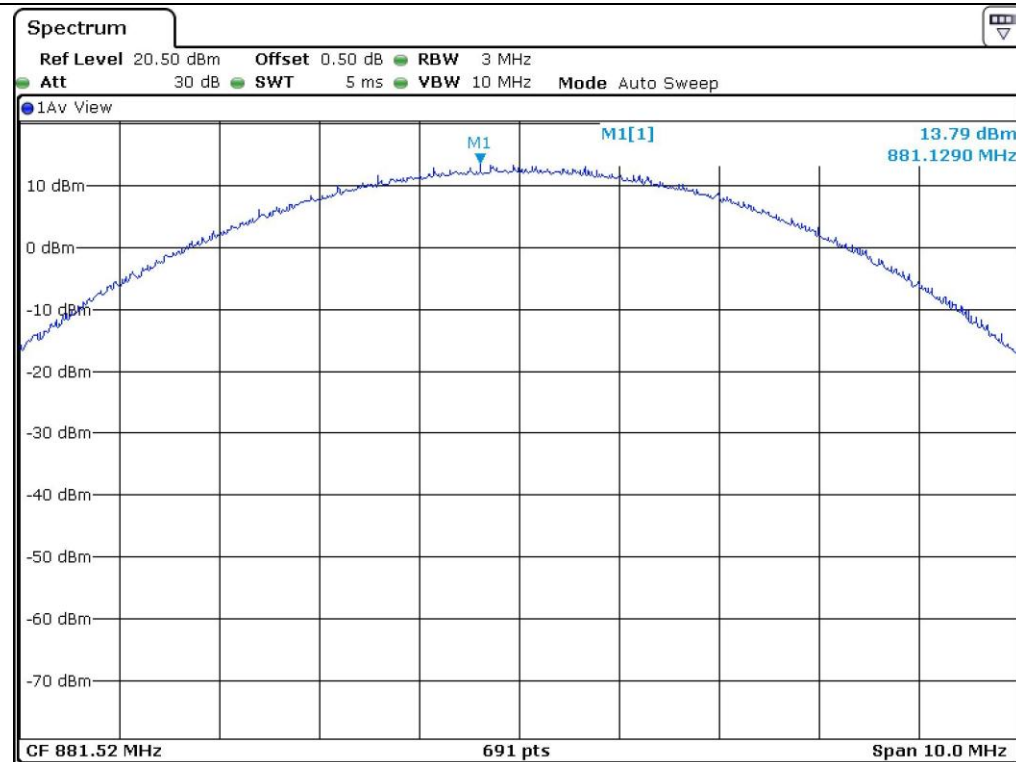


1X RTT – Middle Channel

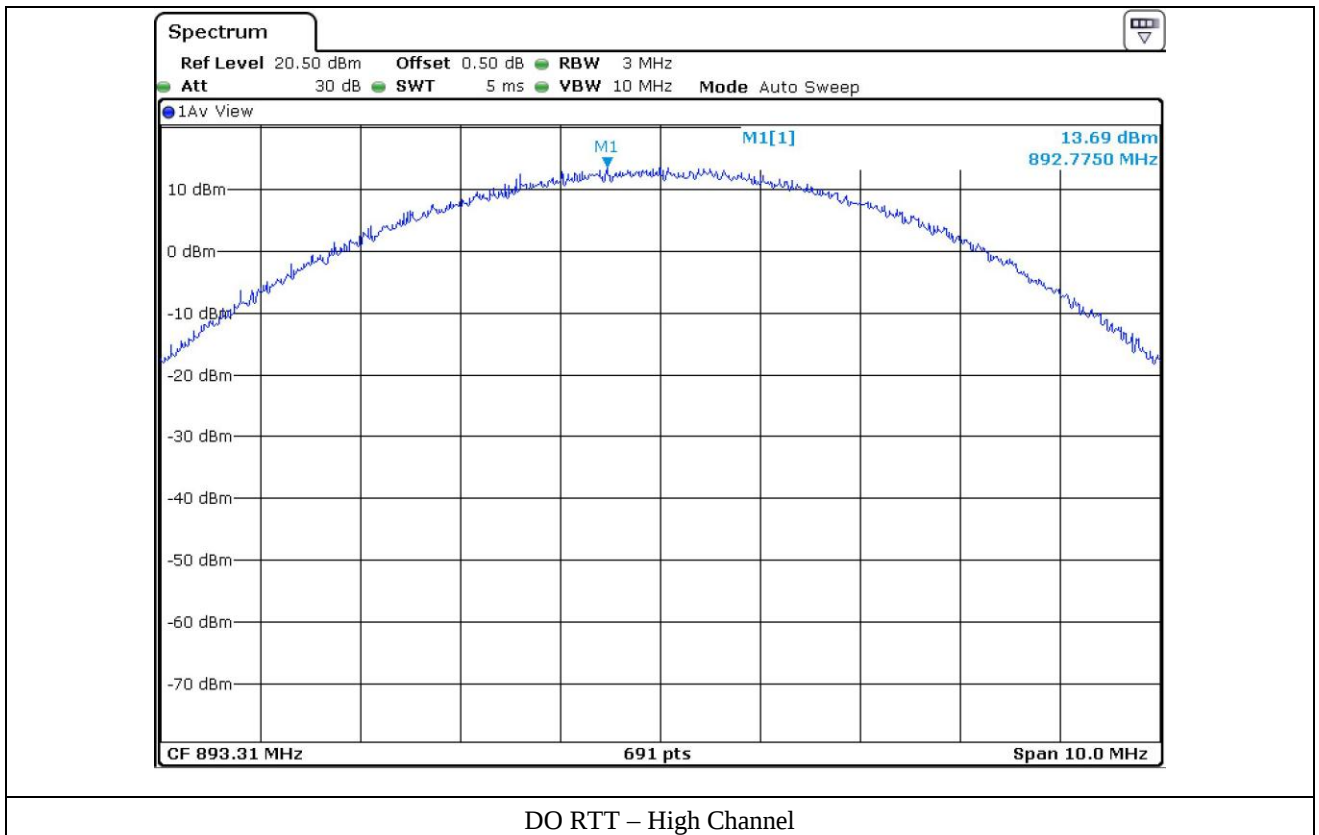




DO RTT – Low Channel



DO RTT – Middle Channel



5.4.2 Test Result for Part 24 E (PCS)

-. Test Date : March 05, 2014

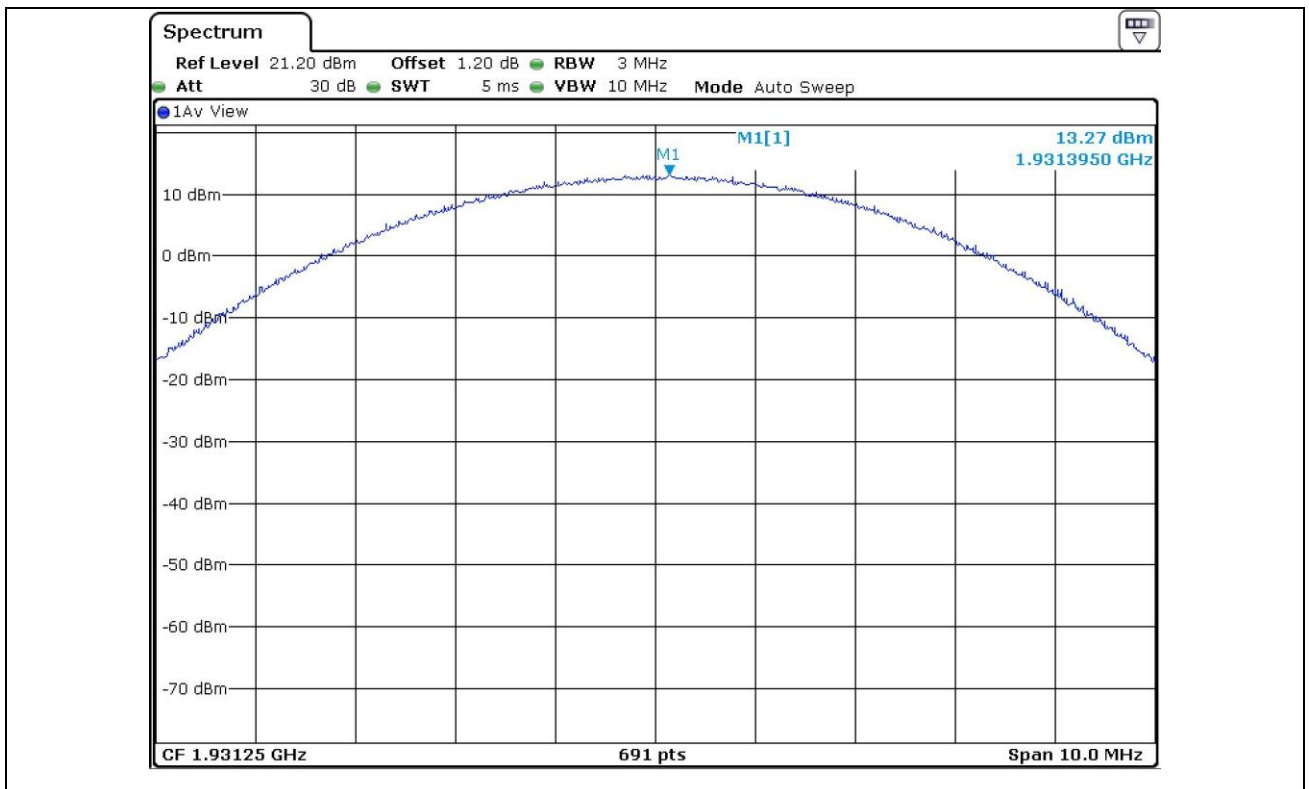
-. Detector Mode : Average detector

-. Test Result : Pass

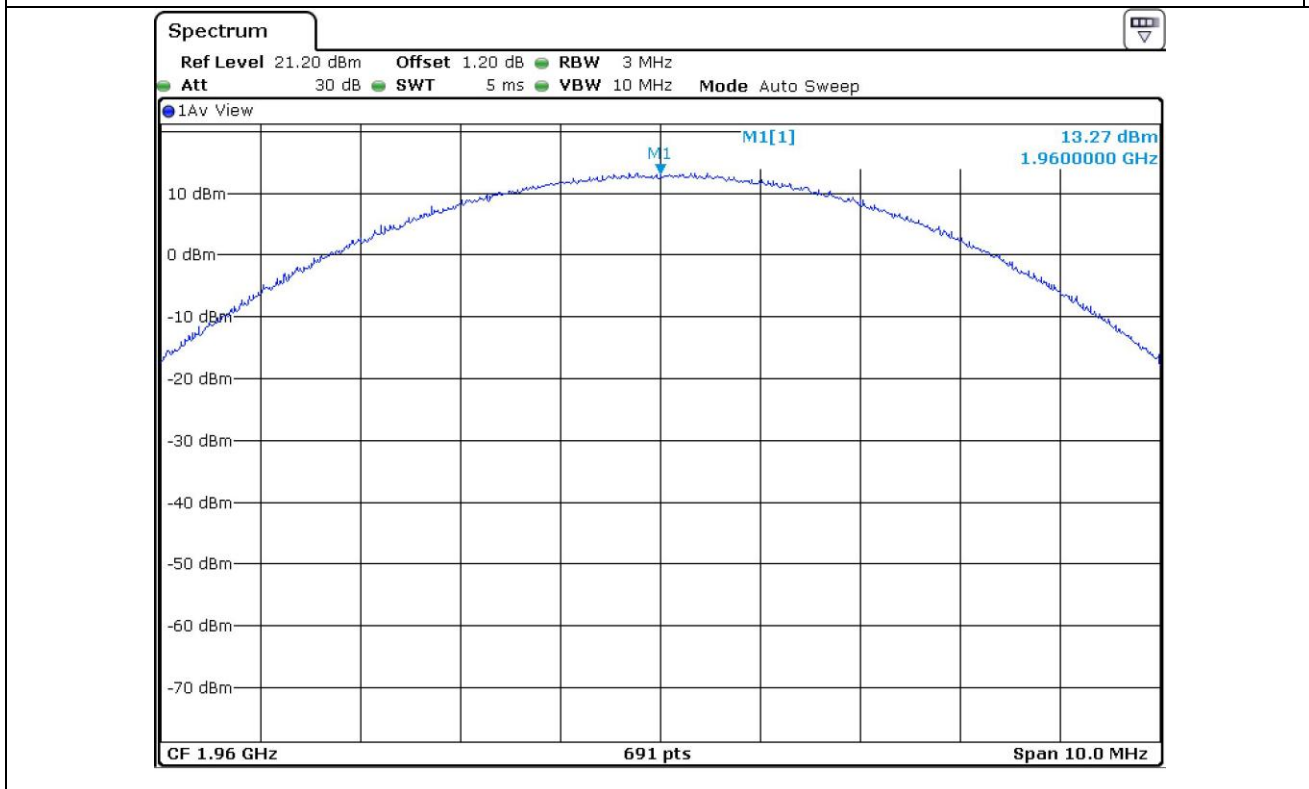
Modulation	Channel	Frequency (MHz)	Output Power (dBm)		Output Power (W)		Limit (W)
			RC1	RC3	RC1	RC3	
			SO2	SO9	SO2	SO9	
1X RTT	Low	1 931.25	13.27	12.58	0.021 232	0.018 113	500.00
	Middle	1 960.00	13.27	12.15	0.021 232	0.016 406	
	High	1 988.75	13.23	12.21	0.021 038	0.016 634	
DO RTT	Low	1 931.25	13.62	13.04	0.023 014	0.020 137	
	Middle	1 960.00	12.91	12.64	0.019 543	0.018 365	
	High	1 988.75	12.67	12.44	0.018 493	0.017 539	



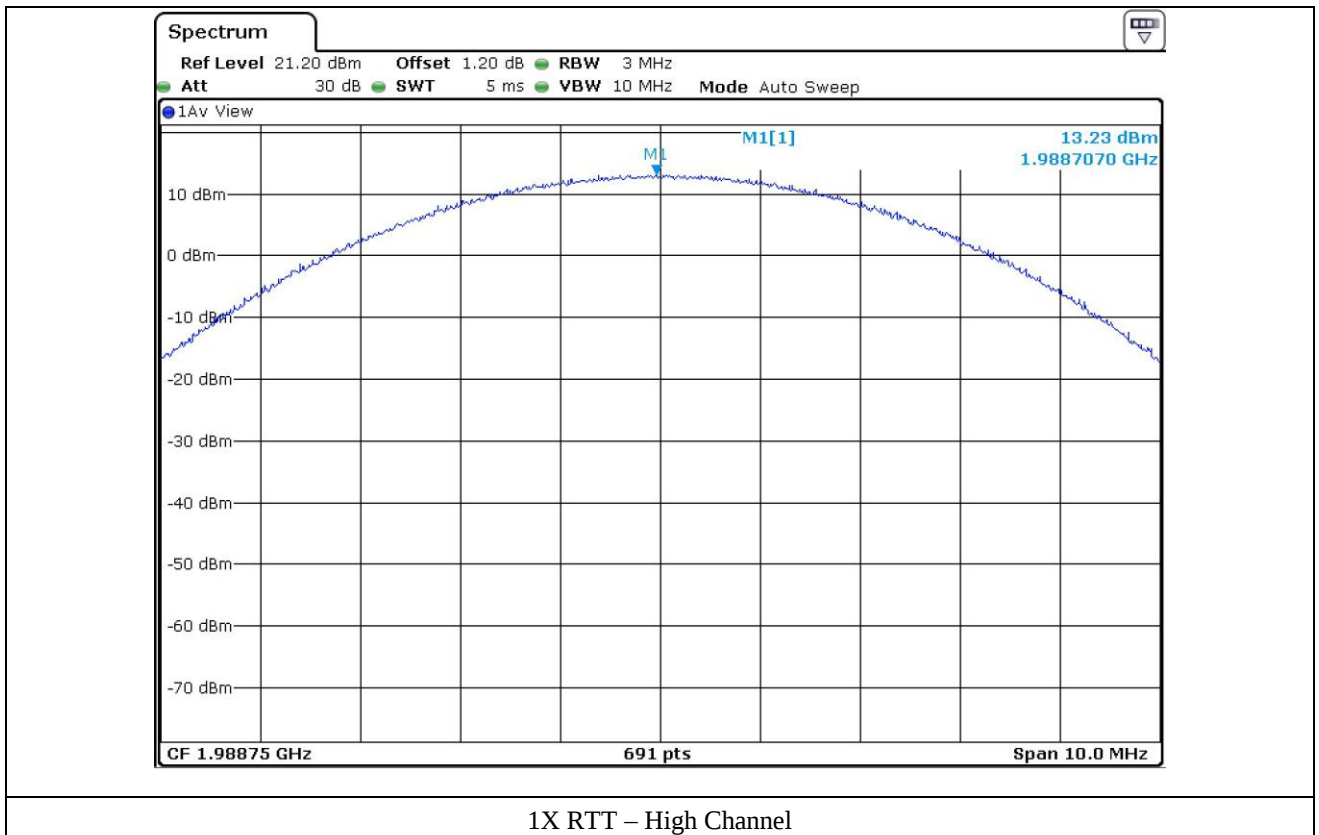
Tested by: Hong-Kyu, Lee/ Engineer



1X RTT – Low Channel

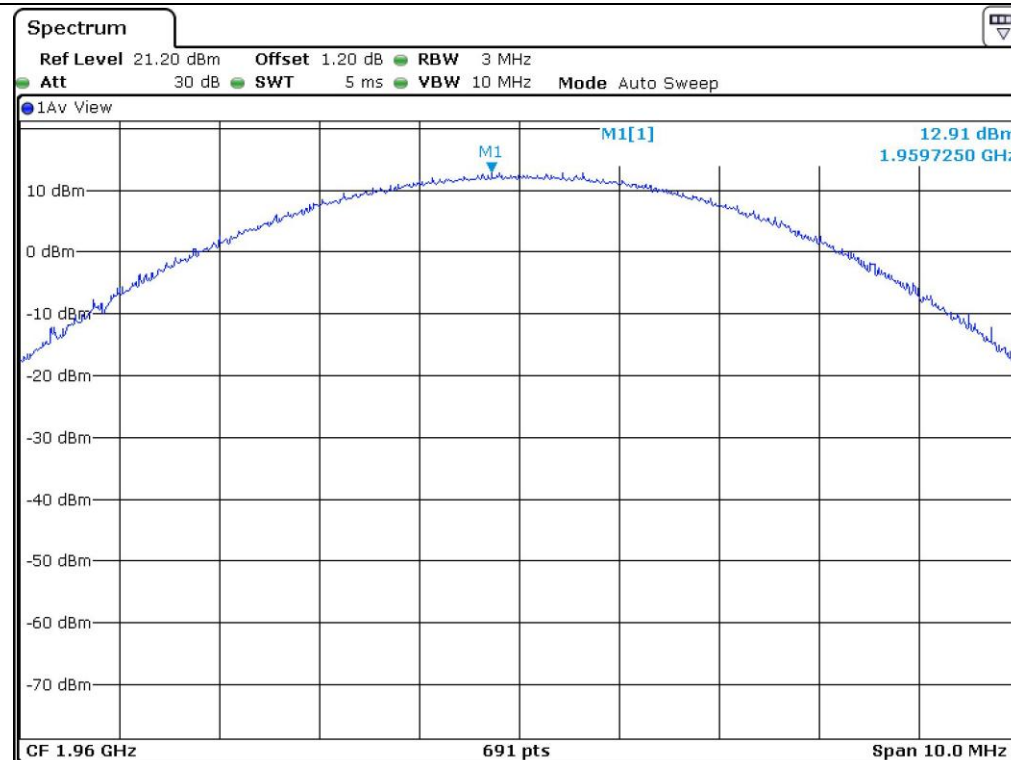


1X RTT – Middle Channel

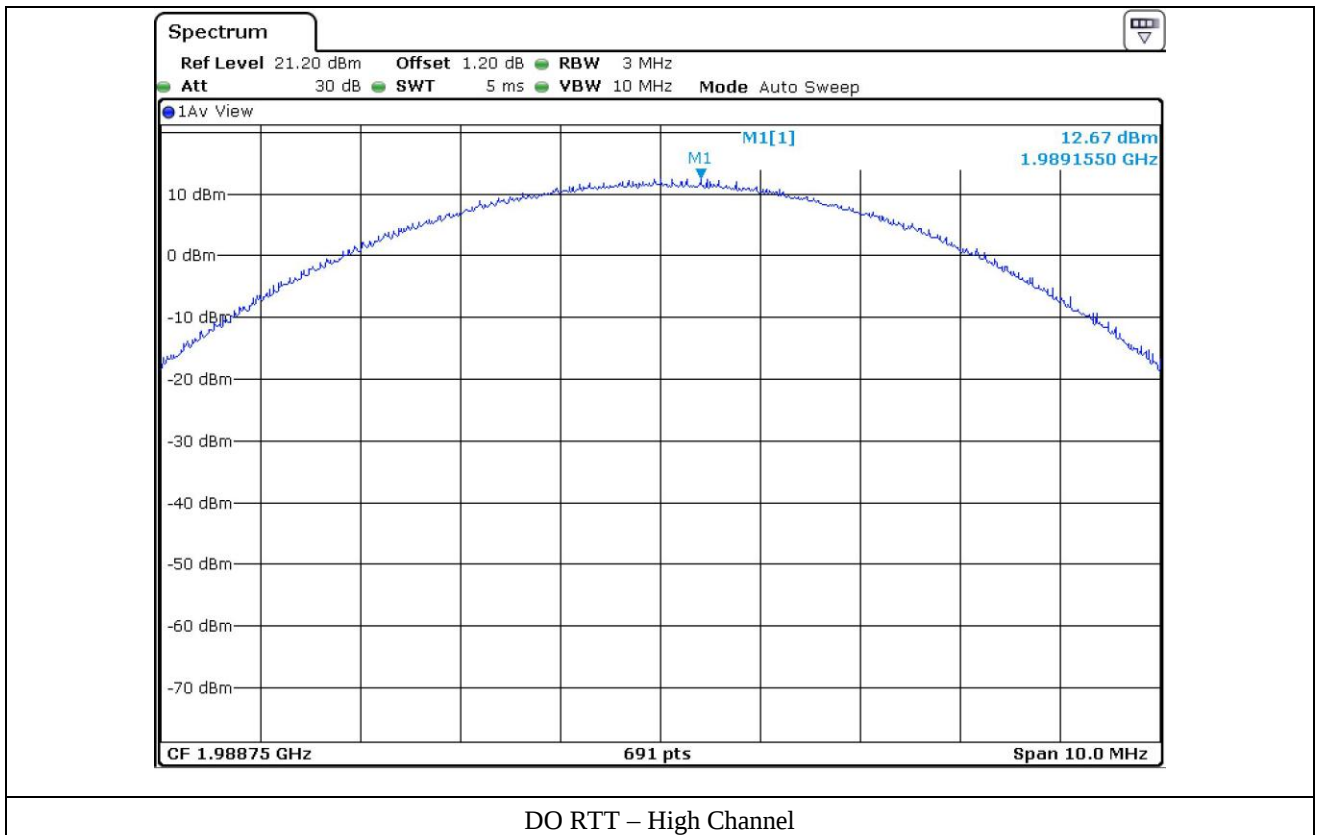




DO RTT – Low Channel



DO RTT – Middle Channel



6. SPURIOUS EMISSION AT ANTENNA TERMINAL

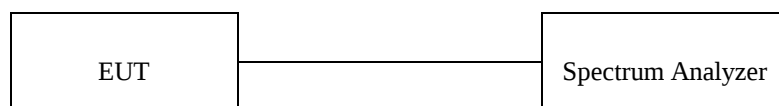
6.1 Operating environment

Temperature : 25 °C

Relative humidity : 45 % R.H.

6.2 Test set-up for conducted measurement

The test was performed at three frequencies (low, middle, and high channels) at each band using all applicable modulation. The resolution bandwidth and video bandwidth of the spectrum analyzer was set at 1 MHz and sufficient scans were taken to show any out of band emissions up to 20 GHz.

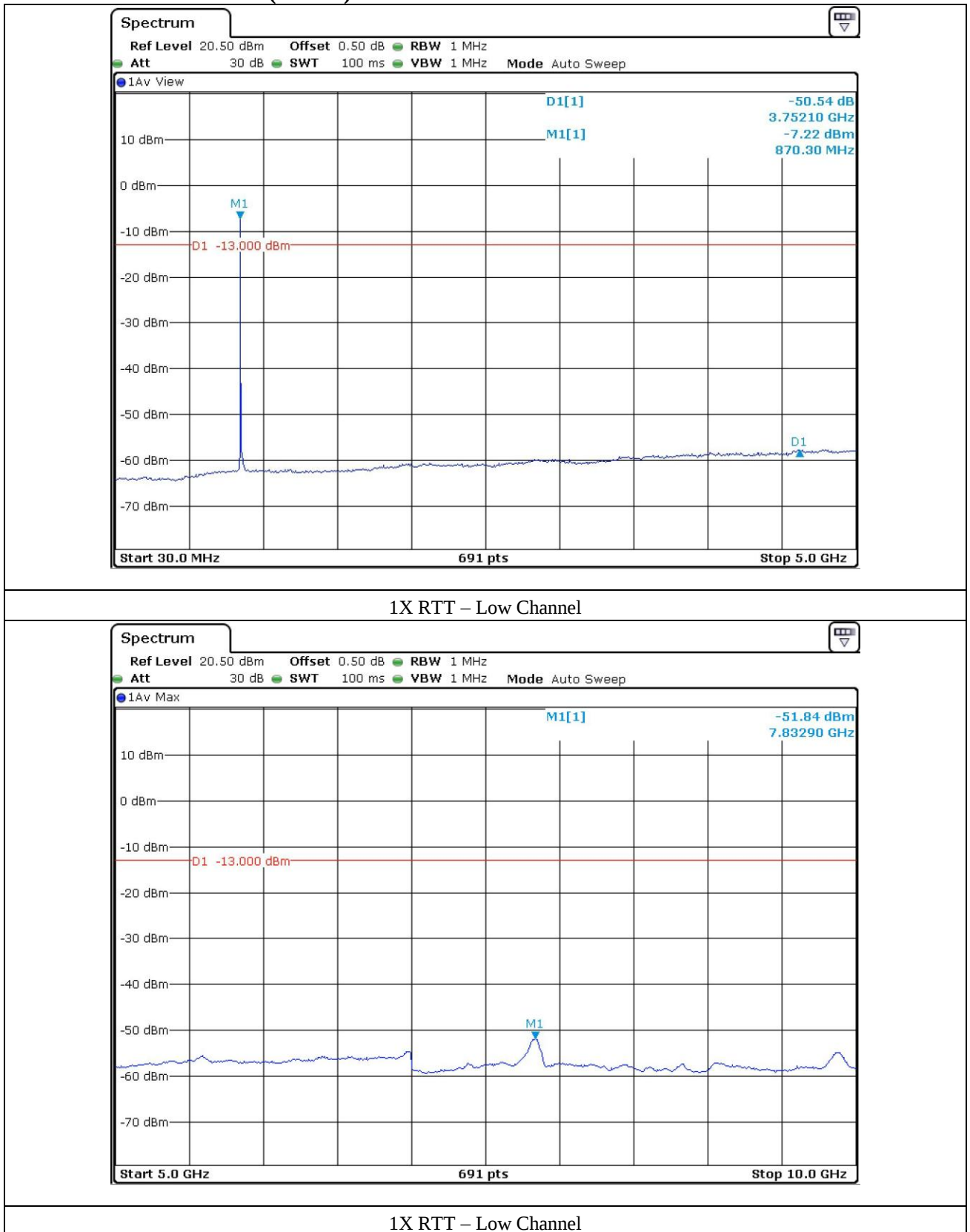


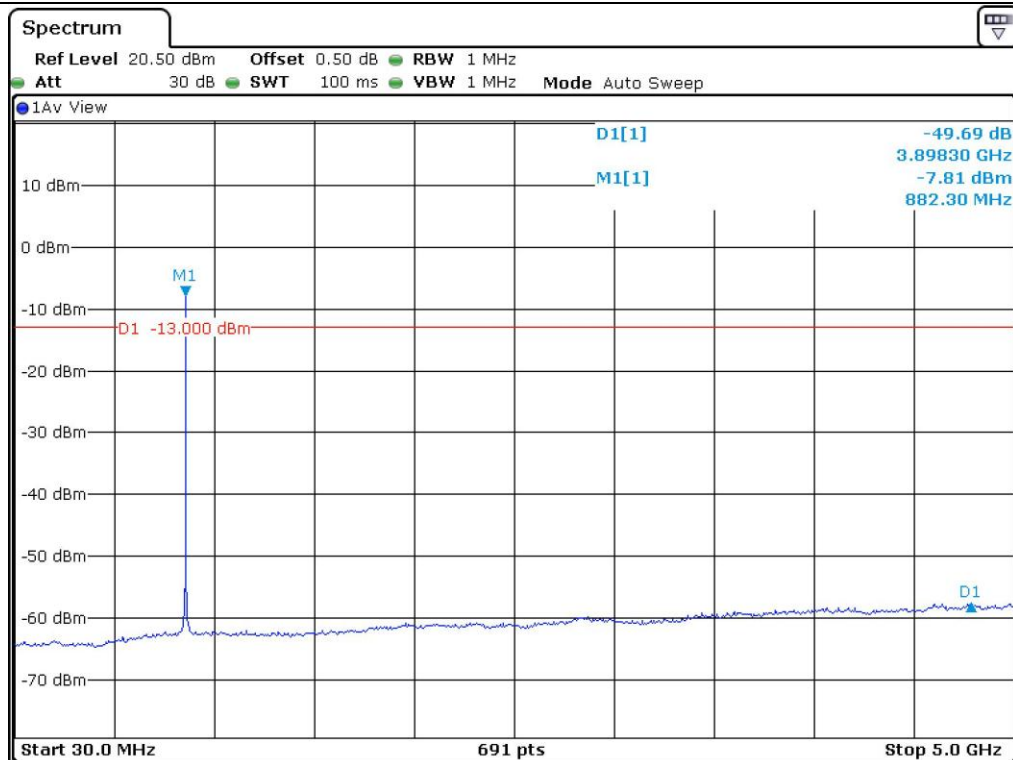
6.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV30	R/S	FSV30 Signal Analyzer	101372	May 20, 2013 (1Y)

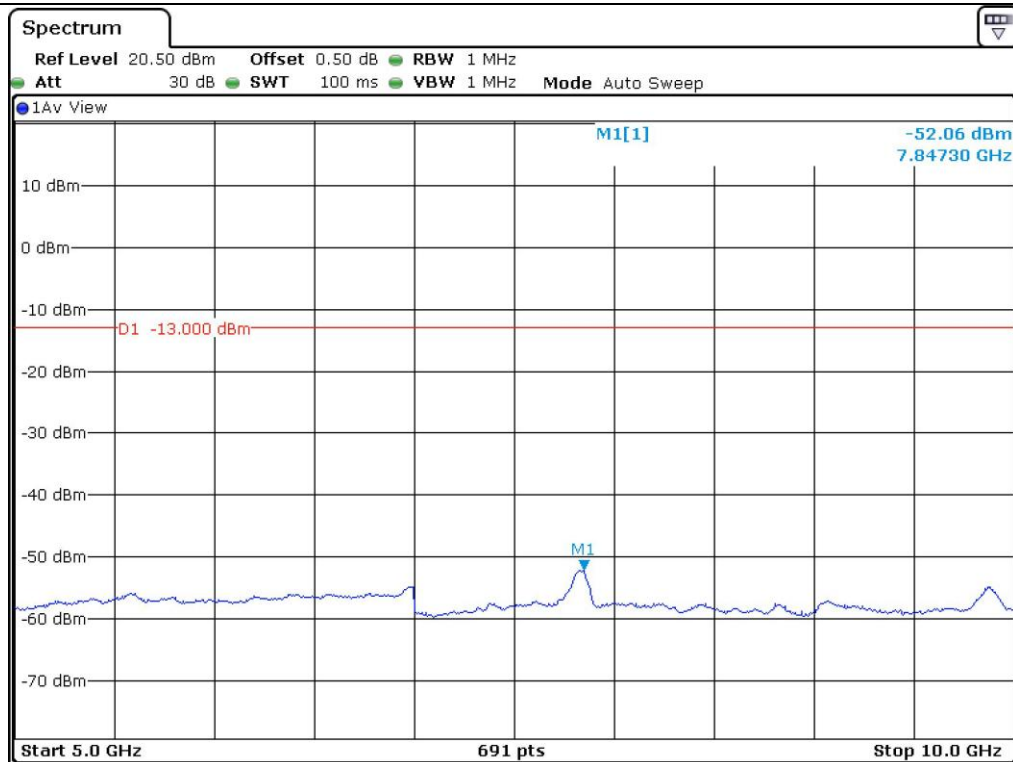
All test equipment used is calibrated on a regular basis.

6.4 Test Result for Part 22 H (CDMA)

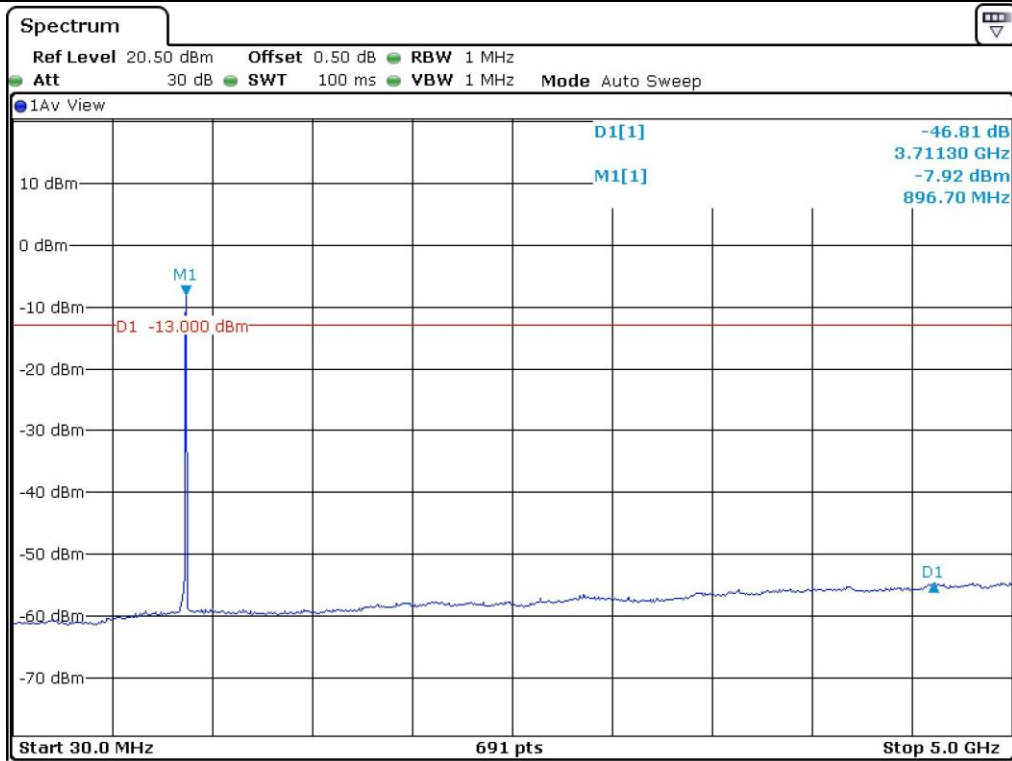




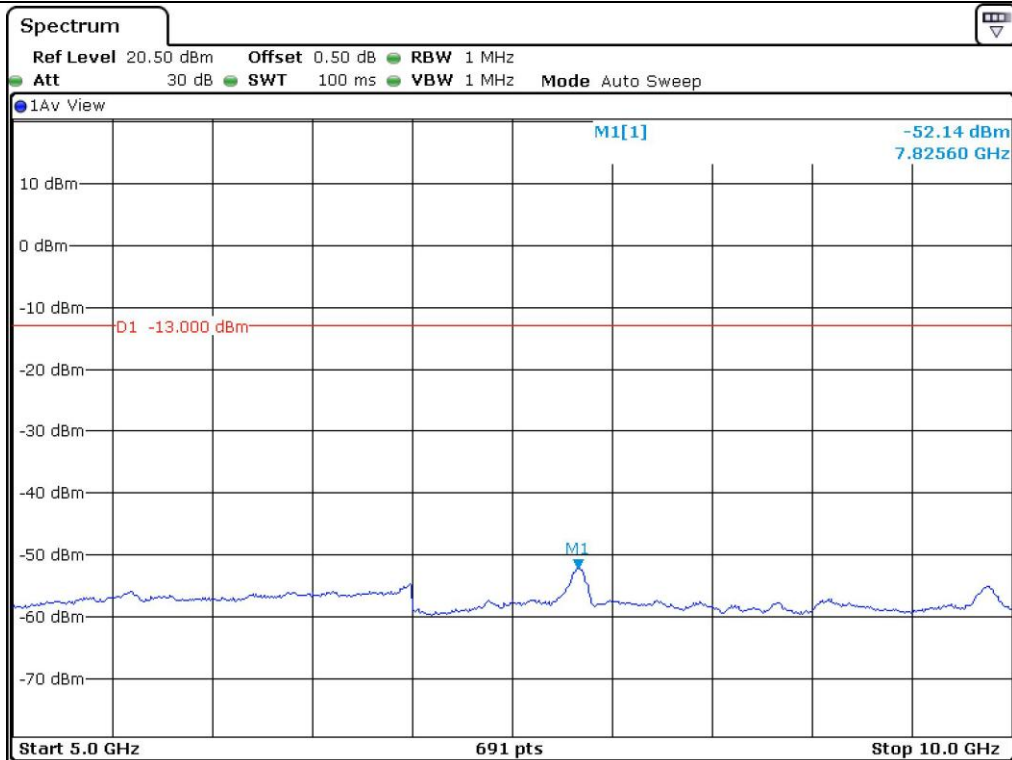
1X RTT – Middle Channel



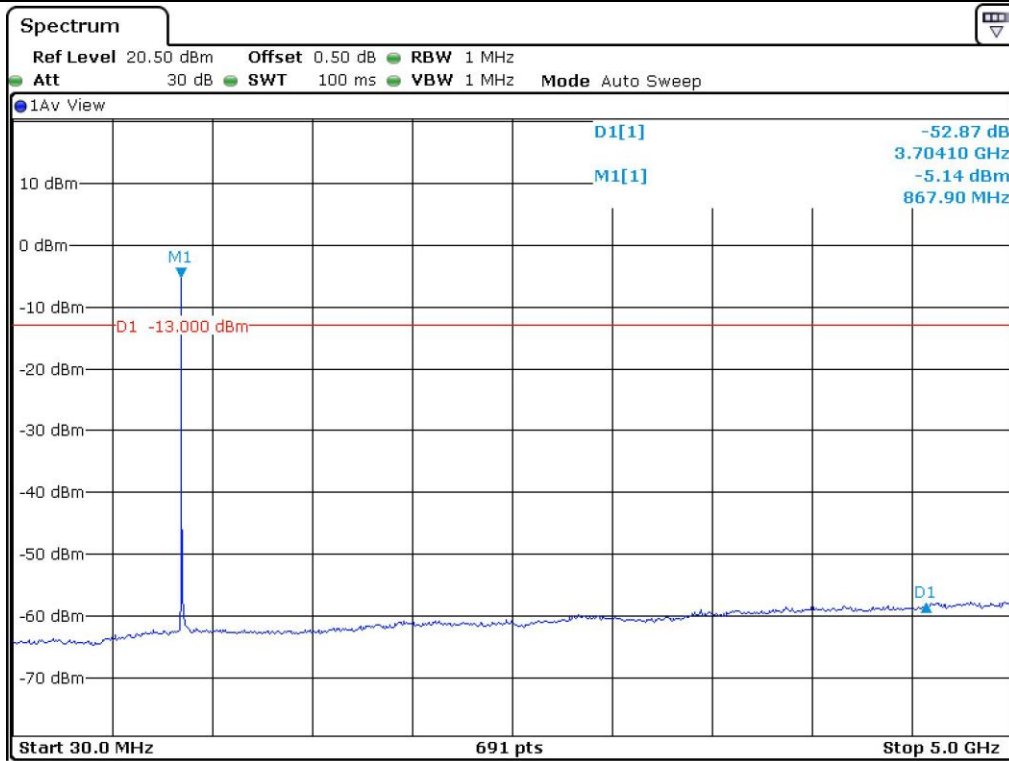
1X RTT – Middle Channel



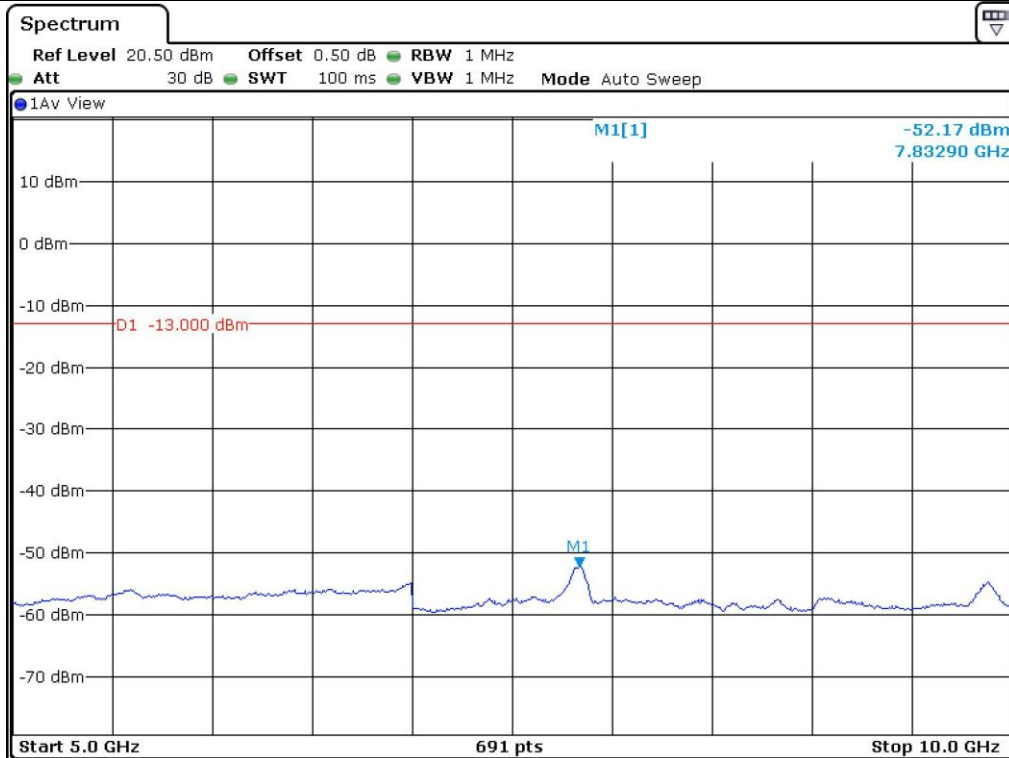
1X RTT – High Channel



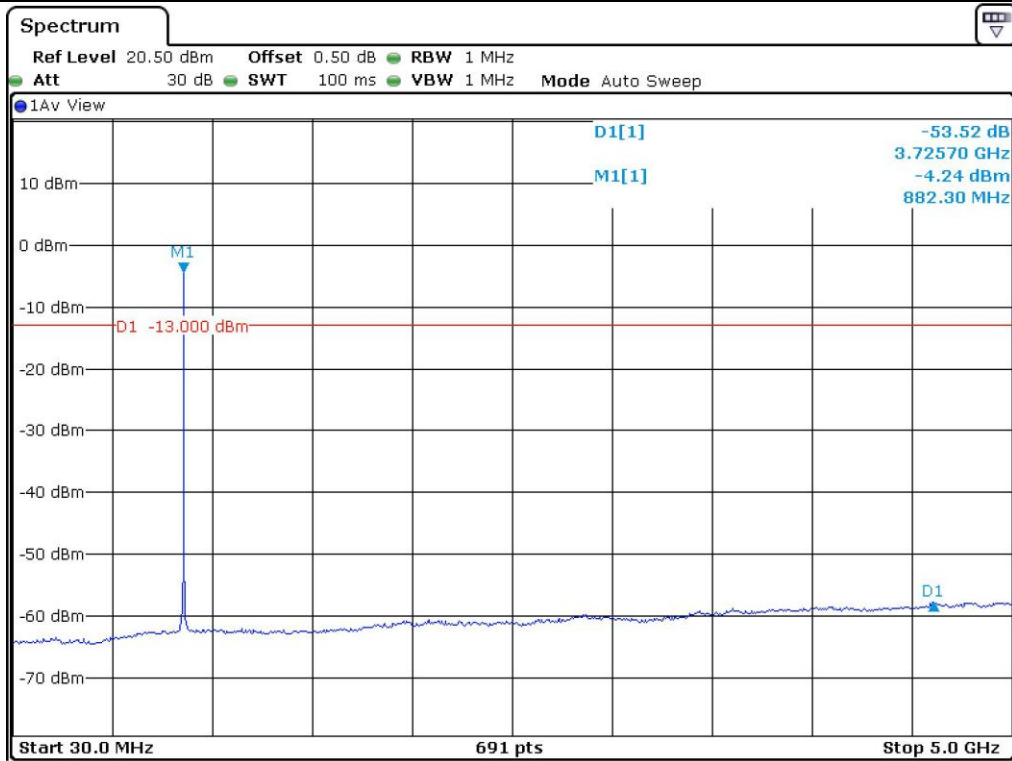
1X RTT – High Channel



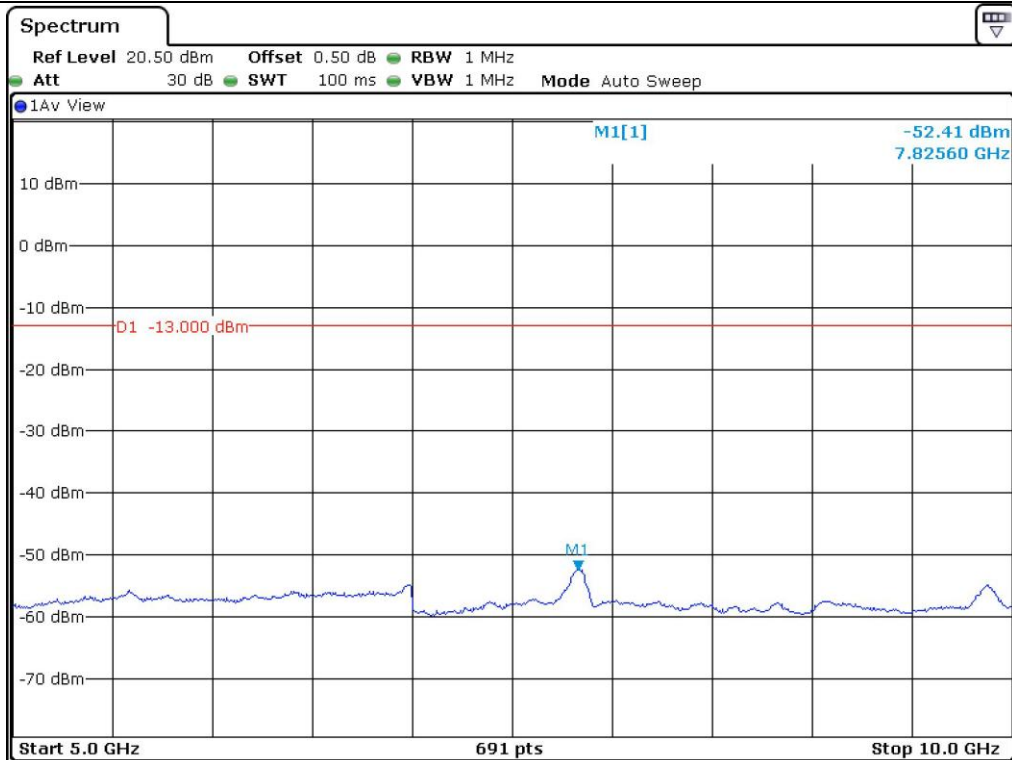
DO RTT – Low Channel



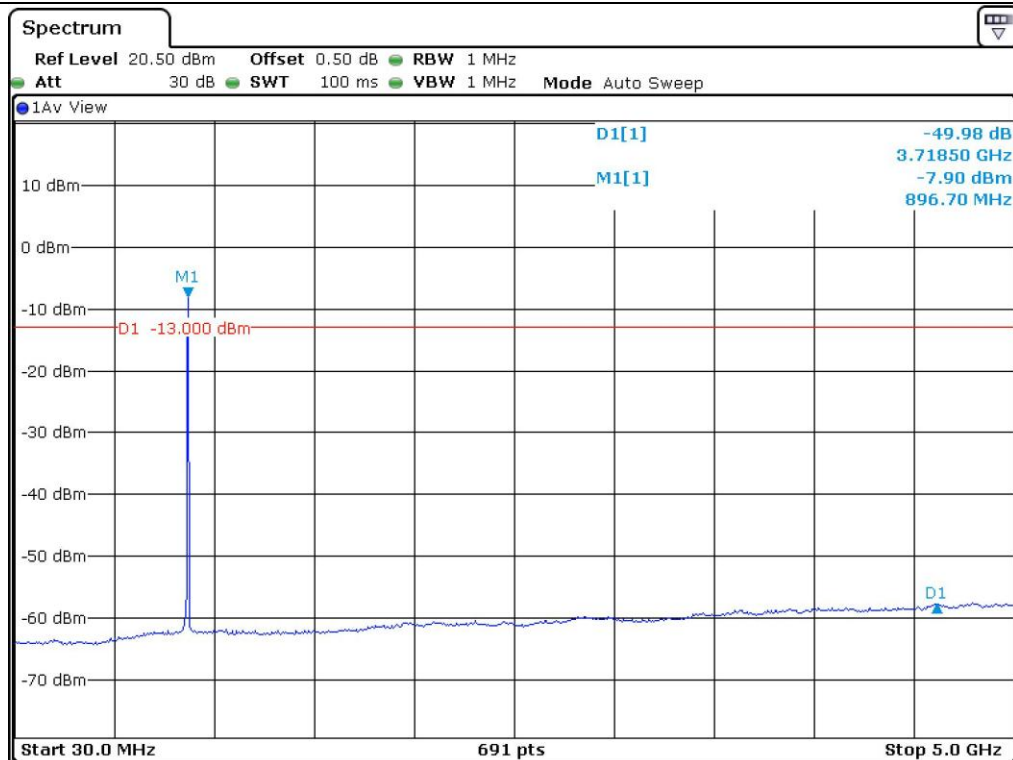
DO RTT – Low Channel



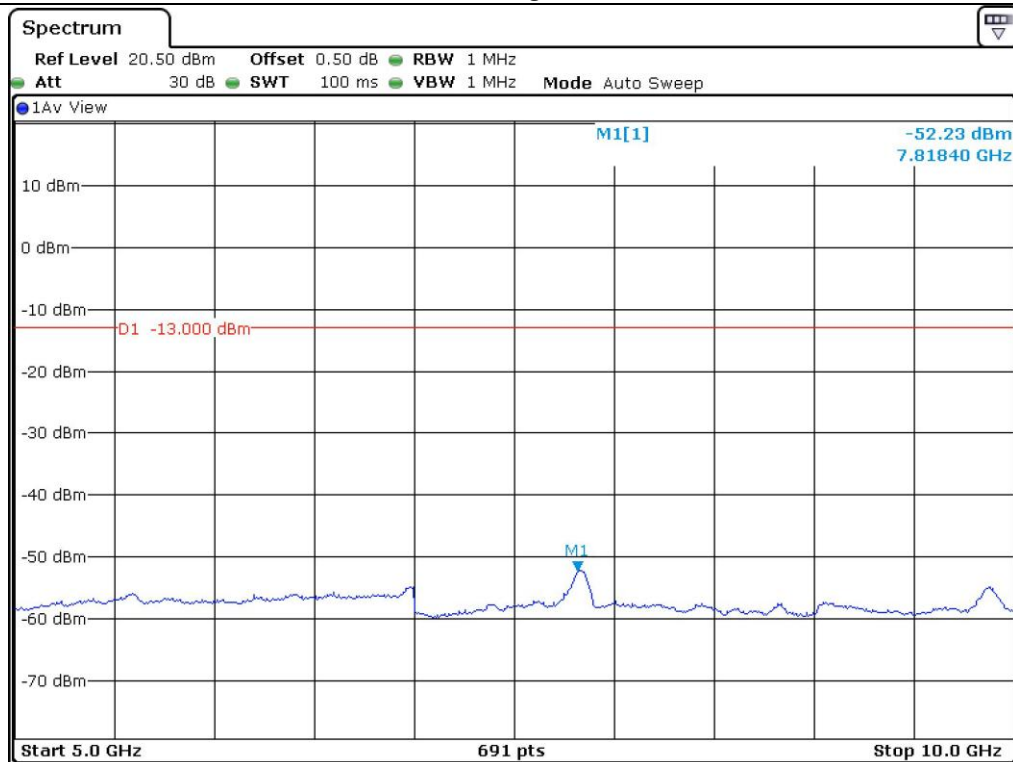
DO RTT – Middle Channel



DO RTT – Middle Channel

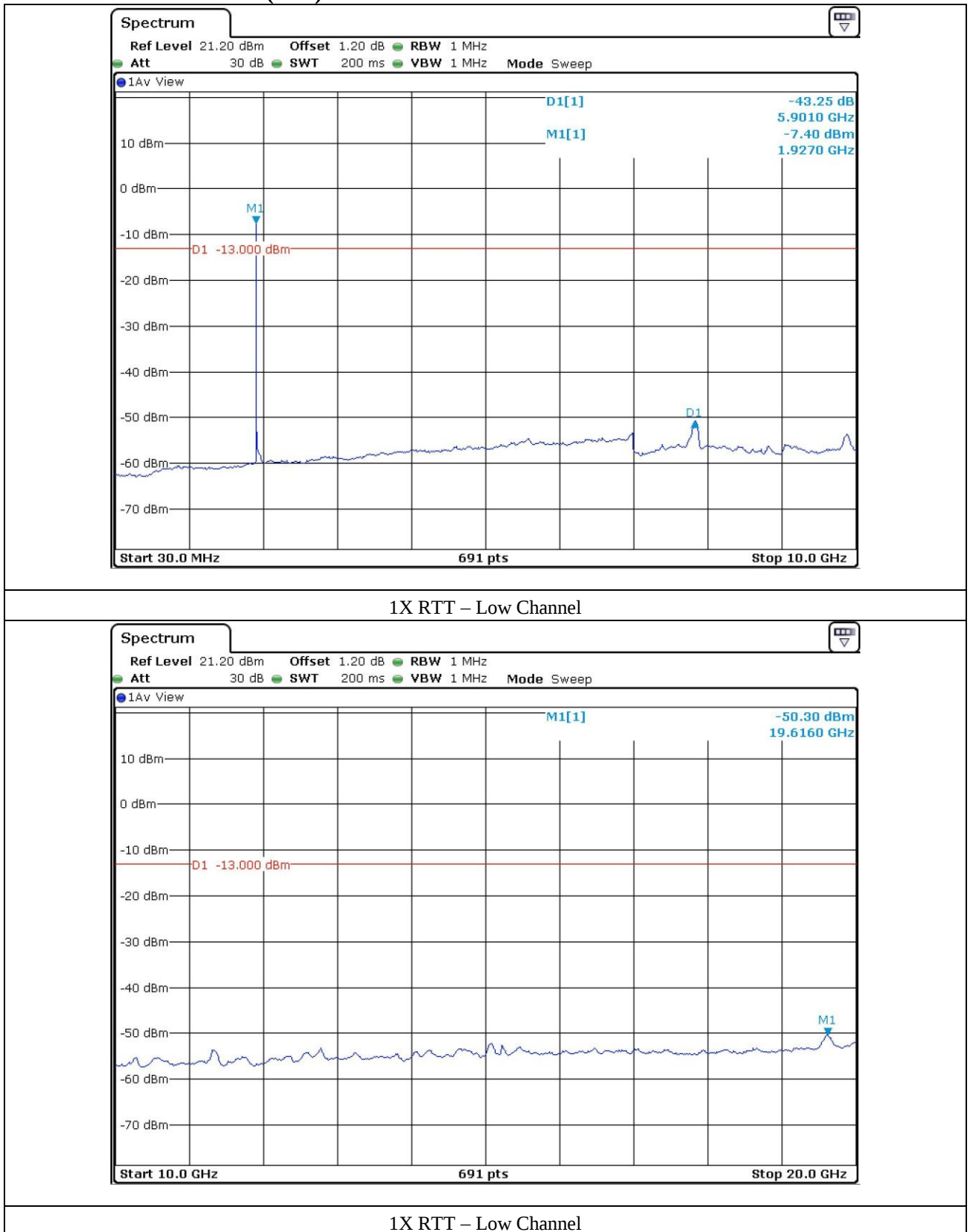


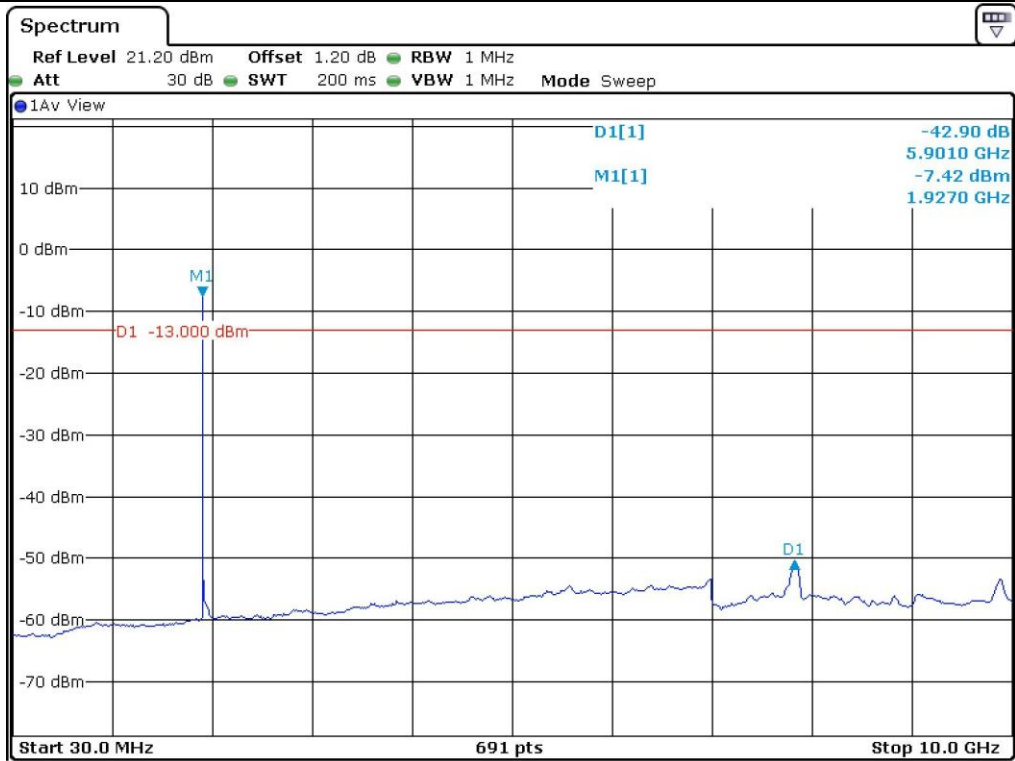
DO RTT – High Channel



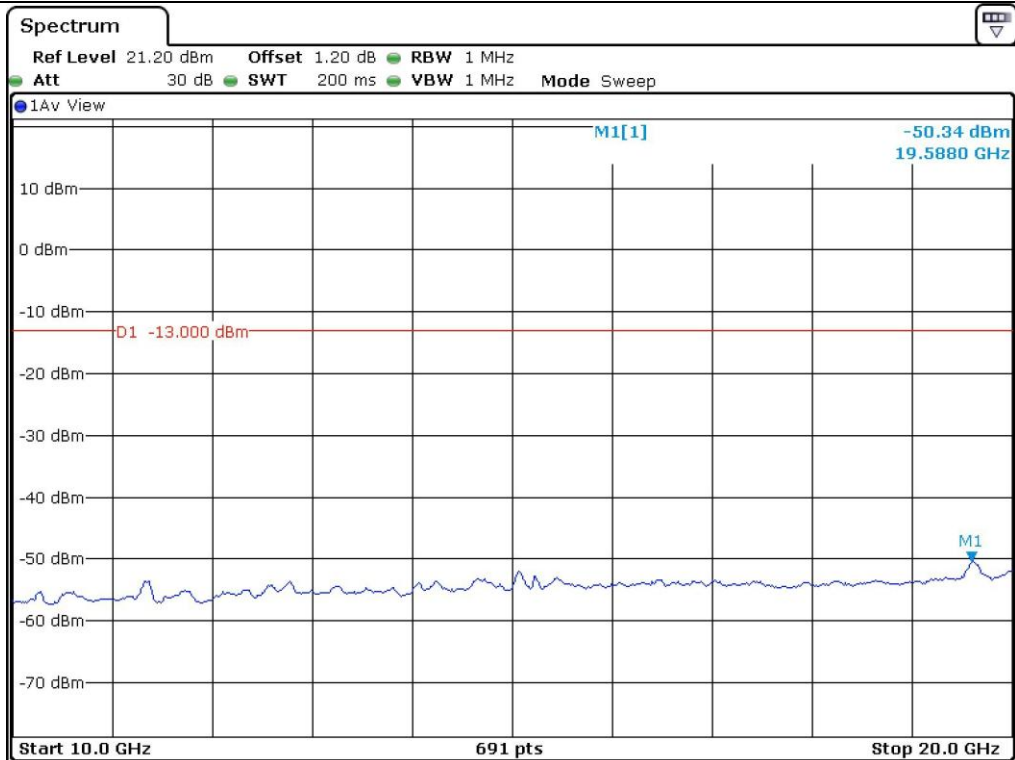
DO RTT – High Channel

6.5 Test Result for Part 24 E (PCS)

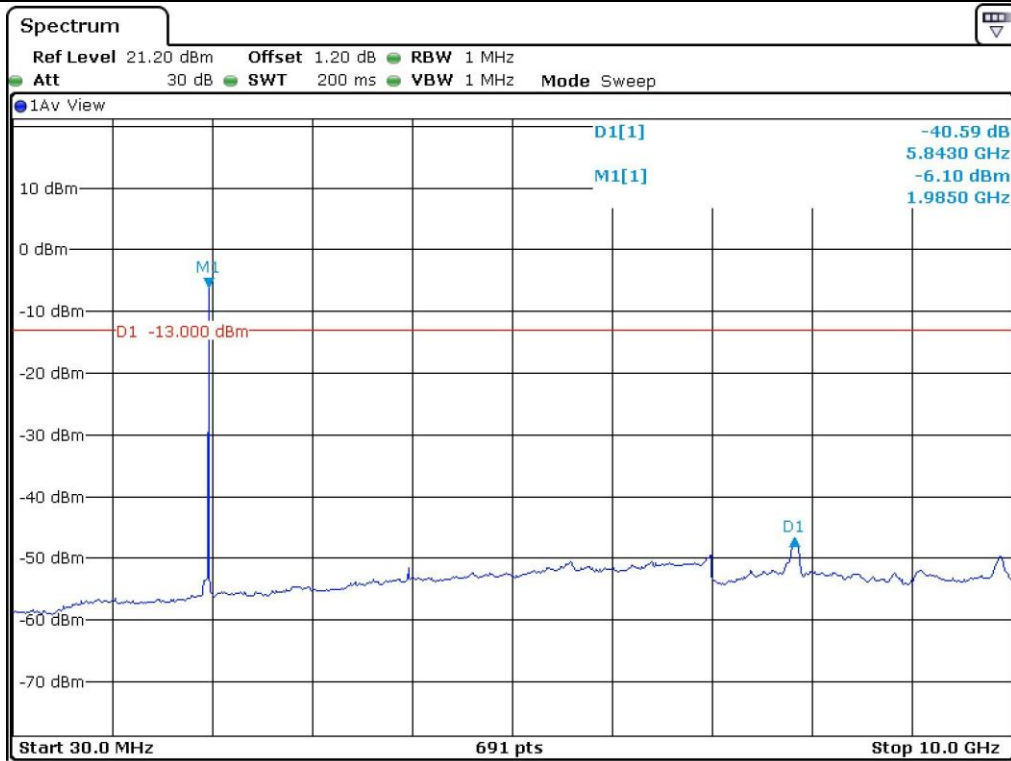




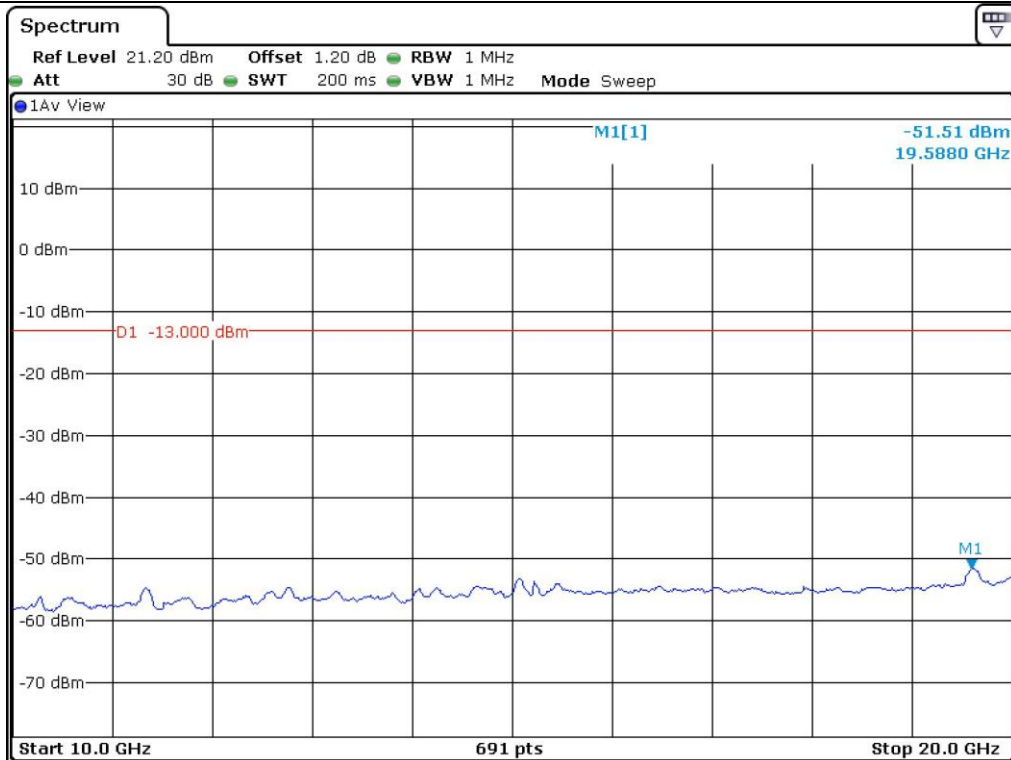
1X RTT – Middle Channel



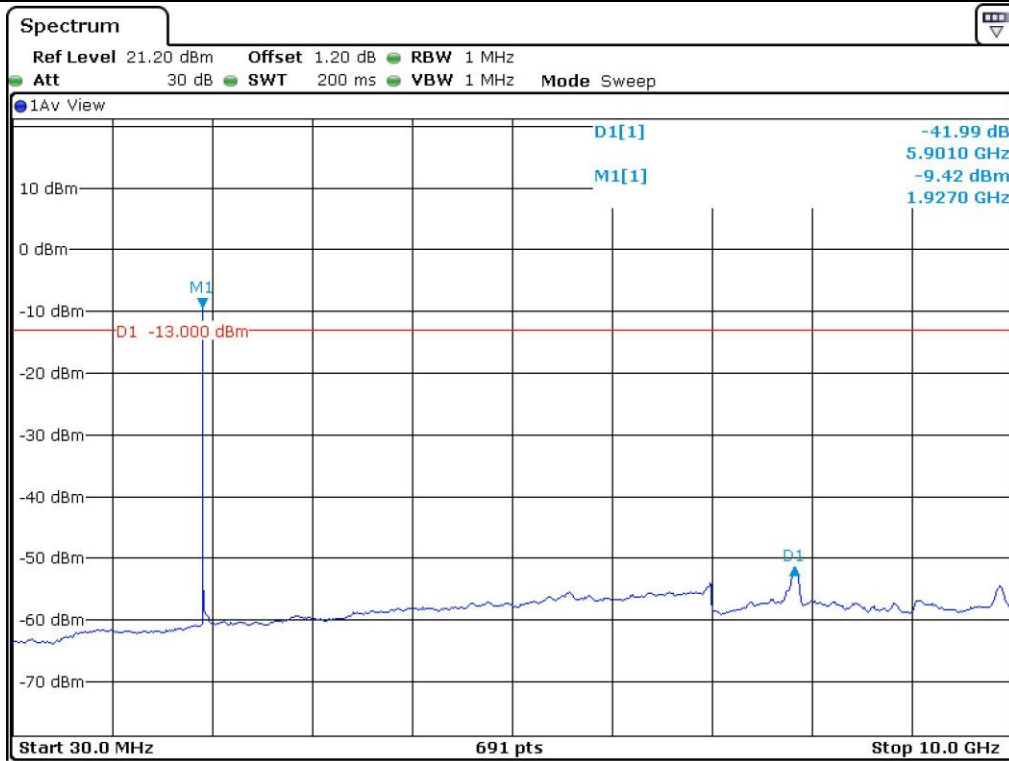
1X RTT – Middle Channel



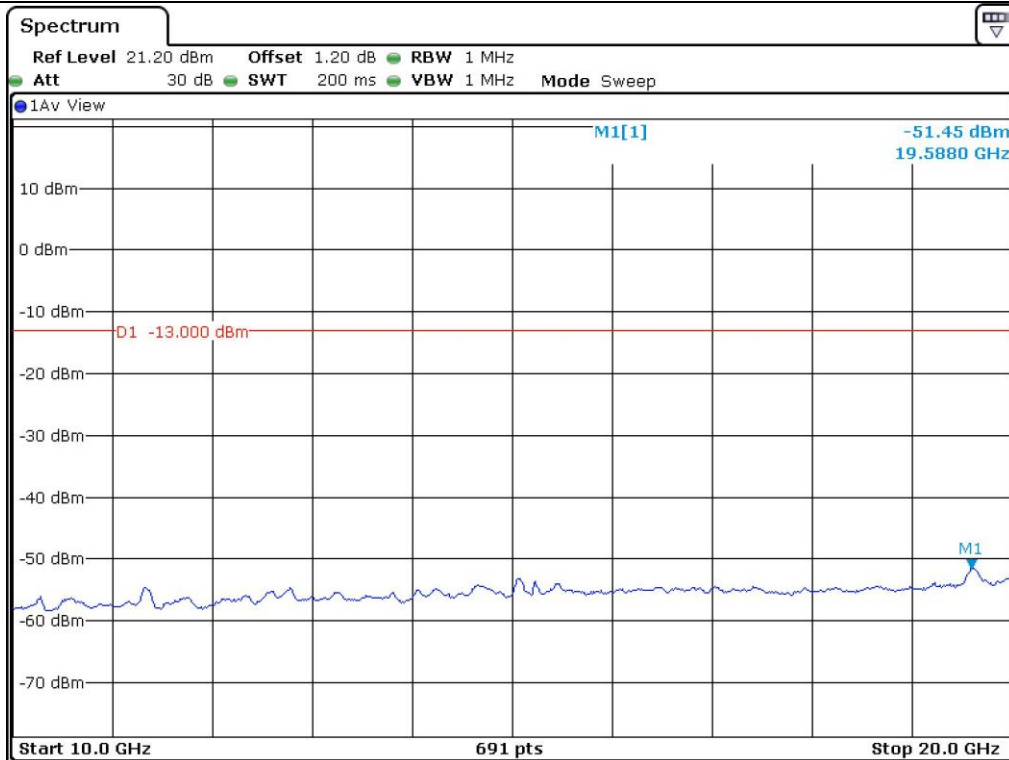
1X RTT – High Channel



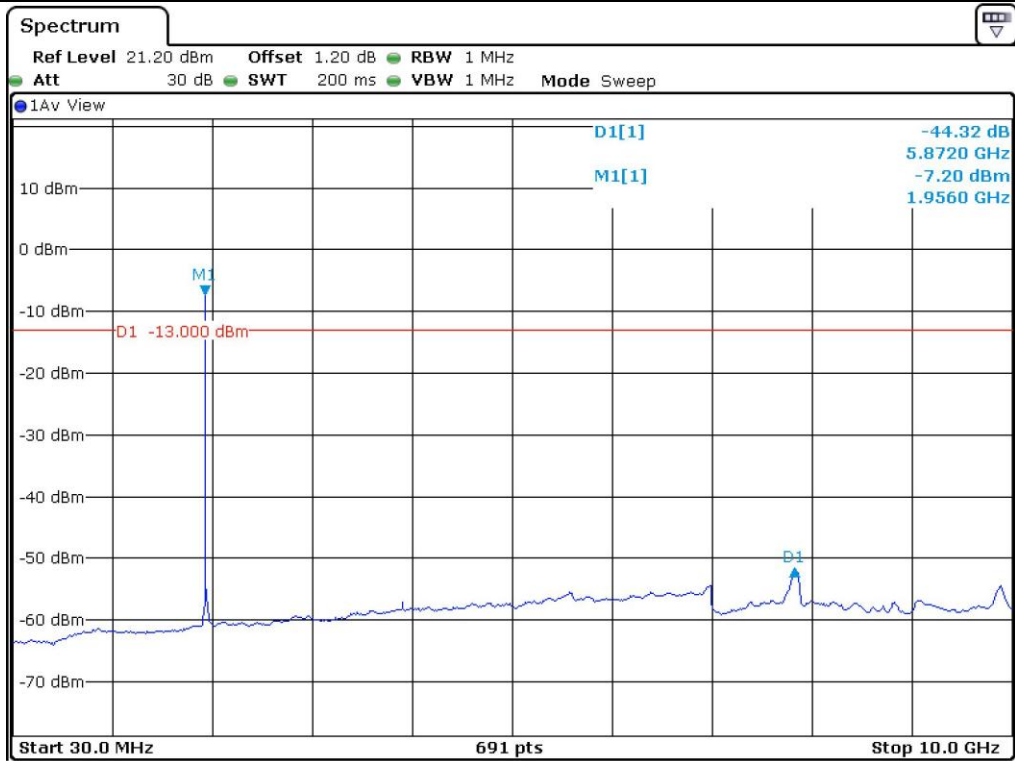
1X RTT – High Channel



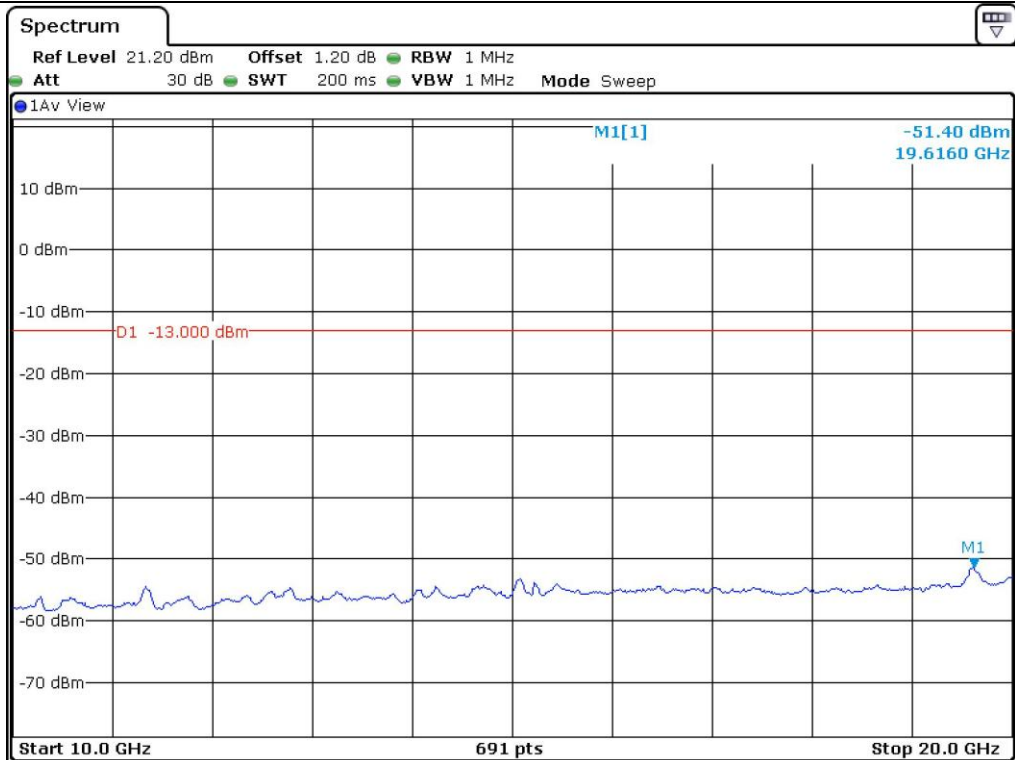
DO RTT – Low Channel



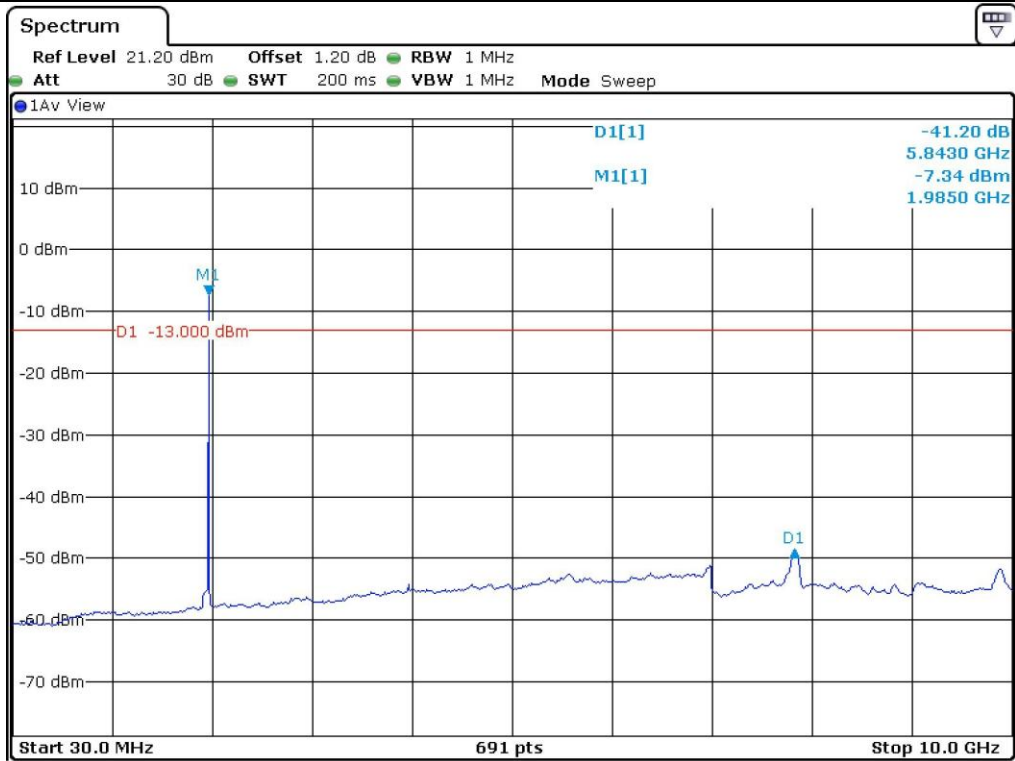
DO RTT – Low Channel



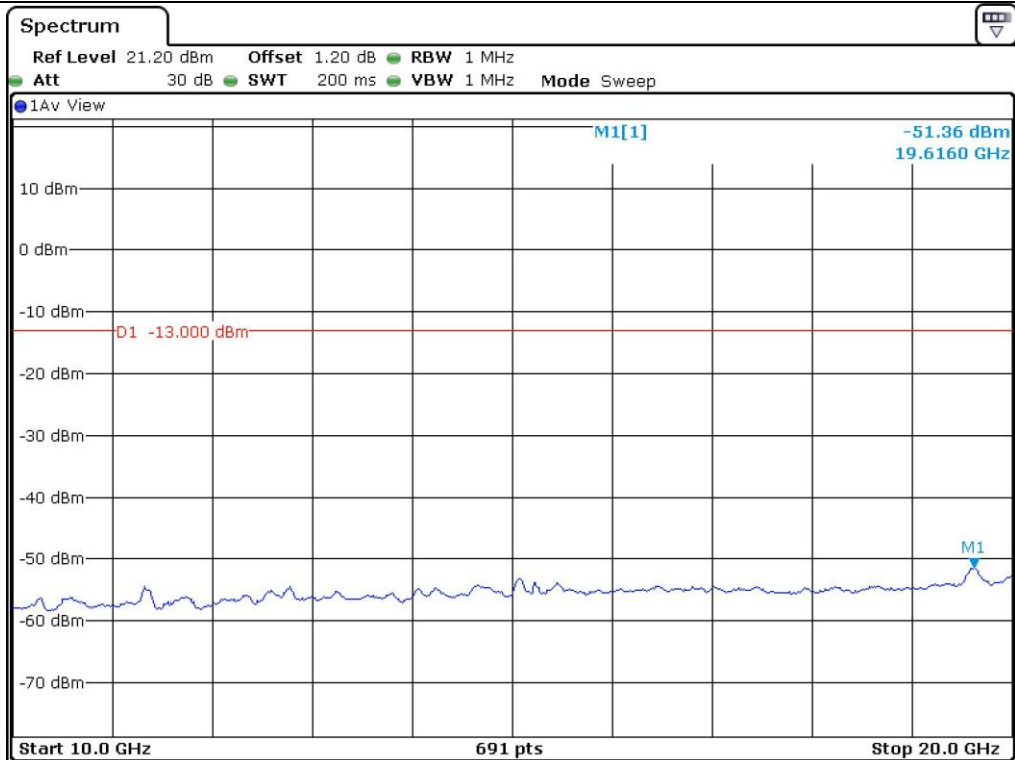
DO RTT – Middle Channel



DO RTT – Middle Channel



DO RTT – High Channel



DO RTT – High Channel

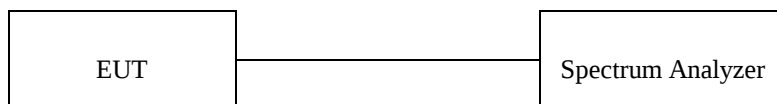
7. BAND EDGE MEASUREMENT

7.1 Operating environment

Temperature : 25 °C
Relative humidity : 45 % R.H.

7.2 Test set-up for conducted measurement

The test was performed at three frequencies (low, middle, and high channels) at each band using all applicable modulation. The resolution bandwidth and video bandwidth of the spectrum analyzer was set according to the regulation and sufficient scans were taken to show any out of band emissions.



7.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV30	R/S	FSV30 Signal Analyzer	101372	May 20, 2013 (1Y)

All test equipment used is calibrated on a regular basis.

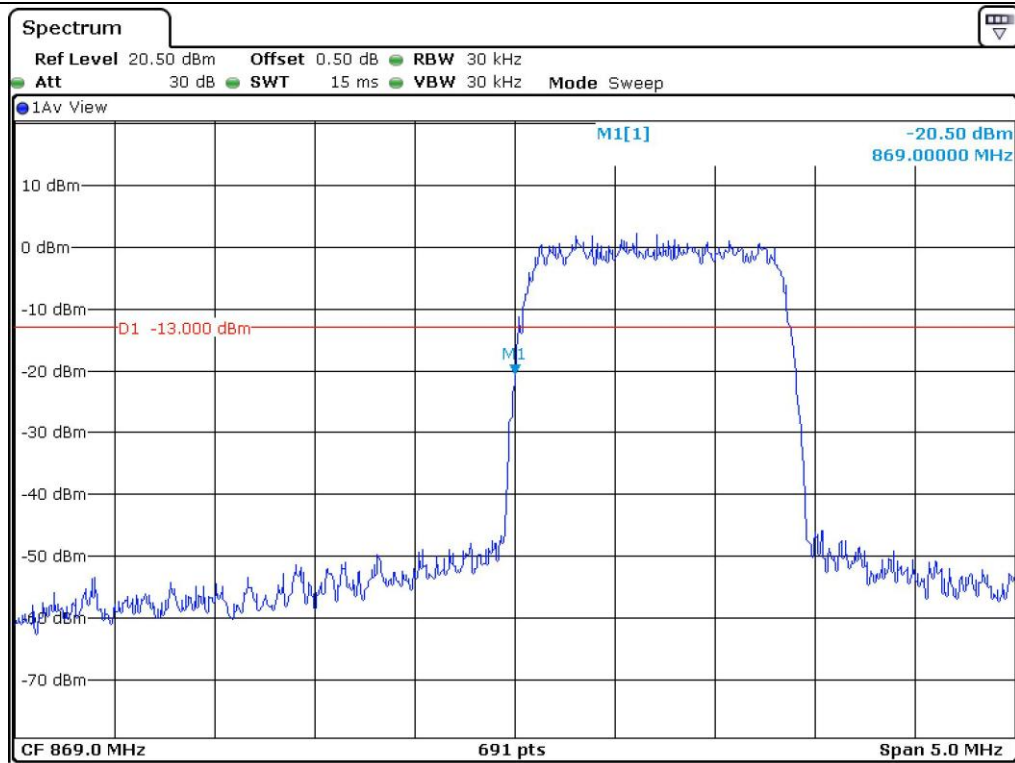
7.4 Test data

7.4.1 Test Result for Part 22 H (CDMA)

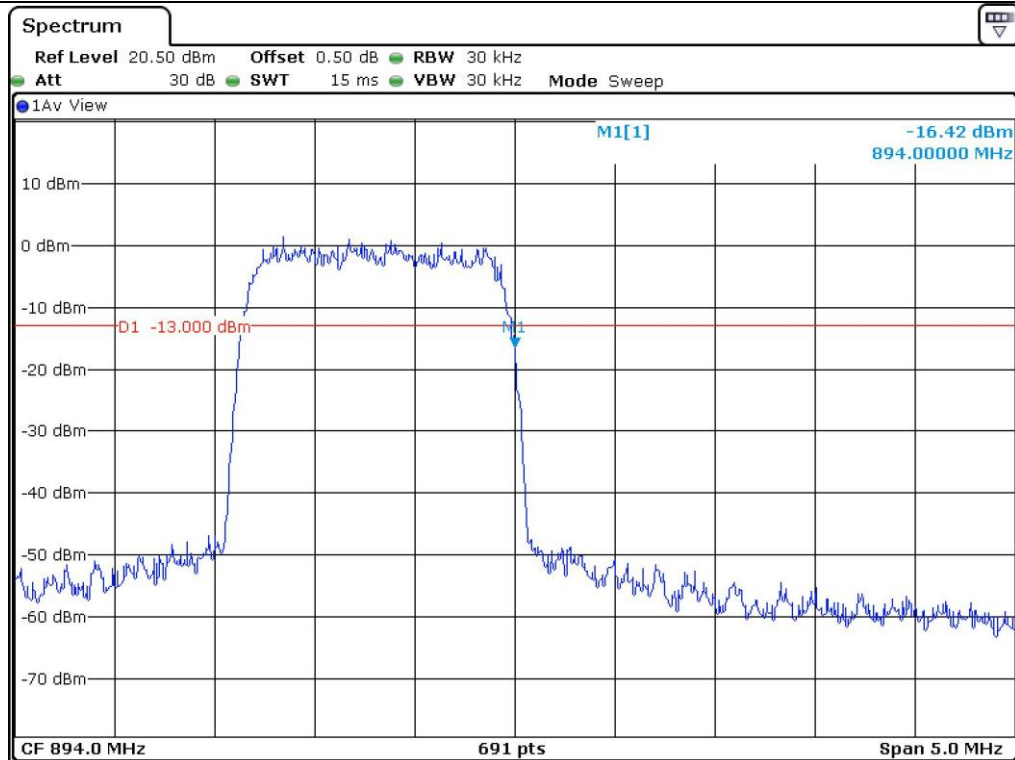
-. Test Date : March 11, 2014

-. Result : Pass

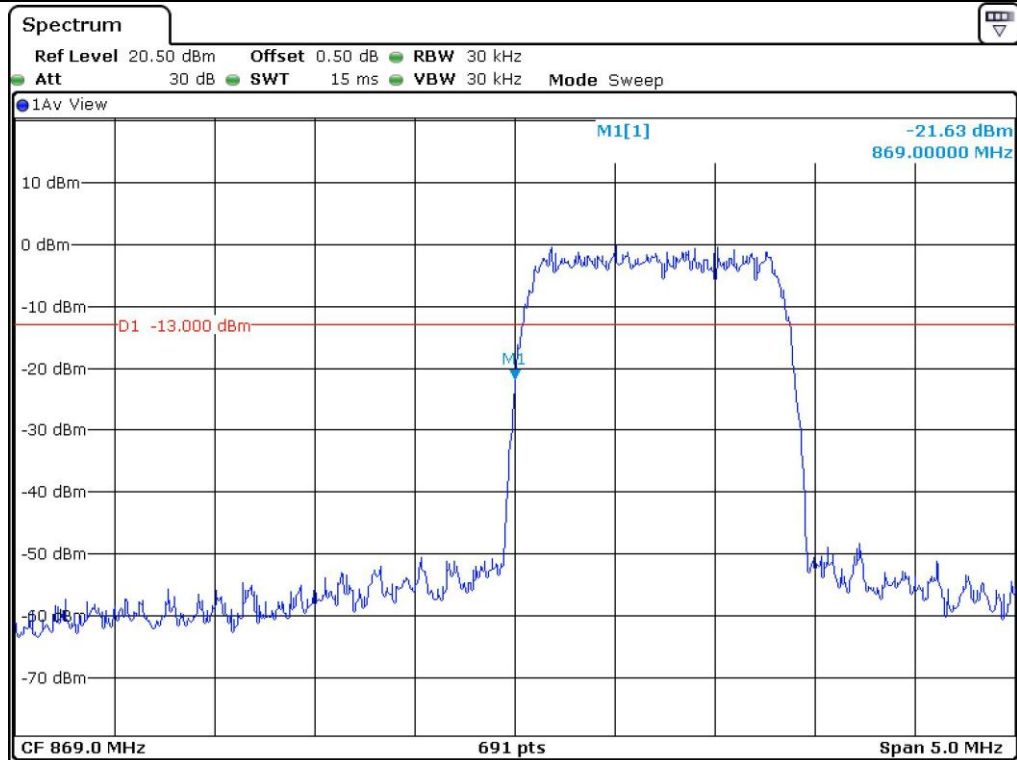
Modulation	Channel	Measured Frequency (MHz)	Measured Value (dBm)
1X RTT	Low	869.00	-20.50
	High	894.00	-16.42
DO RTT	Low	869.00	-21.63
	High	894.00	-19.77



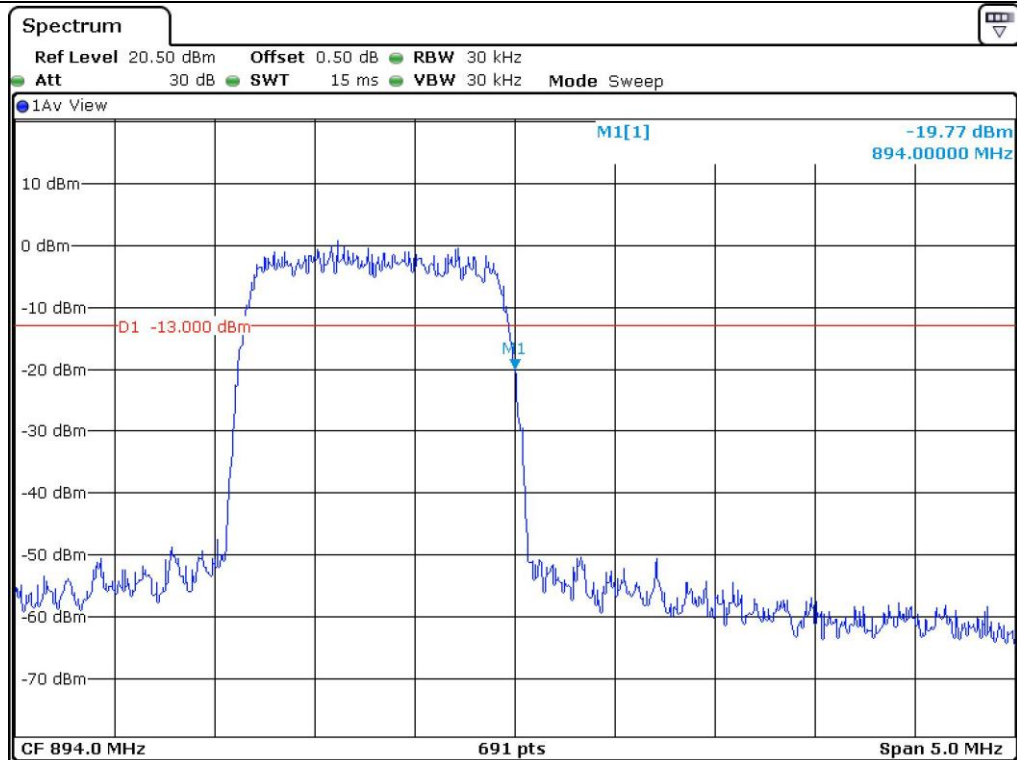
1X RTT – Band Edge (Low Channel)



1X RTT – Band Edge (High Channel)



DO RTT – Band Edge (Low Channel)



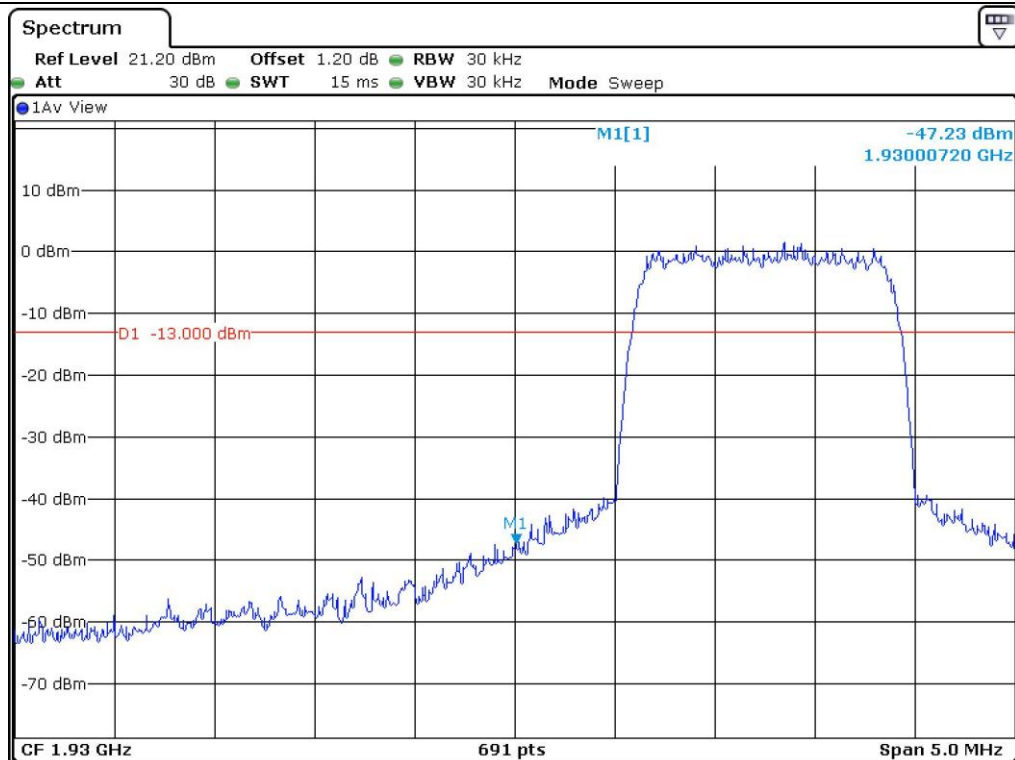
DO RTT – Band Edge (High Channel)

7.4.2 Test Result for Part 24 E (PCS)

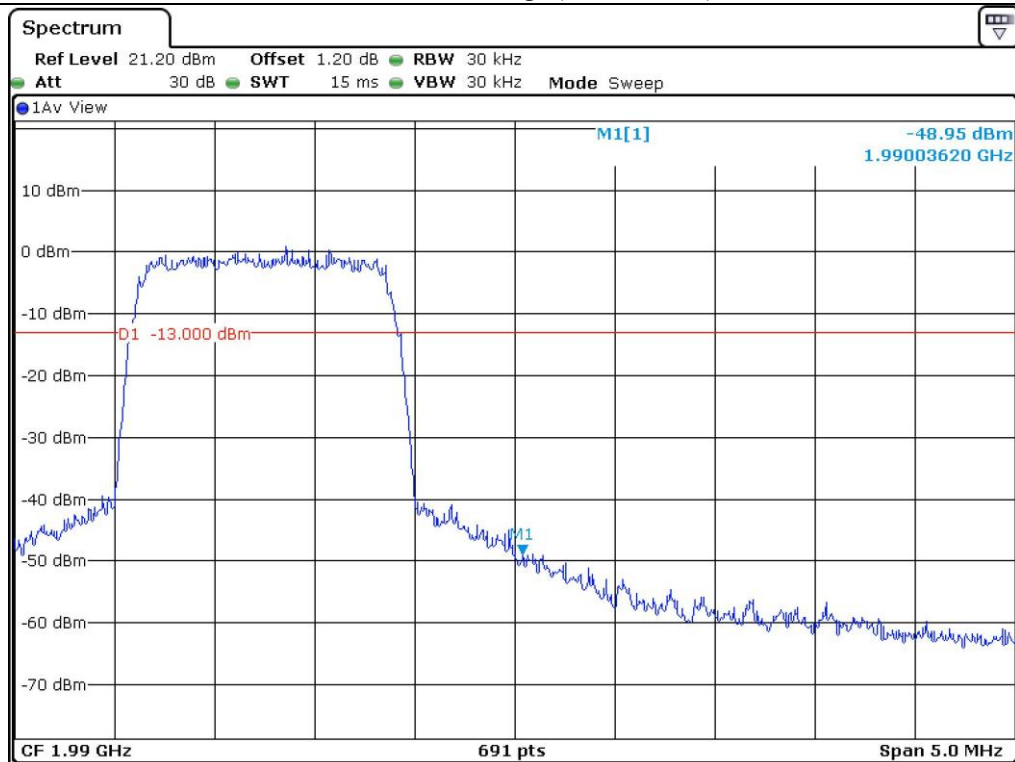
-. Test Date : March 11, 2014

-. Result : Pass

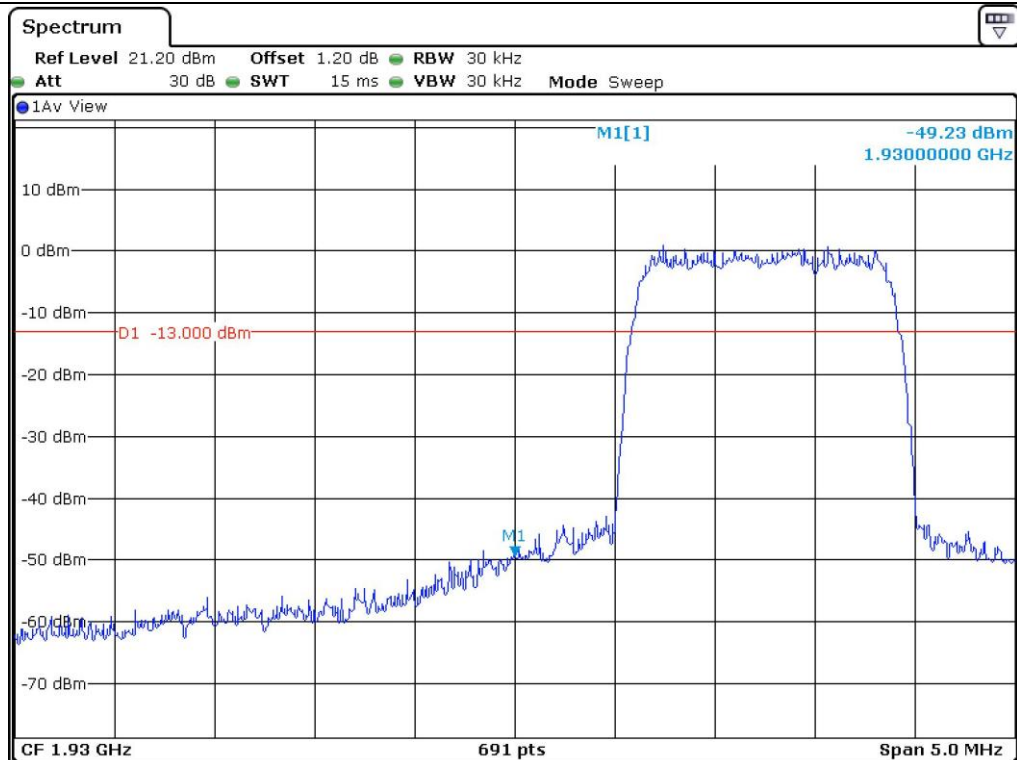
Modulation	Channel	Measured Frequency (MHz)	Max. Measured Value (dBm)
1X RTT	Low	1 930.00	-47.23
	High	1 990.00	-48.95
DO RTT	Low	1 930.00	-49.23
	High	1 990.00	-47.13



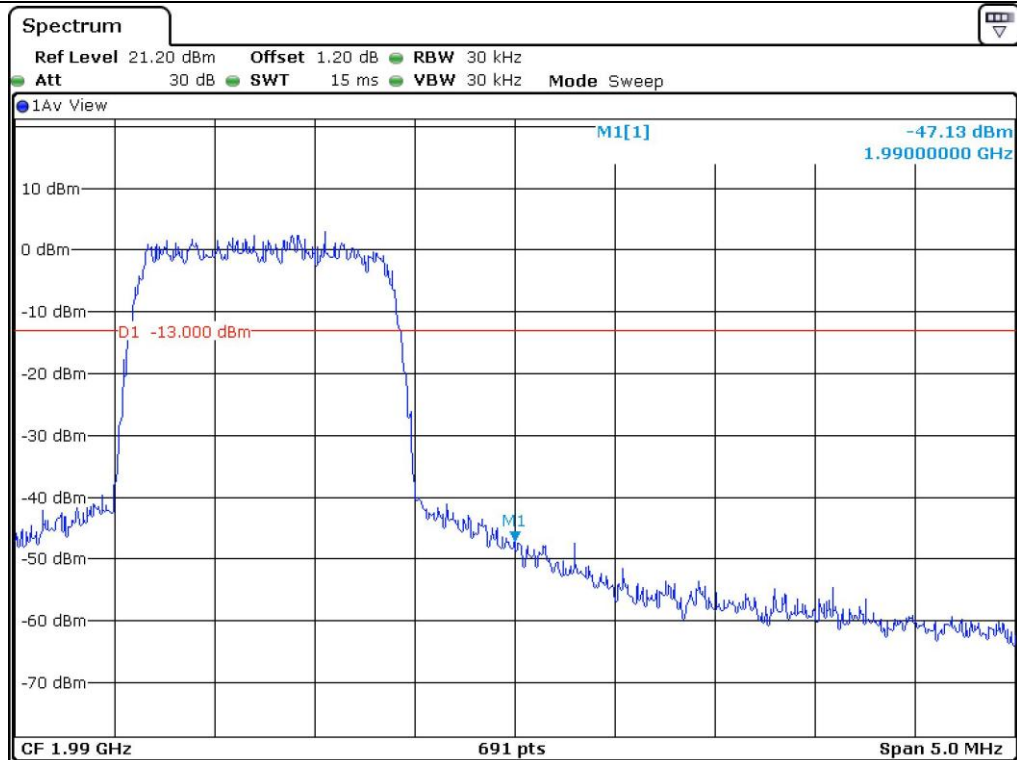
1X RTT – Band Edge (Low Channel)



1X RTT – Band Edge (High Channel)



DO RTT – Band Edge (Low Channel)



DO RTT – Band Edge (High Channel)

8. FIELD STRENGTH OF SPURIOUS RADIATION

8.1 Operating environment

Temperature : 25 °C
Relative humidity : 45 % R.H.

8.2 Test set-up

The radiated emissions measurements were is the 10 m semi anechoic chamber. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

The frequency spectrum from 30 MHz to up to 10th harmonic of the fundamental frequency was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. The test was performed by placing the EUT on 3-orthogonal axis. This procedure was performed for both horizontal and vertical polarization of the receiving antenna. The maximum radiated emission was recorded and used as reference for the effective radiated power measurement. The EUT was then replaced by a tuned dipole antenna or Horn antenna and was oriented for vertical polarization and then the length was adjusted to correspond to the frequency of the transmitter. The substitution antenna was connected to a signal generator with a coaxial cable. The receiving antenna height was raised and lowered again through the specified range of height until maximum signal level is detected by the measuring receiver. The signal to the substitution antenna was adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the EUT radiated power measured, corrected for the change of input attenuation setting of the measuring receiver. The signal generator level was recorded and corrected by the power loss in the cable between the signal generator and substitution antenna and further corrected for the gain of the dipole antenna or horn antenna used relative to an ideal tuned dipole antenna. The measurement was repeated with the test antenna and the substitution antenna oriented for horizontal polarization. The measure of the effective radiated power is the larger of the two levels recorded.

8.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
■	8564E	Hewlett-Packard	Spectrum Analyzer	3650A00756	May 03, 2013 (1Y)
■ -	ESCI	Rohde & Schwarz	Test Receiver	101012	Nov. 18, 2013(1Y)
■ -	310N	Sonoma Instrument	Pre-Amplifier	312544	May 21, 2013 (1Y)
■ -	SCU-18	Rohde & Schwarz	Pre-Amplifier	10041	Jan. 20, 2014 (1Y)
■ -	DT3000	Innco System	Turn Table	930611	N/A
■ -	MA4000-EP	Innco System	Antenna Master	3320611	N/A
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-420	Mar. 27, 2012 (2Y)
■ -	3121C	EMCO	Dipole Antenna	9002-509	Jan. 21, 2014 (2Y)
■ -	YSE 500B	YoungShin Eng.	Frequency Converter	950413001	N/A
■ -	ETCR-10	DaeHa	Automatic Voltage Com.	N/A	N/A
■	83650L	HP	Swept CW Generator	3844A00415	May 20, 2013(1Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Sep. 05, 2013 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D294	Sep. 30, 2013 (2Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Mar. 06, 2013(2Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170179	Mar. 06, 2013(2Y)

All test equipment used is calibrated on a regular basis.

8.4 Test data

8.4.1 Test Result for Part 22 H (CDMA)

8.4.1.1 Test data for 1X RTT

-. Test Date : March 11, 2014

-. Result : Pass

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total		Limit (W)
						(dBm)	(W)	
869.70	124.45	19.56	1.36	H	1.80	19.12	0.08	500.00
	121.22	20.37	1.36	V	1.80	19.93	0.10	
881.52	125.84	21.45	1.18	H	1.81	20.82	0.12	
	122.42	21.91	1.18	V	1.81	21.27	0.13	
893.31	124.78	20.89	1.00	H	1.82	20.06	0.10	
	121.63	21.45	1.00	V	1.82	20.63	0.12	

8.4.1.2 Test Data for Below 30 MHz

Test Date : March 05, 2014

Frequency range : 9 kHz ~ 30 MHz

Result : Pass

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									


 Tested by: Hong-Kyu, Lee/ Engineer

8.4.1.3 Test Data for above 30 MHz

-. Test Date : March 05, 2014
-. Frequency range : 30 MHz ~ 10 GHz
-. Result : Pass

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Margin (dB)	Limit (dBm)
Test Data for Low Channel								
70.74	48.60	-69.50	1.57	V	0.47	-68.40	55.40	-13
121.18	47.60	-68.87	1.75	V	0.61	-67.74	54.74	
147.37	53.00	-64.02	1.70	V	0.69	-63.00	50.00	
368.53	38.90	-74.51	0.93	H	1.13	-74.71	61.71	
1 739.40	81.01	-31.82	9.59	V	2.57	-24.80	11.80	
2 609.10	70.71	-37.56	10.93	V	3.18	-29.80	16.80	
3 478.80	56.96	-49.66	12.84	V	3.80	-40.61	27.61	
Test Data for Middle Channel								
66.86	47.80	-70.16	1.35	V	0.44	-69.25	56.25	-13
121.18	47.80	-68.67	1.75	V	0.61	-67.54	54.54	
148.30	50.90	-66.14	1.70	V	0.69	-65.13	52.13	
368.53	38.70	-74.71	0.93	H	1.13	-74.91	61.91	
1 763.04	81.25	-31.49	9.70	V	2.58	-24.37	11.37	
2 644.56	71.25	-37.06	10.99	V	3.22	-29.29	16.29	
3 526.08	55.38	-50.74	12.91	V	3.83	-41.65	28.65	
Test Data for High Channel								
65.89	47.30	-70.62	1.29	V	0.43	-69.76	56.76	-13
121.18	47.40	-69.07	1.75	V	0.61	-67.94	54.94	
147.37	51.70	-65.32	1.70	V	0.69	-64.30	51.30	
159.98	45.20	-74.04	1.68	H	0.72	-73.07	60.07	
1 786.62	80.04	-32.60	9.81	V	2.59	-25.39	12.39	
2 679.93	71.22	-37.14	11.05	V	3.26	-29.35	16.35	
3 573.24	57.36	-48.49	12.93	V	3.85	-39.41	26.41	
Other frequencies have margin more than 40 dB.								

Tabulated test data for Restricted Band

Remark 1: "H": Horizontal, "V": Vertical

Remark 2: Limit[dBc] = 43+10*Log(P), P is Transmitting Power(W)



Tested by: Hong-Kyu, Lee/ Engineer

8.4.1.4 Test data for DO RTT

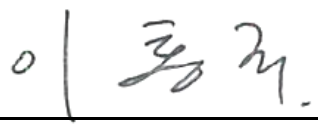
-. Test Date : March 11, 2014
-. Result : Pass

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total		Limit (W)
						(dBm)	(W)	
869.70	120.28	15.39	1.36	H	1.80	14.95	0.03	500.00
	117.38	16.53	1.36	V	1.80	16.09	0.04	
881.52	120.02	15.63	1.18	H	1.81	15.00	0.03	
	116.68	16.17	1.18	V	1.81	15.53	0.04	
893.31	116.64	12.75	1.00	H	1.82	11.92	0.02	
	113.25	13.07	1.00	V	1.82	12.25	0.02	

8.4.1.5 Test Data for Below 30 MHz

Test Date : March 11, 2014
Frequency range : 9 kHz ~ 30 MHz
Result : Pass

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									


 Tested by: Hong-Kyu, Lee/ Engineer

8.4.1.6 Test Data for above 30 MHz

-. Test Date : March 11, 2014
-. Frequency range : 30 MHz ~ 10 GHz
-. Result : Pass

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Margin (dB)	Limit (dBm)
Test Data for Low Channel								
66.86	48.30	-69.66	1.35	V	0.44	-68.75	55.75	-13
148.34	52.50	-64.54	1.70	V	0.69	-63.53	50.53	
368.53	39.00	-74.41	0.93	H	1.13	-74.61	61.61	
614.90	37.10	-69.02	1.85	V	1.51	-68.68	55.68	
1 739.40	81.01	-31.82	9.59	V	2.57	-24.80	11.80	
2 609.10	70.71	-37.56	10.93	V	3.18	-29.80	16.80	
3 478.80	56.96	-49.66	12.84	V	3.80	-40.61	27.61	
Test Data for Middle Channel								
66.86	48.10	-69.86	1.35	V	0.44	-68.95	55.95	-13
146.40	52.60	-64.40	1.71	V	0.68	-63.38	50.38	
368.53	38.60	-74.81	0.93	H	1.13	-75.01	62.01	
614.90	36.90	-69.22	1.85	V	1.51	-68.88	55.88	
1 763.04	80.14	-32.60	9.70	V	2.58	-25.48	12.48	
2 644.56	70.55	-37.76	10.99	V	3.22	-29.99	16.99	
3 526.08	54.85	-51.27	12.91	V	3.83	-42.18	29.18	
Test Data for High Channel								
66.86	48.20	-69.76	1.35	V	0.44	-68.85	55.85	-13
146.40	52.40	-64.60	1.71	V	0.68	-63.58	50.58	
368.53	38.60	-74.81	0.93	H	1.13	-75.01	62.01	
614.90	36.60	-69.52	1.85	V	1.51	-69.18	56.18	
1 786.62	80.96	-31.68	9.81	V	2.59	-24.47	11.47	
2 679.93	70.79	-37.57	11.05	V	3.26	-29.78	16.78	
3 573.24	55.24	-50.61	12.93	V	3.85	-41.53	28.53	
Other frequencies have margin more than 40 dB.								

Tabulated test data for Restricted Band

Remark 1: "H": Horizontal, "V": Vertical

Remark 2: Limit[dBc] = 43+10*Log(P), P is Transmitting Power(W)



Tested by: Hong-Kyu, Lee/ Engineer

8.4.2 Test Result for Part 24 E (PCS)

8.4.2.1 Test data for 1X RTT

-. Test Date : March 11, 2014

-. Result : Pass

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total		Limit (W)
						(dBm)	(W)	
1 931.25	124.54	12.32	10.47	H	2.73	20.06	0.101	250
	124.38	12.34	10.47	V	2.73	20.08	0.102	
1 960.00	123.89	12.12	10.61	H	2.75	19.98	0.099	
	123.01	11.41	10.61	V	2.75	19.27	0.084	
1 988.75	120.96	9.64	10.74	H	2.77	17.61	0.058	
	119.51	8.19	10.74	H	2.77	16.16	0.041	

8.4.2.2 Test Data for Below 30 MHz

Test Date : March 11, 2014

Frequency range : 9 kHz ~ 30 MHz

Result : Pass

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									



Tested by: Hong-Kyu, Lee/ Engineer

8.4.2.3 Test Data for above 30 MHz

-. Test Date : March 11, 2014
 -. Frequency range : 30 MHz ~ 20 GHz
 -. Result : Pass

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Margin (dB)	Limit (dBm)
Test Data for Low Channel								
66.86	48.40	-69.56	1.35	V	0.44	-68.65	55.65	-13
146.40	51.60	-65.40	1.71	V	0.68	-64.38	51.38	
155.13	44.90	-74.35	1.69	H	0.71	-73.37	60.37	
368.53	39.40	-74.01	0.93	H	1.13	-74.21	61.21	
614.90	37.00	-69.12	1.85	V	1.51	-68.78	55.78	
3 862.50	80.88	-23.40	13.06	V	4.04	-14.38	1.38	
5 793.75	71.07	-27.17	13.48	V	4.96	-18.65	5.65	
Test Data for Middle Channel								
66.86	48.40	-69.56	1.35	V	0.44	-68.65	55.65	-13
146.40	50.20	-66.80	1.71	V	0.68	-65.78	52.78	
155.13	46.30	-70.89	1.69	V	0.71	-69.90	56.90	
368.53	38.40	-75.01	0.93	H	1.13	-75.21	62.21	
614.90	36.60	-69.52	1.85	V	1.51	-69.18	56.18	
3 920.00	81.14	-23.01	13.08	V	4.07	-14.01	1.01	
5 880.00	71.22	-26.48	13.44	V	4.99	-18.04	5.04	
Test Data for High Channel								
66.86	47.60	-70.36	1.35	V	0.44	-69.45	56.45	-13
147.37	51.70	-65.32	1.70	V	0.69	-64.30	51.30	
155.13	45.20	-71.99	1.69	V	0.71	-71.00	58.00	
368.53	38.50	-74.91	0.93	H	1.13	-75.11	62.11	
614.90	36.30	-69.82	1.85	V	1.51	-69.48	56.48	
3 977.50	80.25	-24.19	13.11	V	4.11	-15.19	2.19	
5 966.25	72.42	-24.93	13.40	V	5.04	-16.57	3.57	
Other frequencies have margin more than 40 dB.								

Tabulated test data for Restricted Band

Remark 1: "H": Horizontal, "V": Vertical

Remark 2: Limit[dBc] = 43+10*Log(P), P is Transmitting Power(W)



Tested by: Hong-Kyu, Lee/ Engineer

8.4.2.4 Test data for DO RTT

-. Test Date : March 11, 2014
-. Result : Pass

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total		Limit (W)
						(dBm)	(W)	
1 931.25	123.46	11.24	10.47	H	2.73	18.98	0.079	250
	123.55	11.51	10.47	V	2.73	19.25	0.084	
1 960.00	122.16	10.39	10.61	H	2.75	18.25	0.067	
	123.24	11.47	10.61	H	2.75	19.33	0.086	
1 988.75	120.30	8.98	10.74	H	2.77	16.95	0.050	
	119.74	8.42	10.74	H	2.77	16.39	0.044	

8.4.2.5 Test Data for Below 30 MHz

Test Date : March 11, 2014
Frequency range : 9 kHz ~ 30 MHz
Result : Pass

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									



Tested by: Hong-Kyu, Lee/ Engineer

8.4.2.6 Test Data for above 30 MHz

-. Test Date : March 11, 2014
-. Frequency range : 30 MHz ~ 20 GHz
-. Result : Pass

Frequency (MHz)	Spectrum Reading (dBμV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Cable Loss (dB)	Total (dBm)	Margin (dB)	Limit (dBm)
Test Data for Low Channel								
65.89	48.40	-69.52	1.29	V	0.43	-68.66	55.66	-13
146.40	51.10	-65.90	1.71	V	0.68	-64.88	51.88	
155.13	51.80	-67.45	1.69	H	0.71	-66.47	53.47	
368.53	35.30	-76.53	0.93	V	1.13	-76.73	63.73	
614.90	36.80	-69.32	1.85	V	1.51	-68.98	55.98	
3 862.50	79.25	-25.03	13.06	V	4.04	-16.01	3.01	
5 793.75	70.04	-28.20	13.48	V	4.96	-19.68	6.68	
Test Data for Middle Channel								
66.86	48.30	-69.66	1.35	V	0.44	-68.75	55.75	-13
147.37	51.50	-65.52	1.70	V	0.69	-64.50	51.50	
155.13	44.60	-74.65	1.69	H	0.71	-73.67	60.67	
368.53	38.60	-74.81	0.93	H	1.13	-75.01	62.01	
614.90	36.50	-69.62	1.85	V	1.51	-69.28	56.28	
3 920.00	79.69	-24.46	13.08	V	4.07	-15.46	2.46	
5 880.00	70.82	-26.88	13.44	V	4.99	-18.44	5.44	
Test Data for High Channel								
65.89	47.90	-70.02	1.29	V	0.43	-69.16	56.16	-13
146.40	51.90	-65.10	1.71	V	0.68	-64.08	51.08	
147.37	44.60	-74.67	1.70	H	0.69	-73.65	60.65	
368.53	38.70	-74.71	0.93	H	1.13	-74.91	61.91	
614.90	36.10	-70.02	1.85	V	1.51	-69.68	56.68	
3 977.50	79.25	-25.19	13.11	V	4.11	-16.19	3.19	
5 966.25	70.04	-27.31	13.40	V	5.04	-18.95	5.95	
Other frequencies have margin more than 40 dB.								

Tabulated test data for Restricted Band

Remark 1: "H": Horizontal, "V": Vertical

Remark 2: Limit[dBc] = 43+10*Log(P), P is Transmitting Power(W)



Tested by: Hong-Kyu, Lee/ Engineer

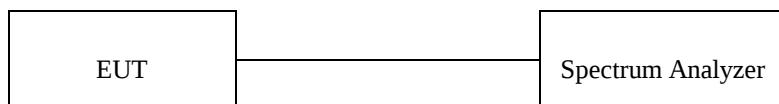
9. OCCUPIED BANDWIDTH

9.1 Operating environment

Temperature : 25 °C
Relative humidity : 45 % R.H.

9.2 Test set-up

The test was performed at three frequencies (low, middle, and high channels) at each band using all applicable modulation. For the testing, the RBW was set to 1 % to 3 % of the 99 % Occupied Bandwidth. The VBW is set to 3 times the RBW and sweep time is coupled.



9.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV30	R/S	FSV30 Signal Analyzer	101372	May 20, 2013 (1Y)

All test equipment used is calibrated on a regular basis.

9.4 Test data

9.4.1 Test Result for Part 22 H (CDMA)

-. Test Date : March 11, 2014

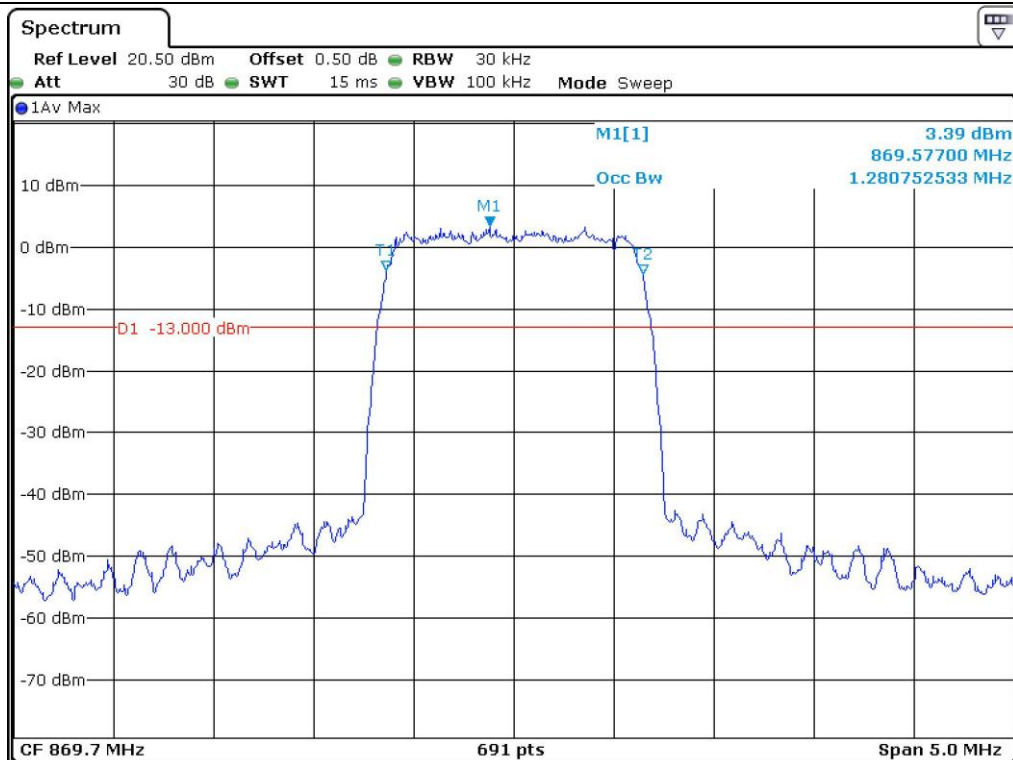
-. Test Result : Pass

Modulation	Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)
1X RTT	Low	869.70	1.28
	Middle	881.52	1.27
	High	893.31	1.27
DO RTT	Low	869.70	1.27
	Middle	881.52	1.27
	High	893.31	1.27

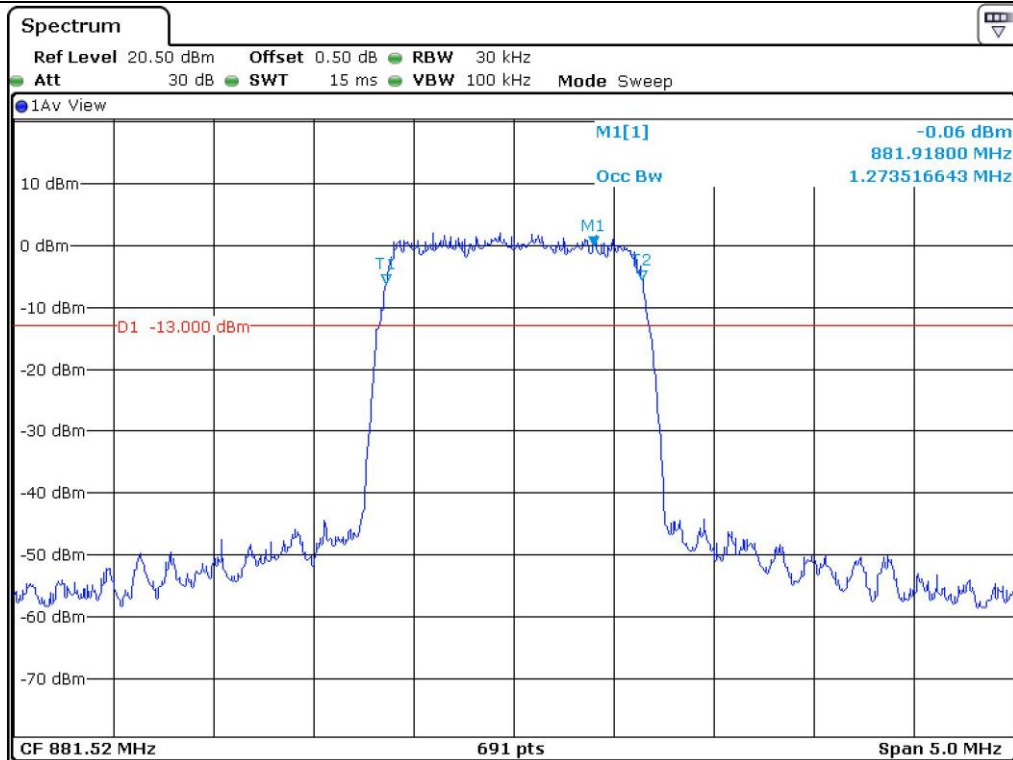
Remark: According to above result, the carrier frequency shall be within the frequency block edges.



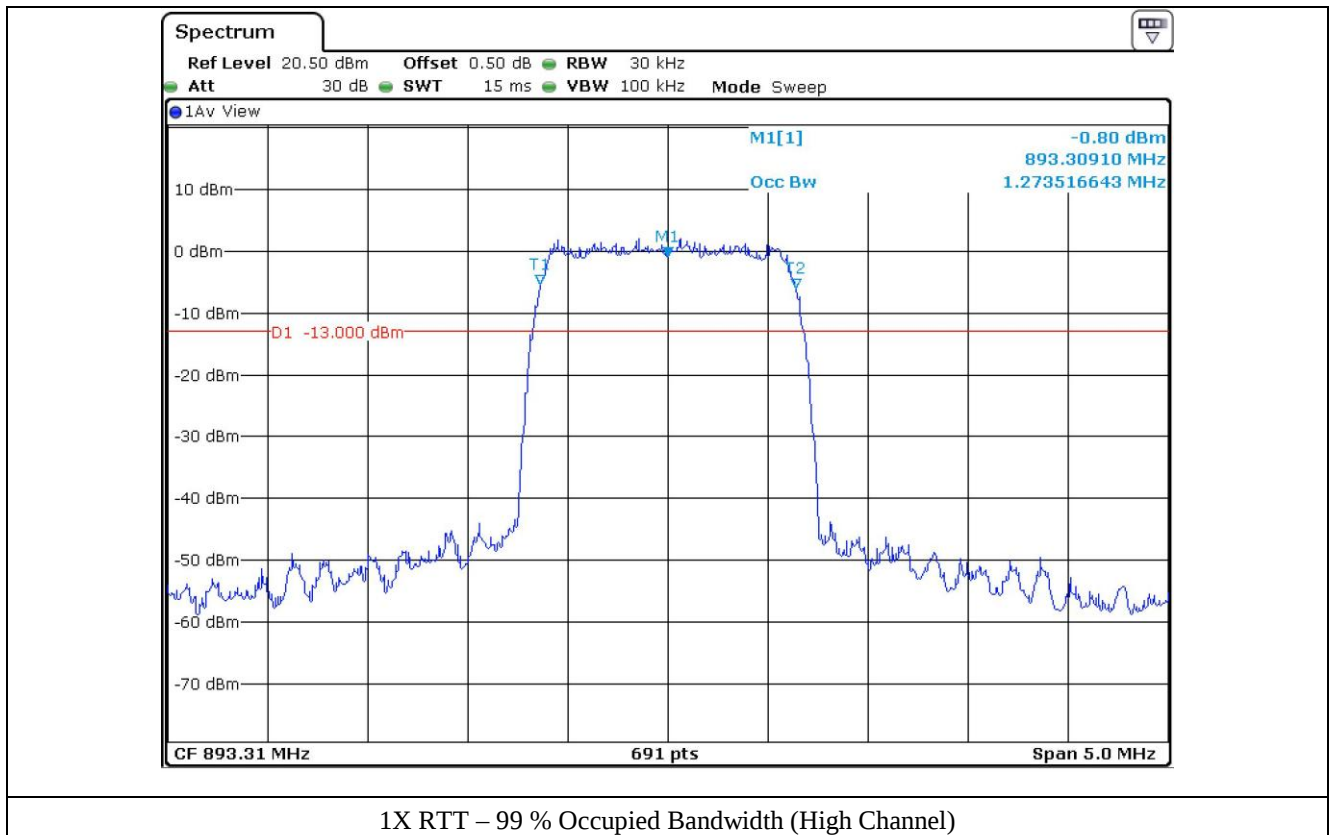
Tested by: Hong-Kyu, Lee/ Engineer

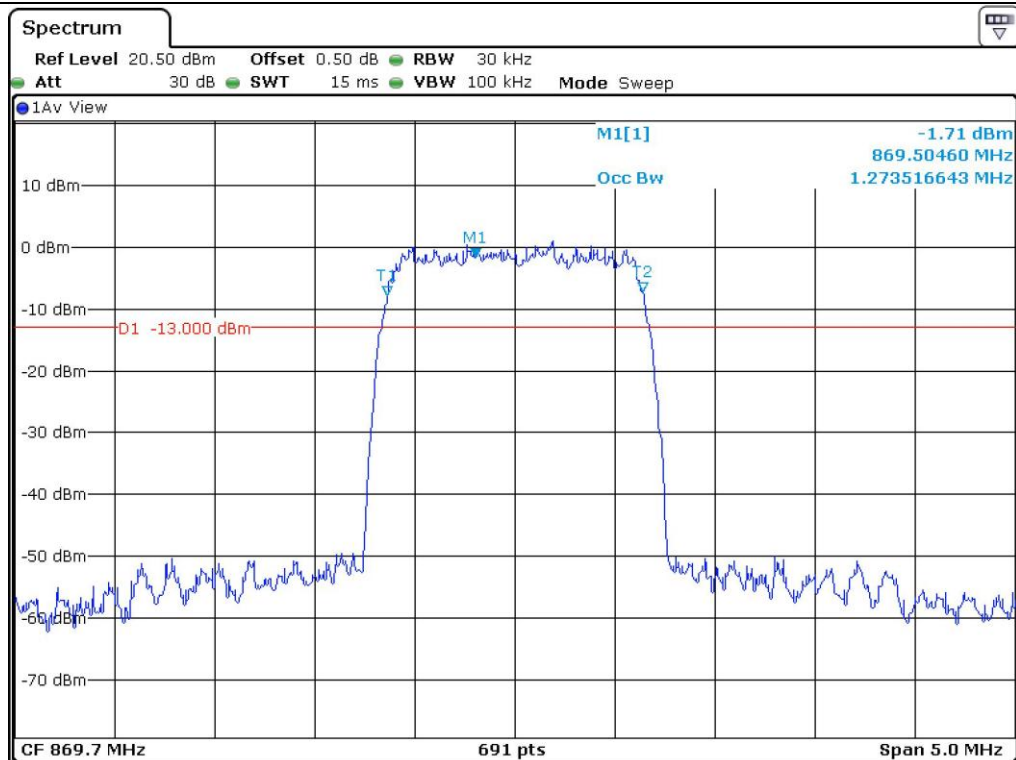


1X RTT – 99 % Occupied Bandwidth (Low Channel)

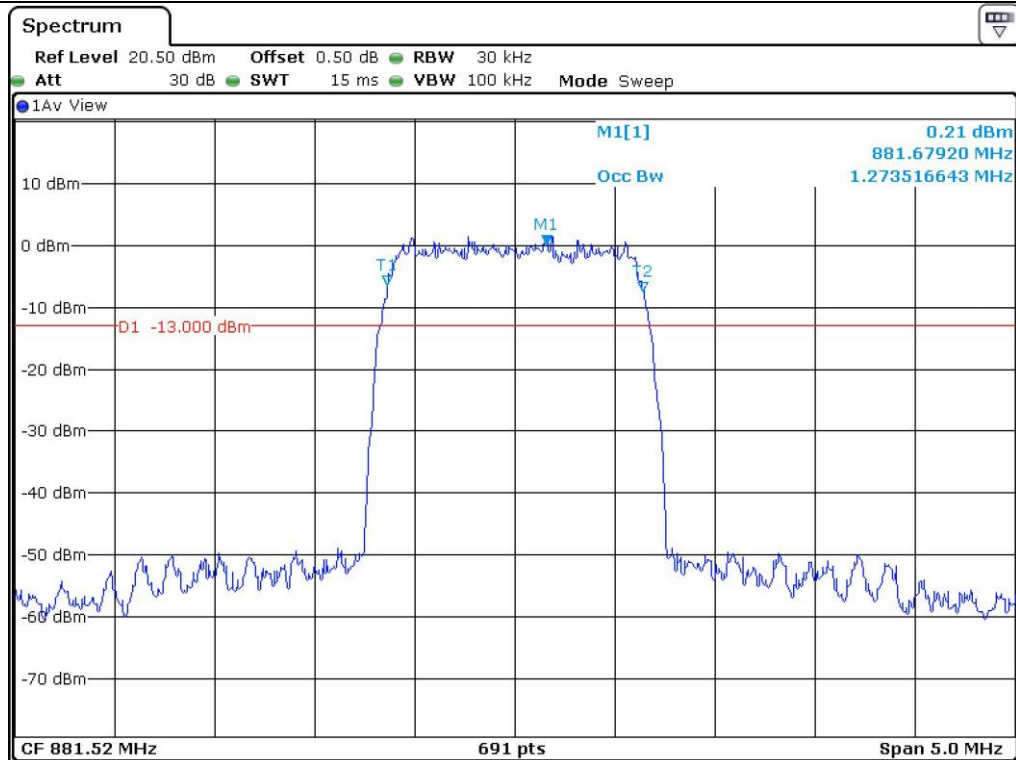


1X RTT – 99 % Occupied Bandwidth (Middle Channel)

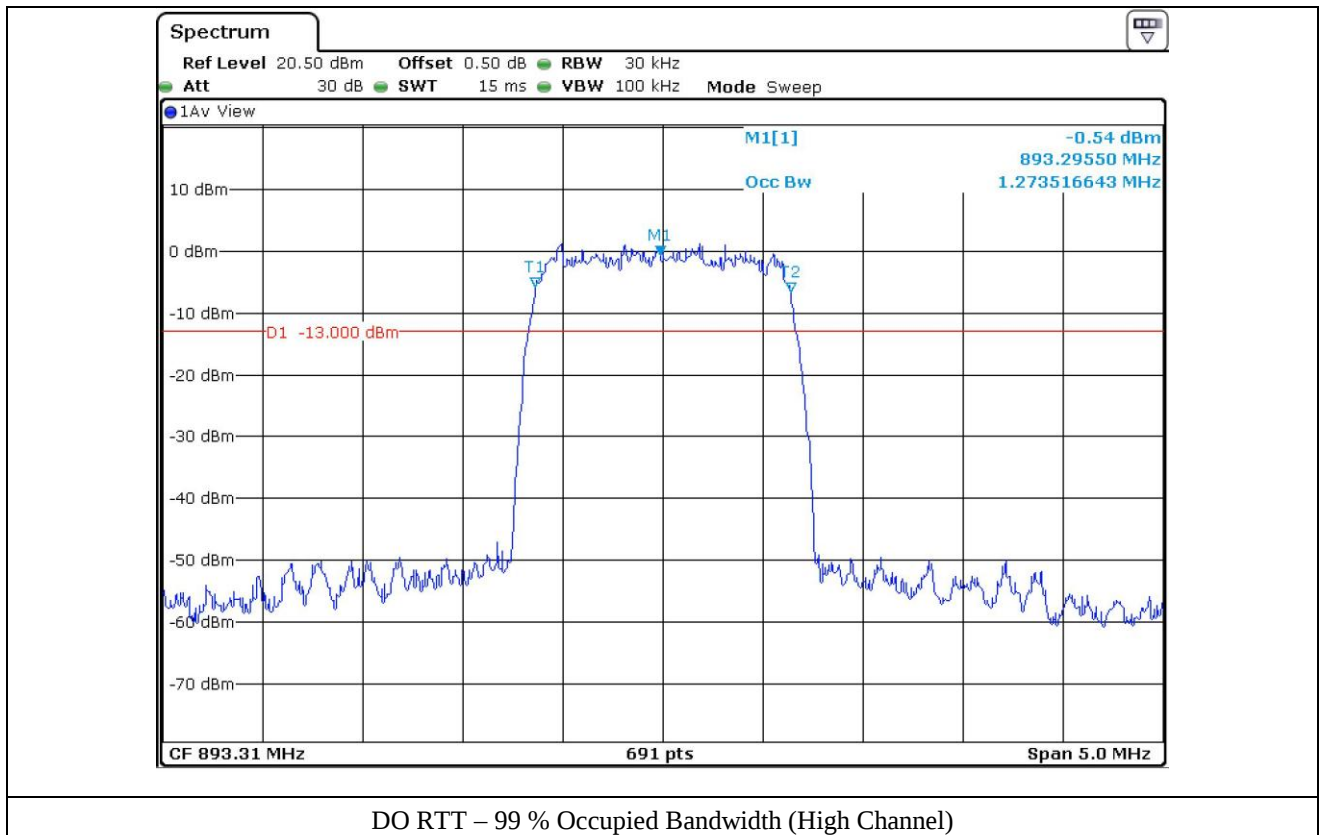




DO RTT – 99 % Occupied Bandwidth (Low Channel)



DO RTT – 99 % Occupied Bandwidth (Middle Channel)



9.4.2 Test Result for Part 24 E (PCS)

-. Test Date : March 05, 2014

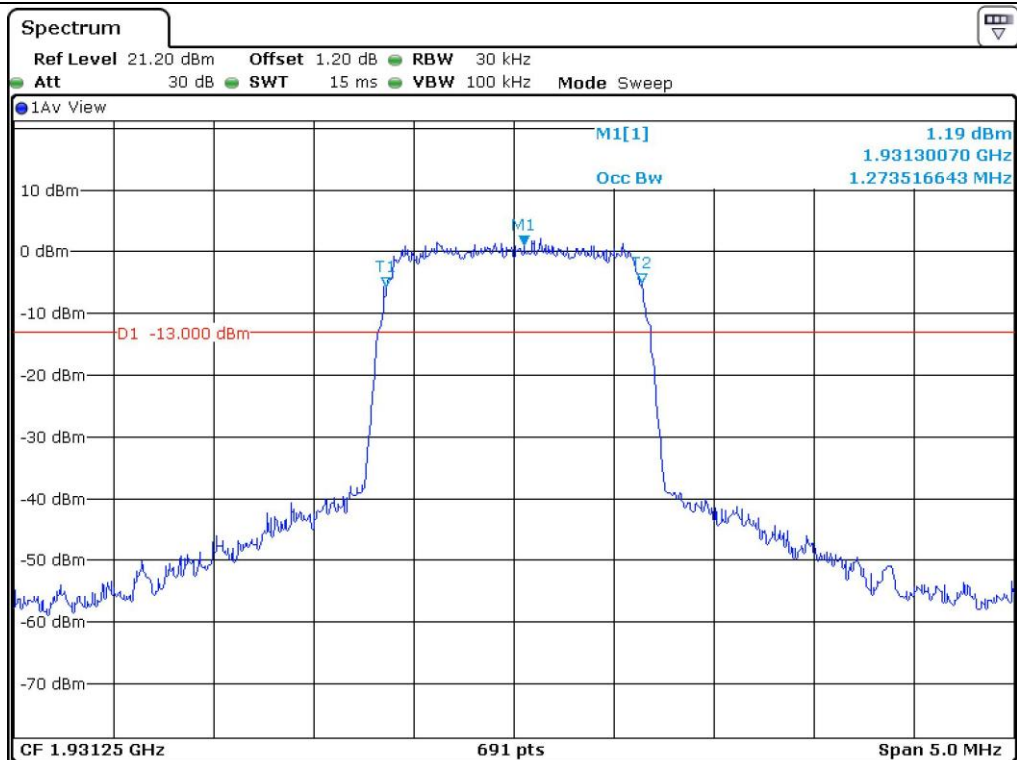
-. Test Result : Pass

Modulation	Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)
1X RTT	Low	1 931.25	1.27
	Middle	1 960.00	1.28
	High	1 988.75	1.27
DO RTT	Low	1 931.25	1.27
	Middle	1 960.00	1.27
	High	1 988.75	1.27

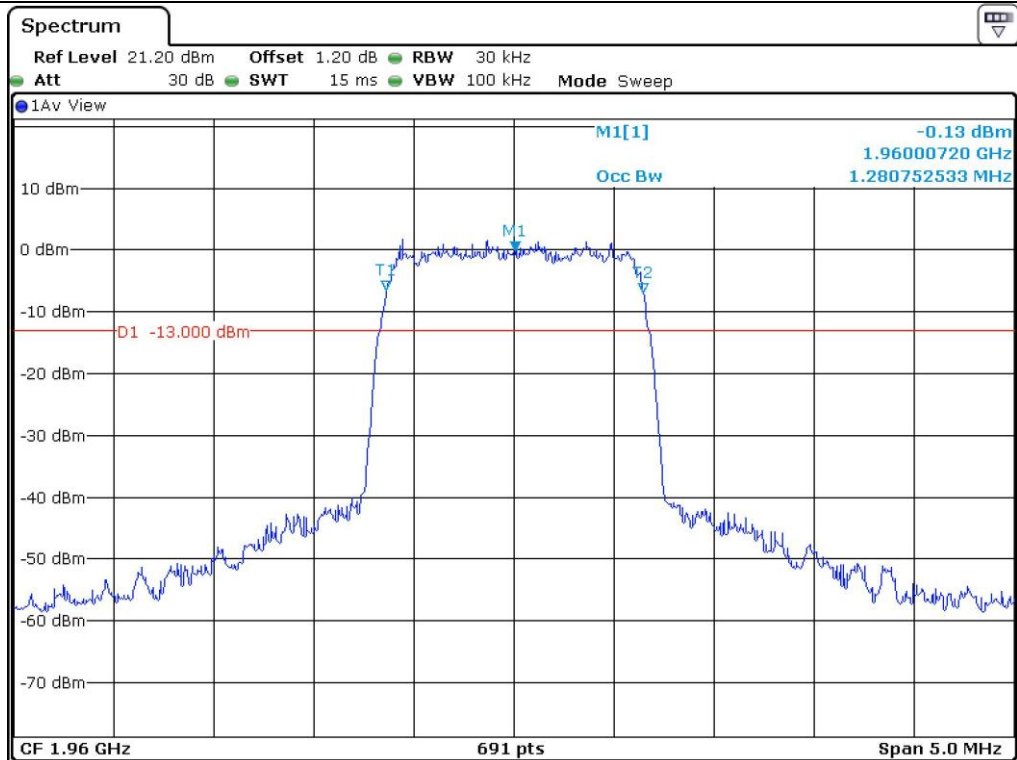
Remark: According to above result, the carrier frequency shall be within the frequency block edges.



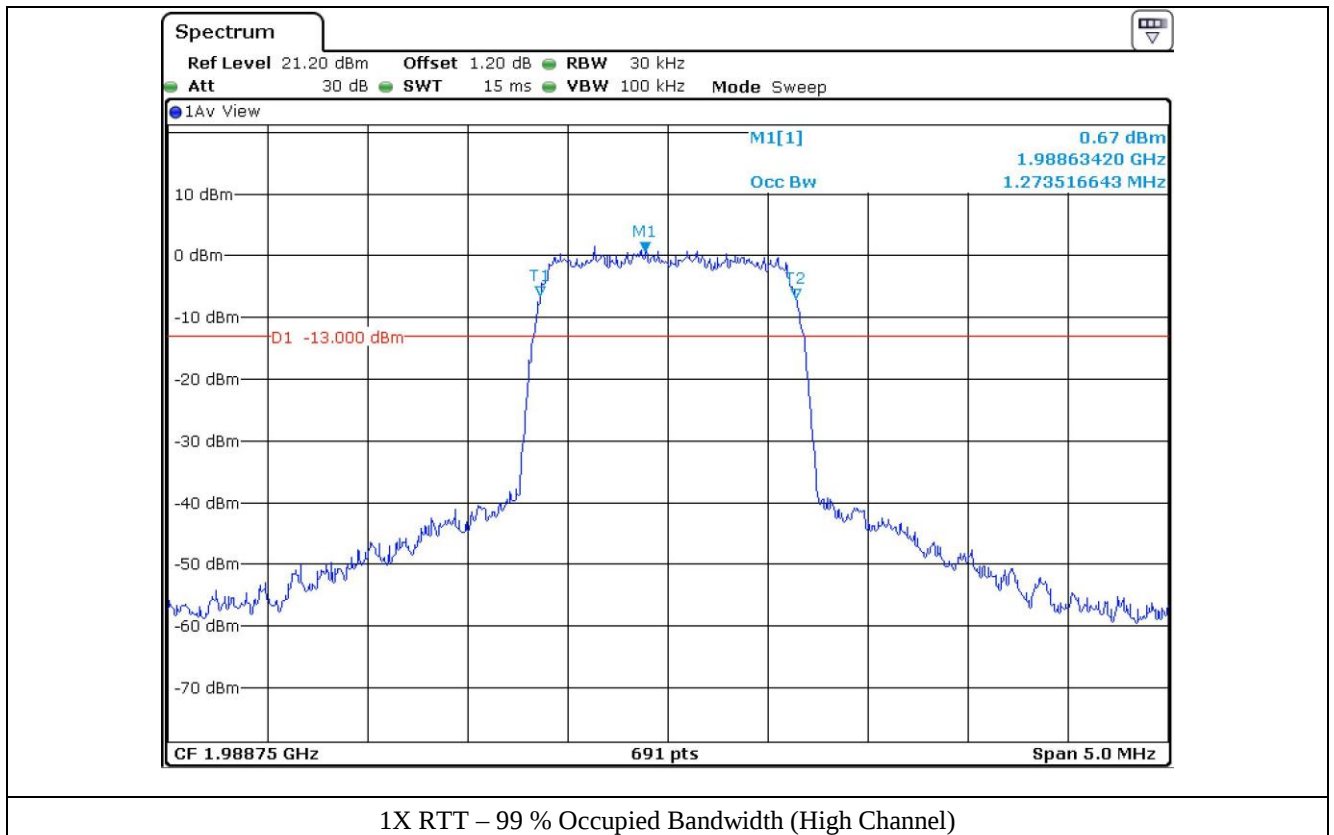
Tested by: Hong-Kyu, Lee/ Engineer

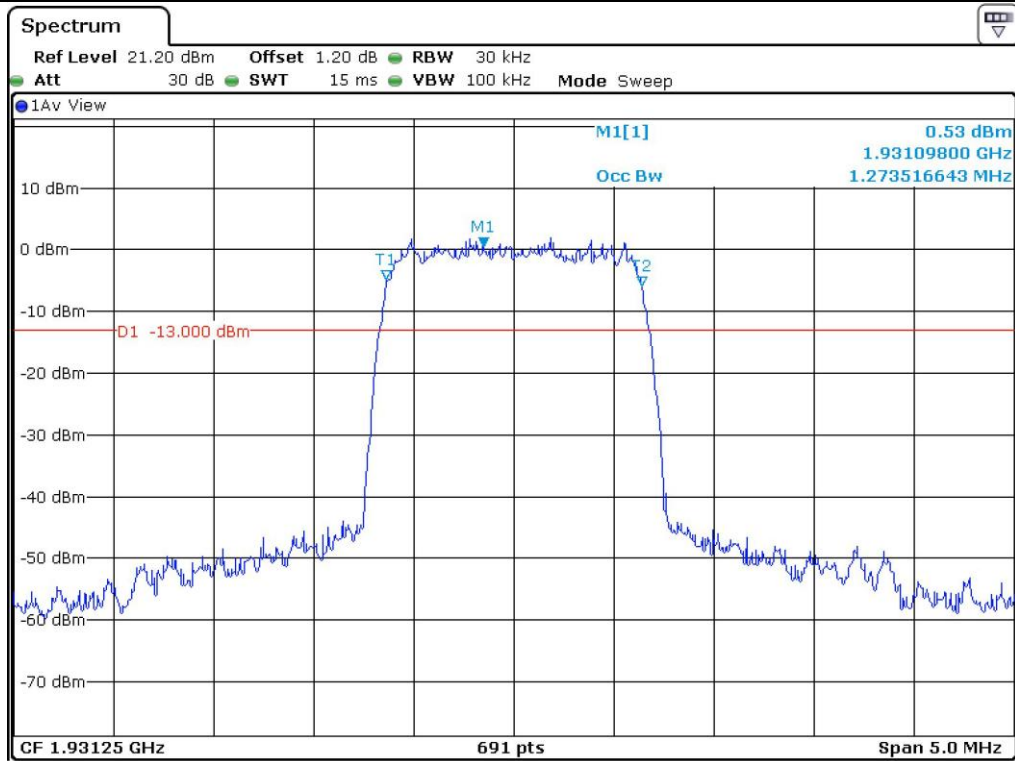


1X RTT – 99 % Occupied Bandwidth (Low Channel)

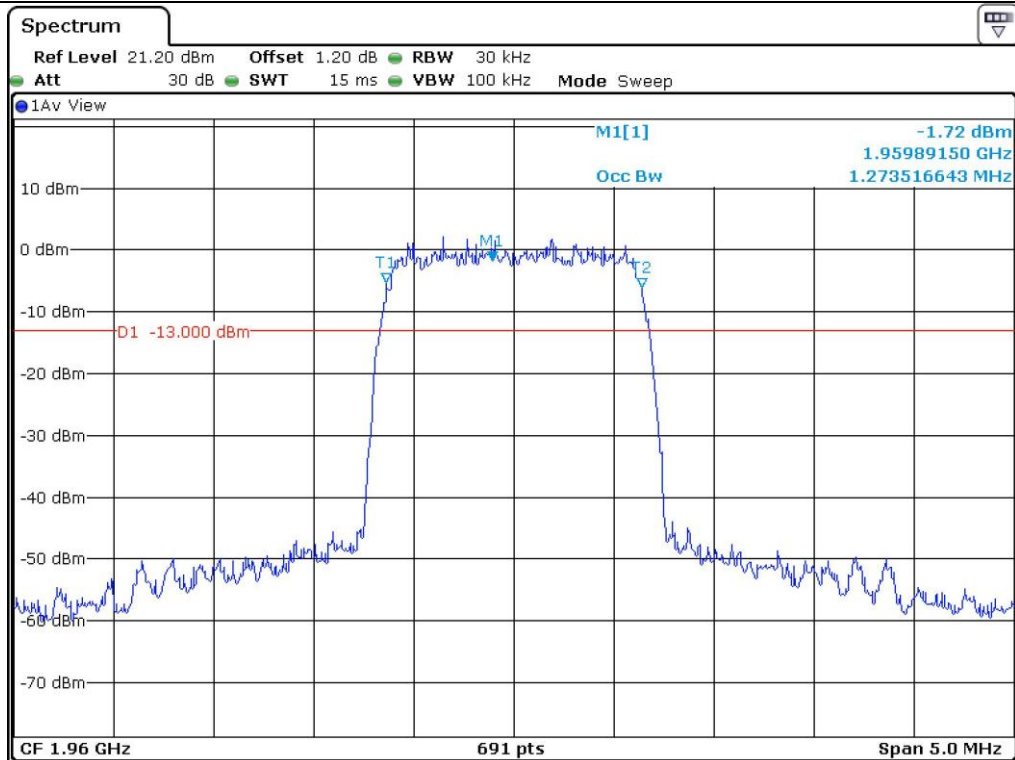


1X RTT – 99 % Occupied Bandwidth (Middle Channel)

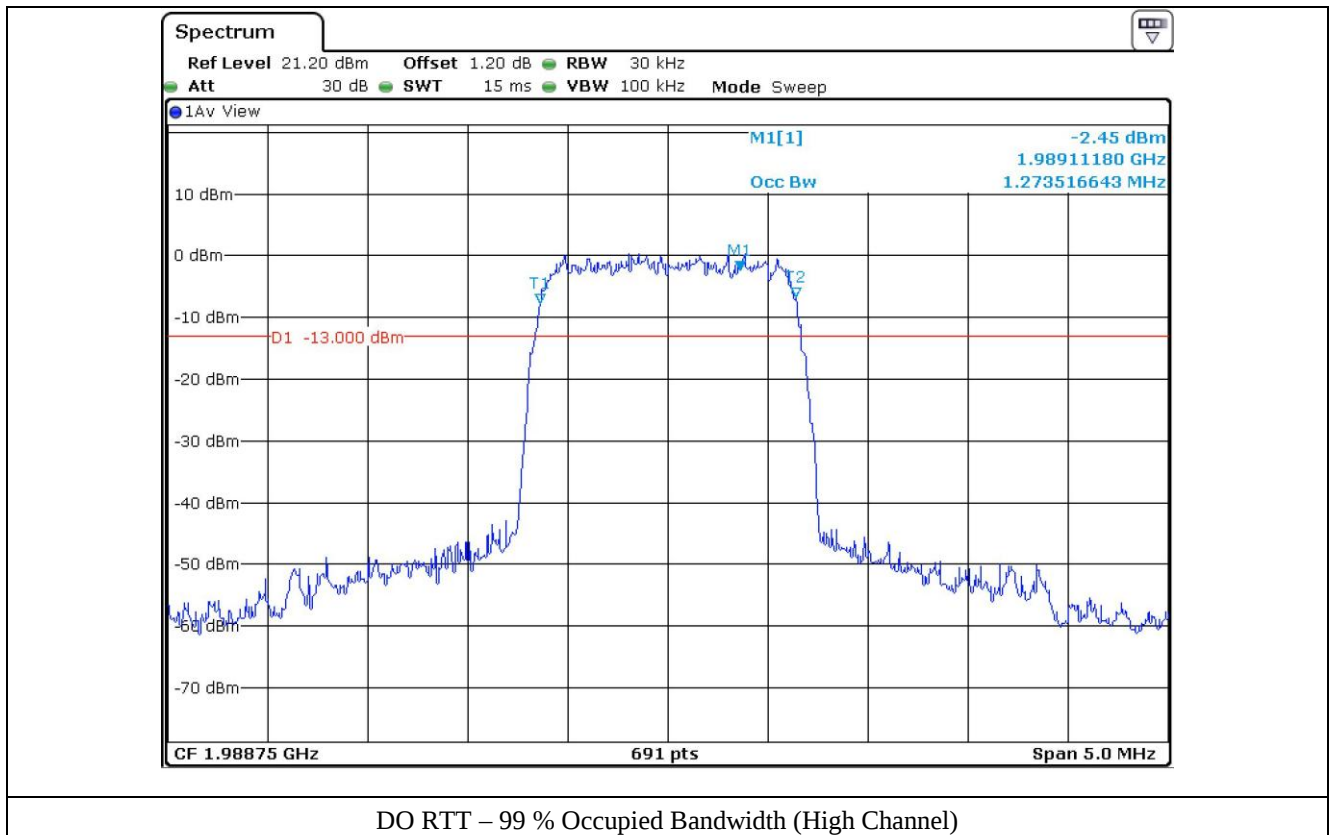




DO RTT – 99 % Occupied Bandwidth (Low Channel)



DO RTT – 99 % Occupied Bandwidth (Middle Channel)



10. FREQUENCY STABILITY WITH TEMPERATURE VARIATION

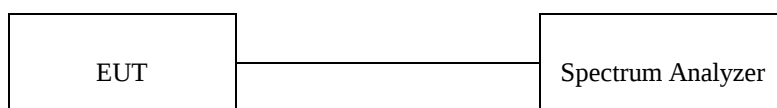
10.1 Operating environment

Temperature : 25 °C
Relative humidity : 45 % R.H.

10.2 Test set-up

The RF signal from the signal generator(s) was injected to the EUT and the amplified RF signal at the output of the EUT was connected to the power meter or spectrum analyzer. The test was performed at three frequencies (low, middle, and high channels) at each band using all applicable unmodulation.

Turn EUT off and set chamber temperature to -30 °C and then allow sufficient time (approximately 20 min to 30 min after chamber reach the assigned temperature) for EUT to stabilize. Turn on the EUT and measure the EUT operating frequency and then turn off the EUT after the measurement. The temperature in the chamber was raised 10 °C step from -30 °C to +50 °C. Repeat above method for frequency measurements every 10 °C step and then record all measured frequencies on each temperature step.



10.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	53152A	HP	Frequency Counter	US39270295	Nov. 07, 2013 (1Y)
■ -	SSE-43CI-A	Samkun	Chamber	060712	May 20, 2013 (1Y)
□ -	FSV30	R/S	FSV30 Signal Analyzer	101372	May 20, 2013 (1Y)

All test equipment used is calibrated on a regular basis.

10.4 Test data

10.4.1 Test Result for Part 22 H (CDMA)

10.4.1.1 Test data for 1X RTT

-. Test Date : March 05, 2014

-. Result : Pass

Temperature (°C)	Ref Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit(PPM)
-30	881 519 322	881 518 252	-1.213 8	1.5
-20		881 518 575	-0.847 4	
-10		881 518 776	-0.619 4	
0		881 518 994	-0.372 1	
10		881 519 174	-0.167 9	
20		881 519 284	-0.043 1	
30		881 519 363	0.046 5	
40		881 519 585	0.298 3	
50		881 519 636	0.356 2	

10.4.1.2 Test data for DO RTT

-. Test Date : March 05, 2014

-. Result : Pass

Temperature (°C)	Ref Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit
-30	881 519 394	881 518 743	-0.738 5	1.5
-20		881 518 842	-0.626 2	
-10		881 518 973	-0.477 6	
0		881 519 112	-0.319 9	
10		881 519 247	-0.166 8	
20		881 519 335	-0.066 9	
30		881 519 473	0.089 6	
40		881 519 528	0.152 0	
50		881 519 714	0.363 0	

10.4.2 Test Result for Part 24 E (PCS)

10.4.2.1 Test data for 1X RTT

-. Test Date : March 05, 2014

-. Result : Pass

Temperature (°C)	Ref Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit(PPM)
-30	1 959 997 394	1 959 996 474	-0.469 4	1.5
-20		1 959 996 582	-0.414 3	
-10		1 959 996 942	-0.230 6	
0		1 959 997 025	-0.188 3	
10		1 959 997 138	-0.130 6	
20		1 959 997 352	-0.021 4	
30		1 959 997 447	0.027 0	
40		1 959 997 635	0.123 0	
50		1 959 997 773	0.193 4	

10.4.2.2 Test data for DO RTT

-. Test Date : March 05, 2014

-. Result : Pass

Temperature (°C)	Ref Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit(PPM)
-30	1 959 997 042	1 959 996 115	-0.473 0	1.5
-20		1 959 996 212	-0.423 5	
-10		1 959 996 394	-0.330 6	
0		1 959 996 684	-0.182 7	
10		1 959 996 832	-0.107 1	
20		1 959 996 994	-0.024 5	
30		1 959 997 124	0.041 8	
40		1 959 997 315	0.139 3	
50		1 959 997 525	0.246 4	

11. FREQUENCY STABILITY WITH VOLTAGE VARIATION

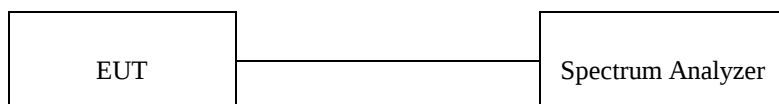
11.1 Operating environment

Temperature : 25 °C
Relative humidity : 45 % R.H.

11.2 Test set-up

The RF signal from the signal generator(s) was injected to the EUT and the amplified RF signal at the output of the EUT was connected to the power meter or spectrum analyzer. The test was performed at three frequencies (low, middle, and high channels) at each band using all applicable unmodulation.

The RF output port of the EUT was connected to the input of the spectrum analyzer. The signal generator was set to center frequency for each band with an un-modulated signal. The voltage of EUT set to 115 % of the nominal value and then was reduced to 85 % of nominal voltage. The output frequency was recorded at each step.



11.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	53152A	HP	Frequency Counter	US39270295	Nov. 07, 2013 (1Y)
□ -	FSV30	R/S	FSV30 Signal Analyzer	101372	May 20, 2013 (1Y)
■ -	DH-60	Dea Kwang Elec.	Slidacs	N/A	Sep. 03, 2013 (1Y)

All test equipment used is calibrated on a regular basis.

11.4 Test data

11.4.1 Test Result for Part 22 H (CDMA)

11.4.1.1 Test data for 1X RTT

-. Test Date : March 05, 2014

-. Result : PASSED

Voltage (Vdc)	Ref Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit(PPM)
115%	881 519 322	881 519 252	-0.079 4	1.5
100%		881 519 292	-0.034 0	
85%		881 519 263	-0.066 9	

11.4.1.2 Test data for DO RTT

-. Test Date : March 05, 2014

-. Result : PASSED

Voltage (Vdc)	Ref Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit(PPM)
115%	881 519 394	881519 382	-0.013 6	1.5
100%		881519 338	-0.063 5	
85%		881519 358	-0.040 8	



Tested by: Hong-Kyu, Lee/ Engineer

11.4.2 Test Result for Part 24 E (PCS)

11.4.2.1 Test data for 1X RTT

-. Test Date : March 05, 2014

-. Result : PASSED

Voltage (Vdc)	Ref Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit(PPM)
115%	1 959 997 394	1 959 997 388	-0.003 1	1.5
100%		1 959 997 350	-0.022 4	
85%		1 959 997 325	-0.035 2	

11.4.2.2 Test data for DO RTT

-. Test Date : March 05, 2014

-. Result : PASSED

Voltage (Vdc)	Ref Freq. (Hz)	Measured Freq. (Hz)	Result (PPM)	Limit(PPM)
115%	1 959 997 042	1 959 996 985	-0.029 1	1.5
100%		1 959 996 992	-0.025 5	
85%		1 959 996 925	-0.059 7	



Tested by: Hong-Kyu, Lee/ Engineer

12. MAXIMUM PERMISSIBLE EXPOSURE

12.1 RF Exposure Calculation

According to the FCC rule 1.1310 table 1B, the limit for the maximum permissible RF exposure for an uncontrolled environment are $f/1500 \text{ mW/cm}^2$ for the frequency range between 300 MHz and 1 500 MHz and 1.0 mW/cm^2 for the frequency range between 1 500 MHz and 100 000 MHz.

The electric field generated for a 1 mW/cm^2 exposure is calculated as follows:

$$E = \sqrt{(30 * P * G) / d}, \text{ and } S = E^2 / Z = E^2 / 377, \text{ because } 1 \text{ mW/cm}^2 = 10 \text{ W/m}^2$$

Where

S = Power density in mW/cm^2 , Z = Impedance of free space, 377Ω

E = Electric field strength in V/m , G = Numeric antenna gain, and d = distance in meter

Combining equations and rearranging the terms to express the distance as a function of the remaining variable

$$d = \sqrt{(30 * P * G) / (377 * 10 S)}$$

Changing to units of mW and cm , using $P (\text{mW}) = P (\text{W}) / 1000$, $d (\text{cm}) = 0.01 * d (\text{m})$

$$d = 0.282 * \sqrt{(P * G) / S}$$

Where

d = distance in cm , P = Power in mW , G = Numeric antenna gain, and S = Power density in mW/cm^2

12.2 Calculated MPE Safe Distance

12.2.1 For Part 22 H (CDMA)

According to above equation, the following result was obtained.

Peak Output Power		Antenna Gain		Safe Distance	Power Density (mW/cm^2)	FCC Limit
(dBm)	(mW)	Log	Linear	(cm)	@ 20 cm Separation	(mW/cm^2)
21.27	133.97	1.38	1.37	3.83	0.0366	0.59

According to above table, safe safe distance, $D = 0.282 * \sqrt{133.97 * 1.37} = 3.83 \text{ cm}$.

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 133.97 * 1.37 / (4 * 3.14 * 20^2) = 0.0366$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

Remark: The Power Density of the above table was calculated for single frequency.

12.2.2 For Part 24 E (PCS)

According to above equation, the following result was obtained.

Peak Output Power		Antenna Gain		Safe Distance	Power Density (mW/cm ²)	FCC Limit
(dBm)	(mW)	Log	Linear	(cm)	@ 20 cm Separation	(mW/cm ²)
20.08	101.86	2.58	1.81	3.83	0.0367	1.0

According to above table, safe safe distance, $D = 0.282 * \sqrt{101.86 * 1.81} = 3.83$ cm.

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 101.86 * 1.81 / (4 * 3.14 * 20^2) = 0.0367$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

Remark: The Power Density of the above table was calculated for single frequency.