

FCC TEST REPORT

Test report No.: EMC- FCC- R0054
FCC ID: A3LSCS-2UZZZZ
Classification: PCS Licensed Transmitter(PCB)
Model Name: SCS-2U01
Brand Name: Samsung
Applicant: Samsung Electronics Co., Ltd.
FCC Rule Part(s): FCC Part 24 Subpart E
Frequency Range: 1 931.25 MHz ~ 1 988.75 MHz
Test result: Complied

The above equipment was tested by EMC compliance Testing Laboratory for compliance with the requirements of FCC Rules and Regulations.

The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Date of test: November 1, 2011 ~ November 19, 2011

Issued date: November 21, 2011


Tested by:

KIM, CHANG MIN


Approved by:

YOO, SUNG YOUNG

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1. Client information

Applicant: SAMSUNG Electronics Co.,Ltd
Address: 416, Maetan-3dong, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea
Telephone number: +82-31-279-3509
Facsimile number:
Contact person: Duk-Hun Kim / thekern.kim@samsung.com

Manufacturer: SAMSUNG Electronics Co.,Ltd
Address: 416, Maetan-3dong, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea

2. Laboratory information

Address

EMC Compliance Ltd.
480-5 Shin-dong, Yeongtong-gu, Suwon-city, Gyunggi-do, 443-390, Korea

Telephone Number: 82 31 336 9919 Facsimile Number: 82 31 336 4767

Certificate

CBTL Testing Laboratory, KOLAS NO.: 231
FCC Filing No.: KR0040
VCCI Registration No.: C-1713, R-1606, T-258

SITE MAP



3. Description of E.U.T.

3.1 Basic description

Applicant :	Samsung Electronics Co., Ltd.
Address of Applicant:	416, Maetan-3dong, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea
Manufacturer:	Samsung Electronics Co., Ltd.
Address of Manufacturer:	416, Maetan-3dong, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea
Type of equipment:	Verizon Wireless Network Extender
Basic Model:	SCS-2U01
Brand name:	Samsung
Serial number:	Proto Type

3.2 General description

Frequency Range (TX)	1 931.25 MHz ~ 1 988.75MHz
Frequency Range (RX)	1 851.25 MHz ~ 1 908.75 MHz
Type of Modulation	BPSK,QPSK,16QAM
Type of Antenna	Dipole Antenna
Antenna Gain	2.584 dBi
Transmit Power	13.11 dBm (1X) / 13.88 dBm (DO)
Power supply	DC 12 V , 1.5A from AC/DC adapter
Frequency Tolerance	2.5 ppm
Emission Designator	1M28F9W
Operator selection of Frequency	Software Controlled
Power output adjustment Capability	Software Controlled

3.3 Test frequency

	Frequency
Low frequency	1931.25 MHz
Middle frequency	1960.00 MHz
High frequency	1988.75 MHz

3.4 Test Voltage

mode	Voltage
Norminal voltage	AC 110 V

3.5 Ancillary/peripheral equipment

Type	Model / Part #	Serial number	Manufacturer
Gigabit Switch	3CGSU05A	AB/9U8QBV00085BA	3COM

4. Summary of test results

4.1 Standards & results

Rule Reference	Parameter	Report Section	Test Result
2.1046	RF power output	5.1	C
24.232	Equivalent isotropically radiated power (EIRP)	5.2	C
2.1049 / 24.238	Occupied bandwidth	5.3	C
2.1051 / 24.238 22.359	Spurious Emission	5.4	C
24.235	Frequency Stability	5.5	C
Note: C=complies NC= Not complies NT=Not tested NA=Not Applicable			

4.2 Uncertainty

Measurement Item	Combined Standard Uncertainty U_c	Expanded Uncertainty $U = KU_c (K = 2)$
Conducted RF power	± 1.106 dB	± 3.120 dB
Radiated disturbance	+2.280dB / - 2.278 dB	+4.560dB / - 4.556 dB
Conducted disturbance	+1.883 dB / - 1.676 dB	+3.766dB / - 3.352 dB

4.3 Methodes and Prosedures

The methods and procedures used were as detailed in:

ANSI/TIA-603-B-2003

Land Mobile Communications Equipment, Measurements and performance Standards

ANSI C63.2

American National Standard for Instrumentation- Electromagnetic noise and field strength.

ANSI C63.4

American National Standard method of Measurement of Electromagnetic Emissions from Low Voltage Electrical and Electric equipment in the range of 9 kHz to 40 GHz.

ANSI C63.5

American National Standard for the Calibration of antenna used for radiated Emission measurement in Elctromagnetic interference (EMI) Control.

ANSI C63.7

American National Standard Guide for Construction of open Area Test Sites for performing radiated emission Measurement.

CISPR 16-1

Specitification For Radio Disturbance and Immunity Measuring Appatus and Method. Part 1 : radio Disturbance and Immunity Measuring Appartus.

5. Test results

5.1 RF power output

5.1.1 Regulation

FCC part 2.1046

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 2.983(d)(5). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

FCC Limit (Part 24.232)

c) Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

5.1.2 Result

-Complied

The output power was measured under all R.C.s and S.O.s which are listed below measurement data. The Worst case output power is reported with SO2 of RC1 for PCS band.

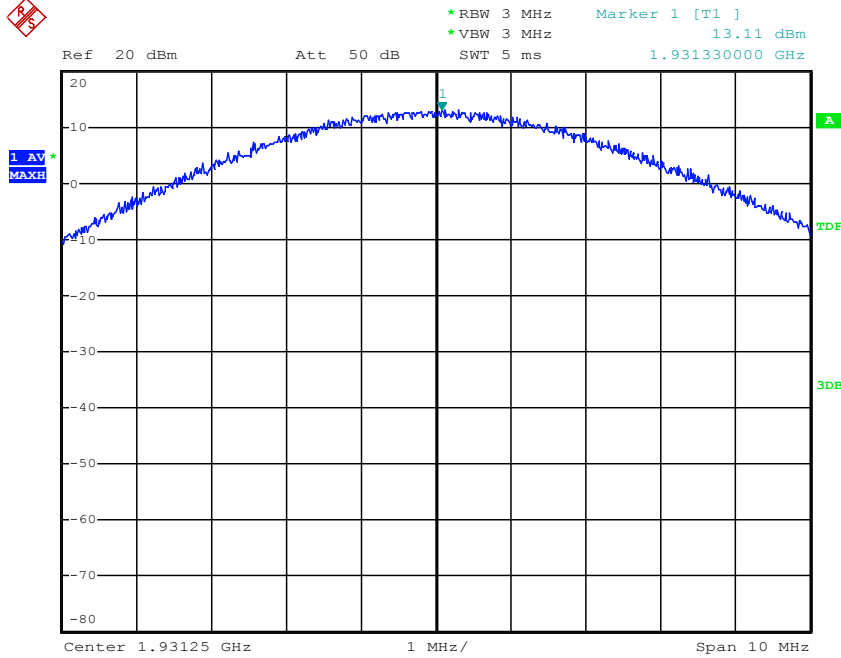
5.1.2.1 Test Result- 1X RTT

Channel No.	Frequency	1X RTT [dBm]	
		RC1	RC3
		SO2	SO9
25	1931.25	13.11	12.58
600	1960.00	12.90	12.38
1175	1988.75	12.62	11.97

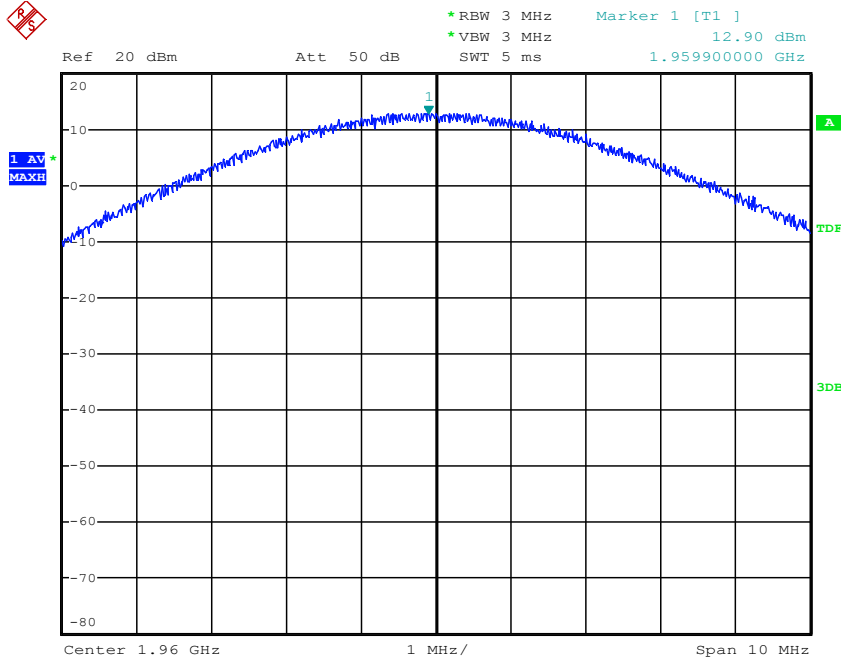
5.1.2.2 Test Result- DO RTT

Channel No.	Frequency	DO RTT [dBm]	
		RC1	RC3
		SO2	SO9
25	1931.25	13.75	13.06
600	1960.00	13.88	12.96
1175	1988.75	12.09	12.53

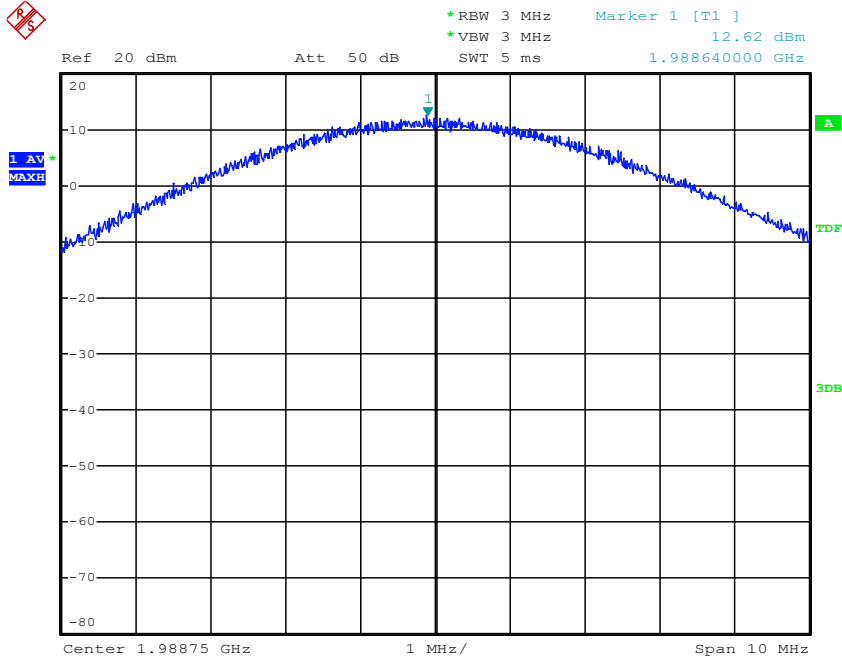
5.1.2.3 Test Result- 1X RTT TEST PLOT
 - ch. 25



-ch. 600

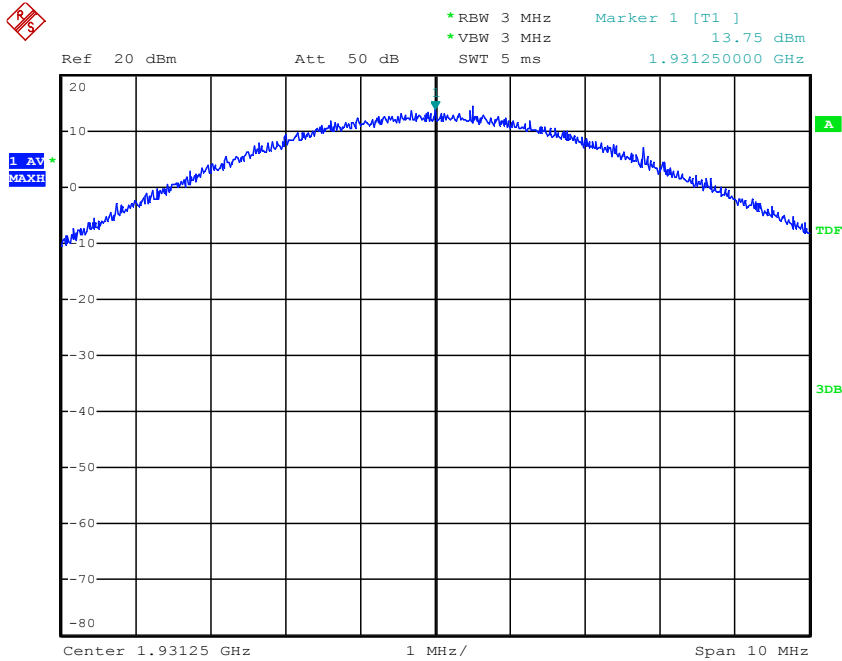


- ch. 1175

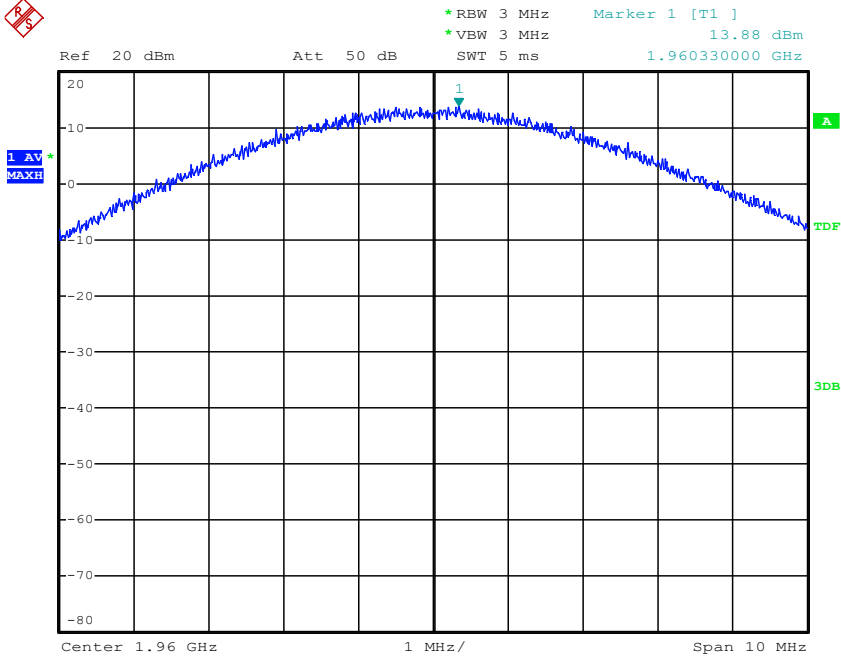


5.1.2.4 Test Result- DO RTT TEST PLOT

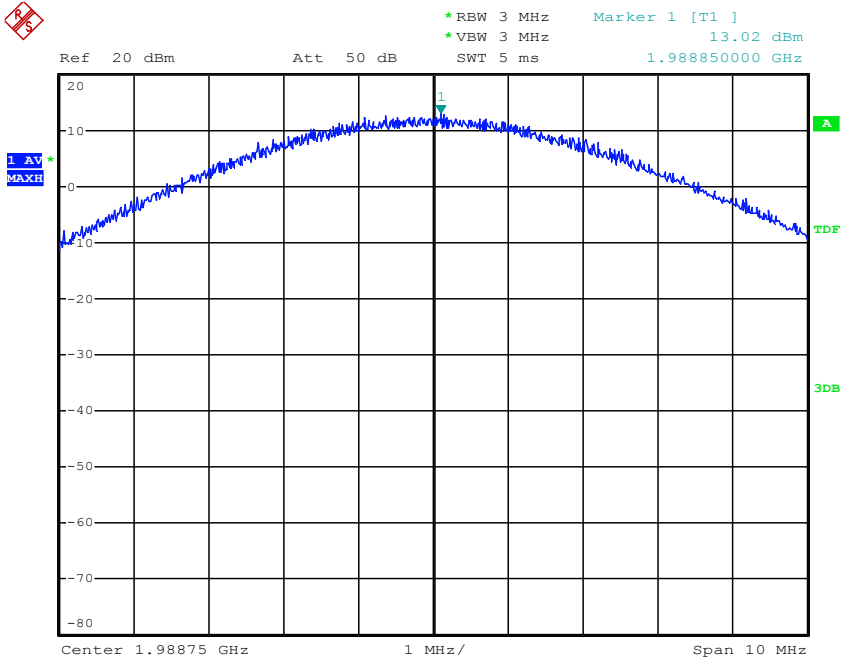
-ch. 25



- ch. 600



-ch. 1175



5.2 Equivalent isotropically radiated power (EIRP)

5.2.1 Regulation

FCC Limit (Part 24.132)

(c) Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

5.2.2 Test Result

-complied

1. Test Mode: All R.C.s and S.O.s / all Polarization
2. The worst case mode is reported RC1/ SO2

5.2.2.1 Test Result- 1X RTT

Frequency [MHz]	Pol. [V/H]	Measured LEVEL [dBm]	EIRP [dBm]	EIRP [W]	Limit [W]
1931.25	H	20.2	20.2	0.105	2
1931.25	V	21.4	21.4	0.138	2
1960.00	H	20.1	20.1	0.102	2
1960.00	V	19.5	19.5	0.089	2
1988.75	H	17.6	17.6	0.058	2
1988.75	V	15.4	15.4	0.035	2

5.2.2.2 Test Result- DO RTT

Frequency [MHz]	Pol. [V/H]	Measured LEVEL [dBm]	EIRP [dBm]	EIRP [W]	Limit [W]
1931.25	H	19.0	19.0	0.079	2
1931.25	V	19.6	19.6	0.091	2
1960.00	H	18.7	18.7	0.074	2
1960.00	V	19.5	19.5	0.089	2
1988.75	H	17.1	17.1	0.051	2
1988.75	V	16.7	16.7	0.047	2

5.3 Spurious Emission

5.3.1 Regulation

FCC Part 2.1051

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 per-missible value need not be specified.

FCC Part 2.1057 - Frequency Spectrum to be investigated

The spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

FCC Part 24.238 Limit

The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

- (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.
- (b) *Measurement procedure.* Compliance with these rules 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.* 1 MHz or 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.

5.3.2 Test Result

-complied

5.3.2.1 Test Result- 1X RTT

Field Strength spurious radiation – Low channel

Frequency [MHz]:	1931.25
Channel No.:	25
Measured output power [dBm]:	13.11 dBm
Measured output power [W]:	0.0205
Limit [dBc] = 43+10log ₁₀ (W):	26.11

Worst case mode (SO2 of RC1) for Final test.

Frequency [MHz]	Pol. [V/H]	Maximum LEVEL [dBm]	Level [dBc]	Limit [dBc]
76.817	V	-59.80	-72.91	26.11
368.639	V	-64.90	-78.01	26.11
533.275	H	-61.00	-74.11	26.11
614.405	V	-56.40	-69.51	26.11
737.298	V	-56.60	-69.71	26.11
2425.610	V	-40.10	-53.21	26.11
3702.470	V	-24.10	-37.21	26.11
3862.520	V	-21.60	-34.71	26.11
7725.400	H	-32.70	-45.81	26.11

Field Strength spurious radiation –Mid channel

Frequency [MHz]:	1960.00
Channel No.:	600
Measured output power [dBm]:	12.90 dBm
Measured output power [W]:	0.0195
Limit [dBc] = 43+10log ₁₀ (W):	25.90

Worst case mode (SO2 of RC1) for Final test.

Frequency [MHz]	Pol. [V/H]	Maximum LEVEL [dBm]	Level [dBc]	Limit [dBc]
76.229	V	-58.90	-71.80	25.90
368.623	V	-63.90	-76.80	25.90
533.274	H	-61.00	-73.90	25.90
614.395	V	-56.60	-69.50	25.90
737.280	V	-58.30	-71.20	25.90
2425.000	V	-41.30	-54.20	25.90
3702.585	V	-26.40	-39.30	25.90
3760.030	V	-33.60	-46.50	25.90
3920.315	V	-30.90	-43.80	25.90

Field Strength spurious radiation –High channel

Frequency [MHz]:	1988.75
Channel No.:	1175
Measured output power [dBm]:	12.62 dBm
Measured output power [W]:	0.0183
Limit [dBc] = 43+10log ₁₀ (W):	25.62

Worst case mode (SO2 of RC1) for Final test.

Frequency [MHz]	Pol. [V/H]	Maximum LEVEL [dBm]	Level [dBc]	Limit [dBc]
75.092	V	-58.30	-70.92	25.62
368.652	V	-63.60	-76.22	25.62
533.279	H	-60.90	-73.52	25.62
614.415	V	-56.50	-69.12	25.62
737.269	V	-57.90	-70.52	25.62
2425.320	V	-39.60	-52.22	25.62
3702.455	V	-26.40	-39.02	25.62
3817.550	V	-33.60	-46.22	25.62
3977.340	V	-35.40	-48.02	25.62

5.3.2.1 Test Result- DO RTT

Field Strength spurious radiation – Low channel

Frequency [MHz]:	1931.25
Channel No.:	25
Measured output power [dBm]:	13.75 dBm
Measured output power [W]:	0.0237
Limit [dBc] = 43+10log ₁₀ (W):	26.75

Worst case mode (SO2 of RC1) for Final test.

Frequency [MHz]	Pol. [V/H]	Maximum LEVEL [dBm]	Level [dBc]	Limit [dBc]
76.034	V	-58.70	-72.45	26.75
368.641	V	-63.20	-76.95	26.75
533.279	H	-61.20	-74.95	26.75
614.406	V	-56.50	-70.25	26.75
737.280	V	-58.20	-71.95	26.75
3702.480	V	-26.40	-40.15	26.75
3862.615	V	-23.90	-37.65	26.75
4681.840	V	-43.20	-56.95	26.75

- Field Strength spurious radiation – Mid channel

Frequency [MHz]:	1960.00
Channel No.:	600
Measured output power [dBm]:	13.88 dBm
Measured output power [W]:	0.0244
Limit [dBc] = 43+10log ₁₀ (W):	26.88

- Worst case mode (SO2 of RC1) for Final test.

Frequency [MHz]	Pol. [V/H]	Maximum LEVEL [dBm]	Level [dBc]	Limit [dBc]
76.847	V	-58.70	-72.58	26.88
368.655	V	-63.50	-77.38	26.88
533.266	H	-61.60	-75.48	26.88
614.402	V	-56.30	-70.18	26.88
737.287	V	-58.10	-71.98	26.88
2424.290	V	-30.70	-44.58	26.88
3124.180	H	-35.50	-49.38	26.88
3760.060	V	-25.10	-38.98	26.88
4684.150	H	-40.70	-54.58	26.88

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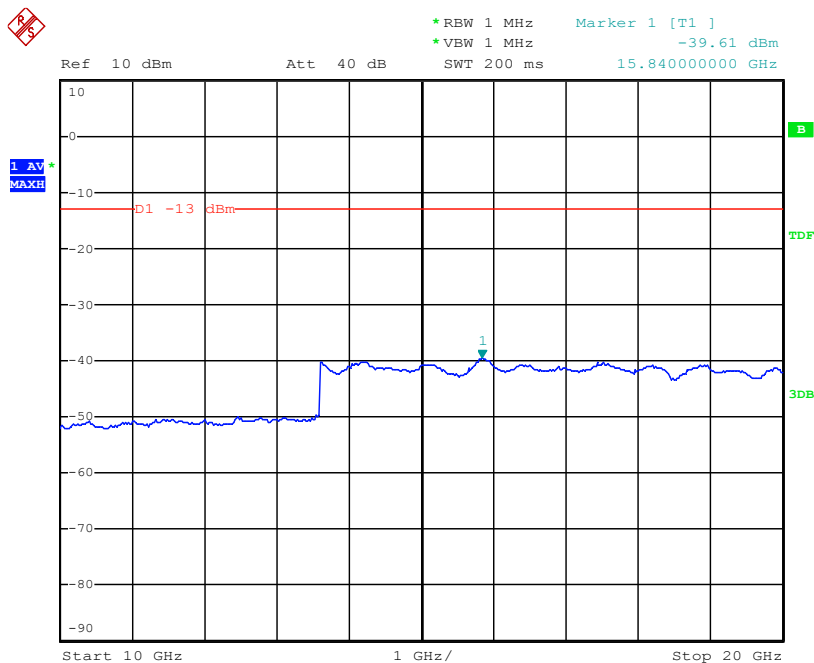
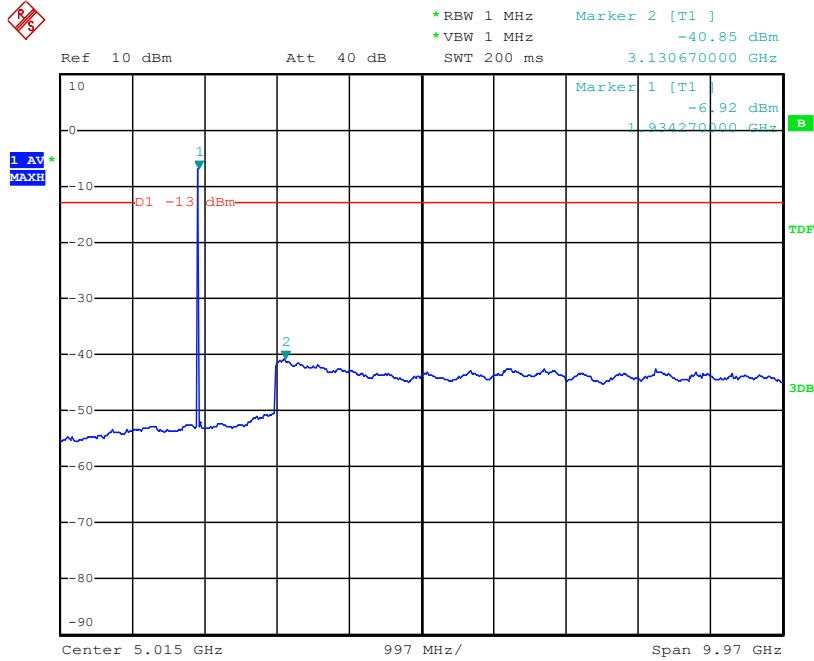
- Field Strength spurious radiation –High channel

Frequency [MHz]:	1988.75
Channel No.:	1175
Measured output power [dBm]:	12.09 dBm
Measured output power [W]:	0.0162
Limit [dBc] = 43+10log ₁₀ (W):	25.09

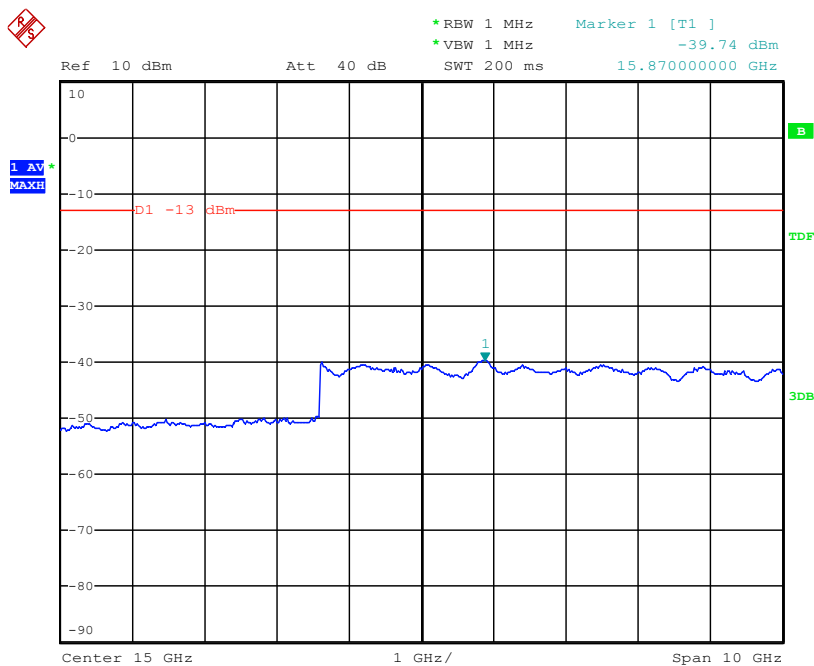
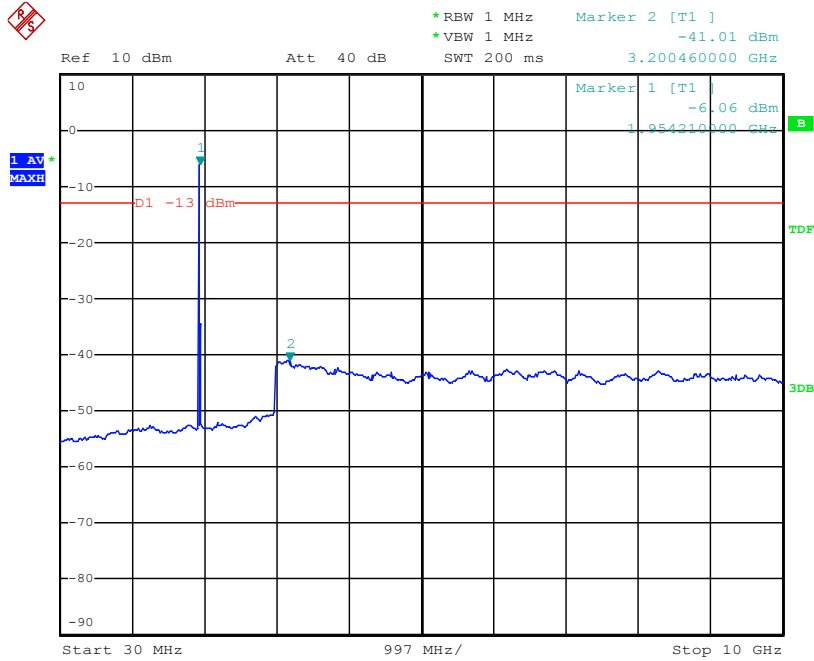
- Worst mode (SO2 of RC1) for Final test.

Frequency [MHz]	Pol. [V/H]	Maximum LEVEL [dBm]	Level [dBc]	Limit [dBc]
76.034	V	-58.70	-70.79	25.09
368.641	V	-63.20	-75.29	25.09
533.279	H	-61.20	-73.29	25.09
614.406	V	-56.50	-68.59	25.09
737.280	V	-58.20	-70.29	25.09
3124.030	H	-35.40	-47.49	25.09
3817.470	V	-21.40	-33.49	25.09
3977.390	V	-32.00	-44.09	25.09
4685.575	H	-34.60	-46.69	25.09

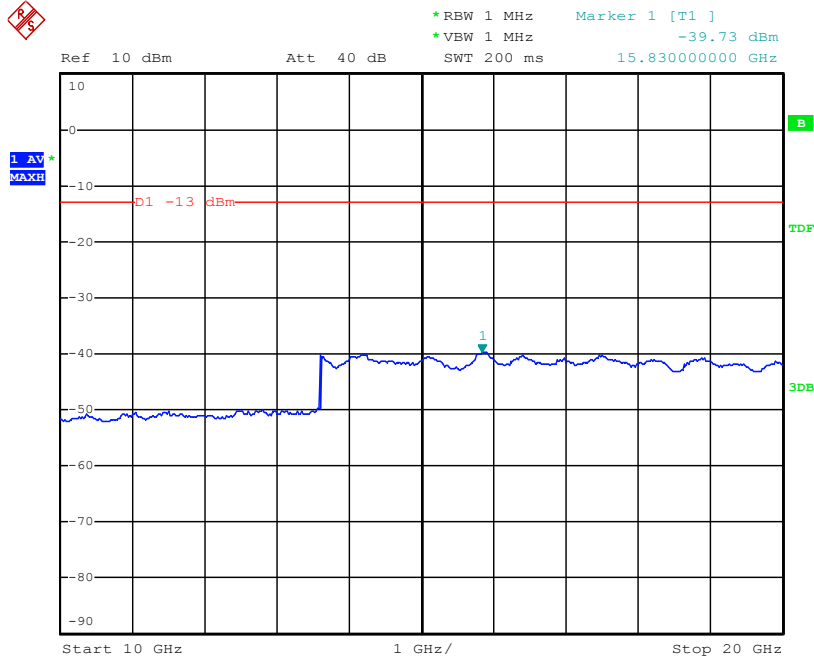
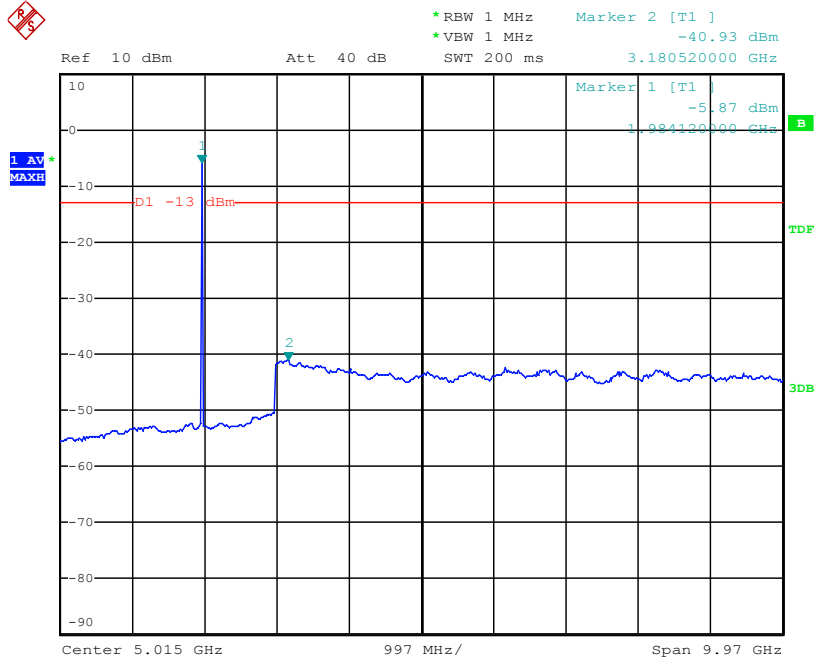
5.3.2.3 Conducted Spurious Test Result- 1X RTT
- Conducted Spurious ch .25



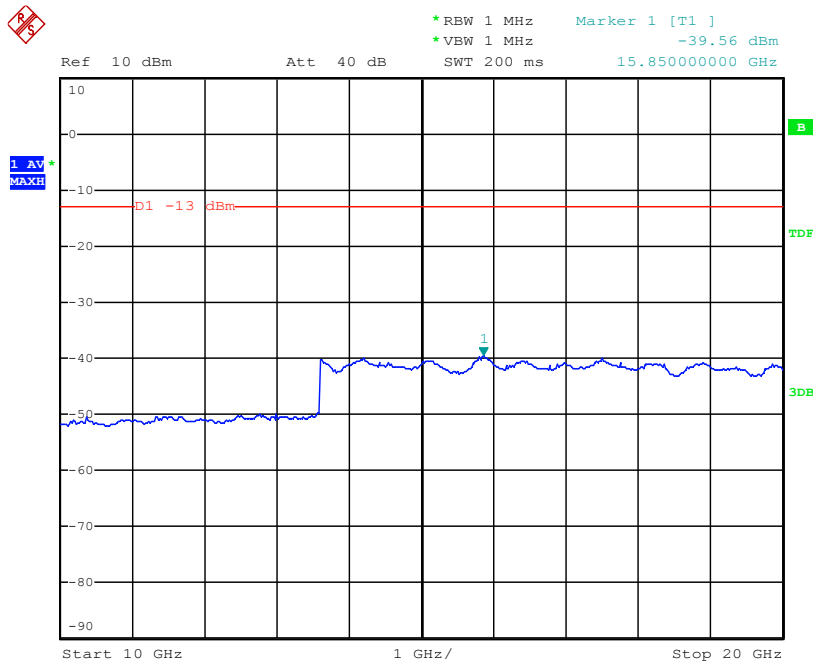
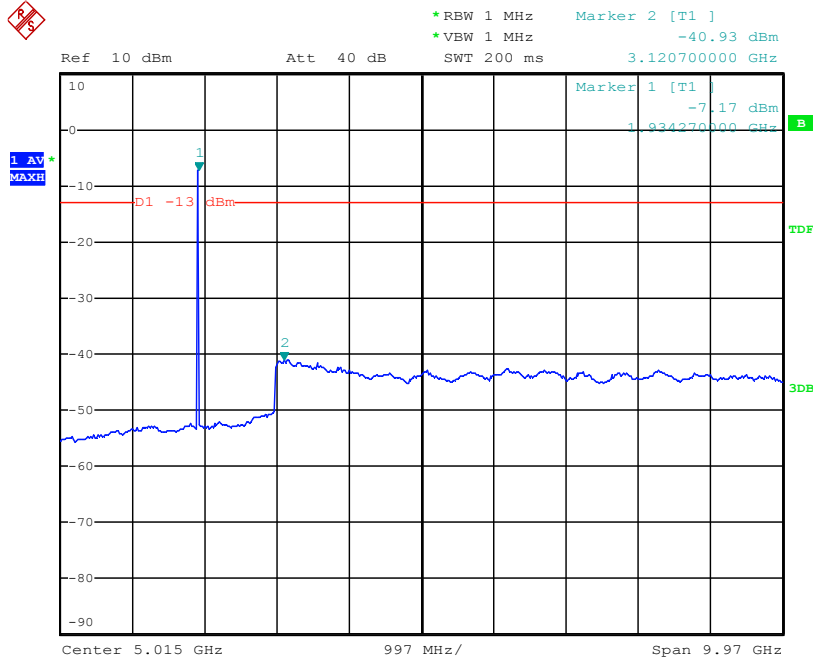
- Conducted Spurious ch .600



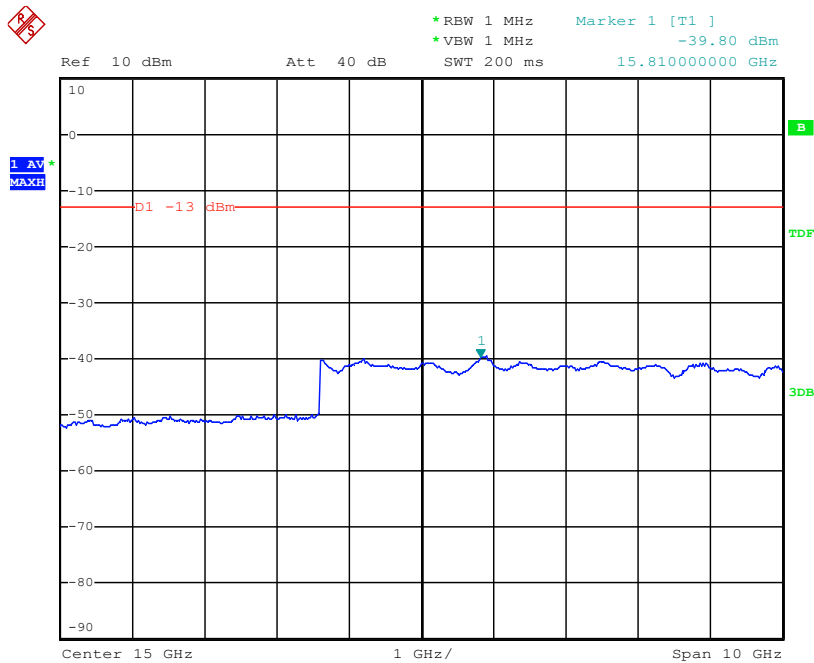
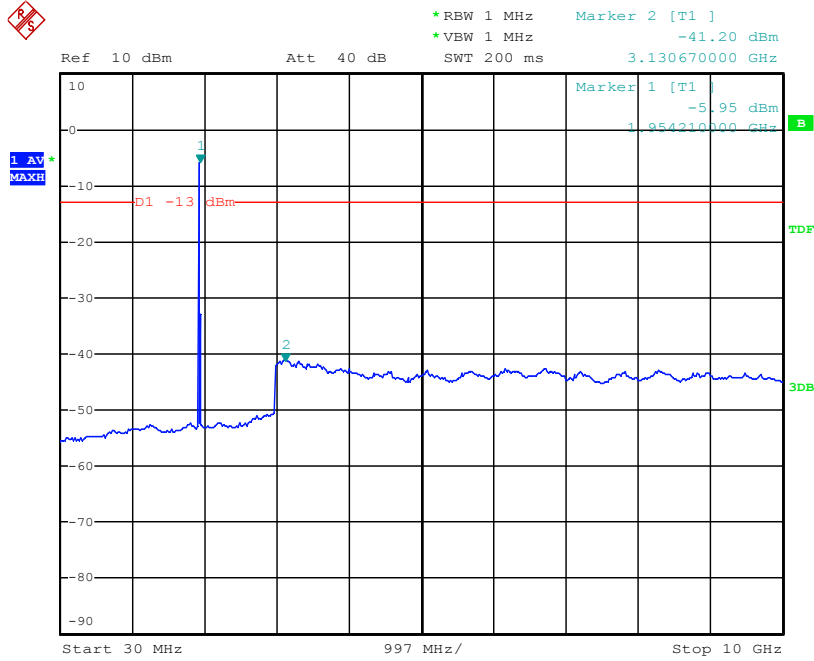
- Conducted Spurious ch .1175



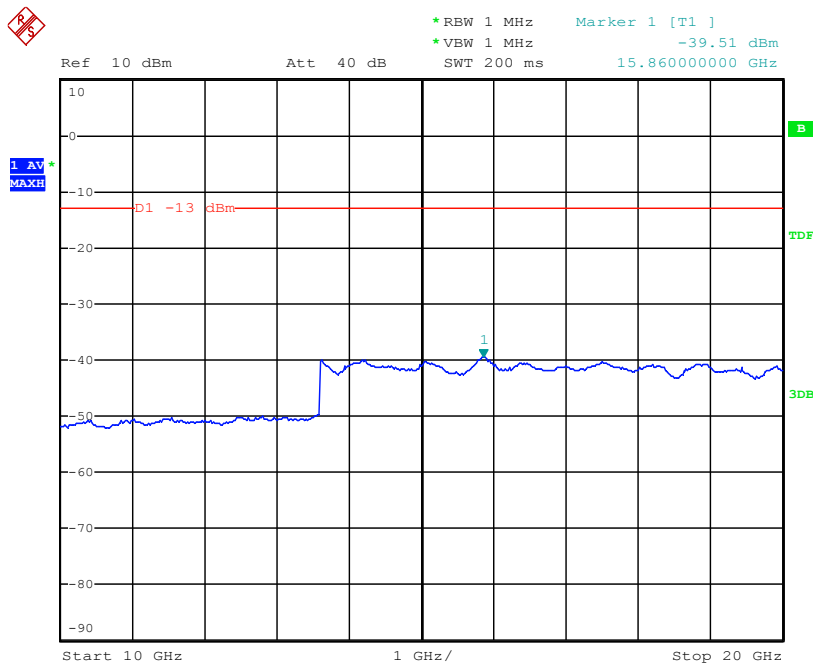
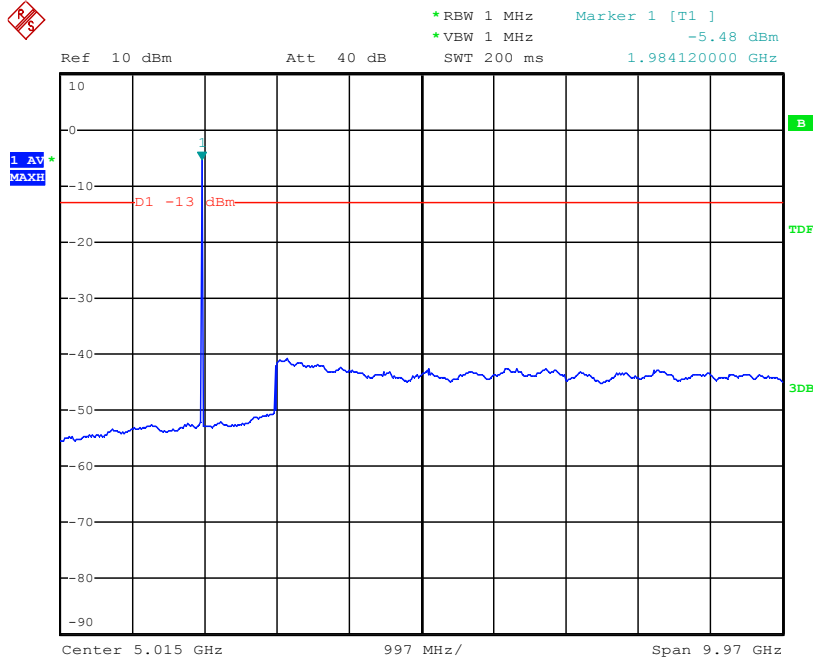
5.3.2.4 Conducted Spurious Test Result- DO RTT
- Conducted Spurious ch .25



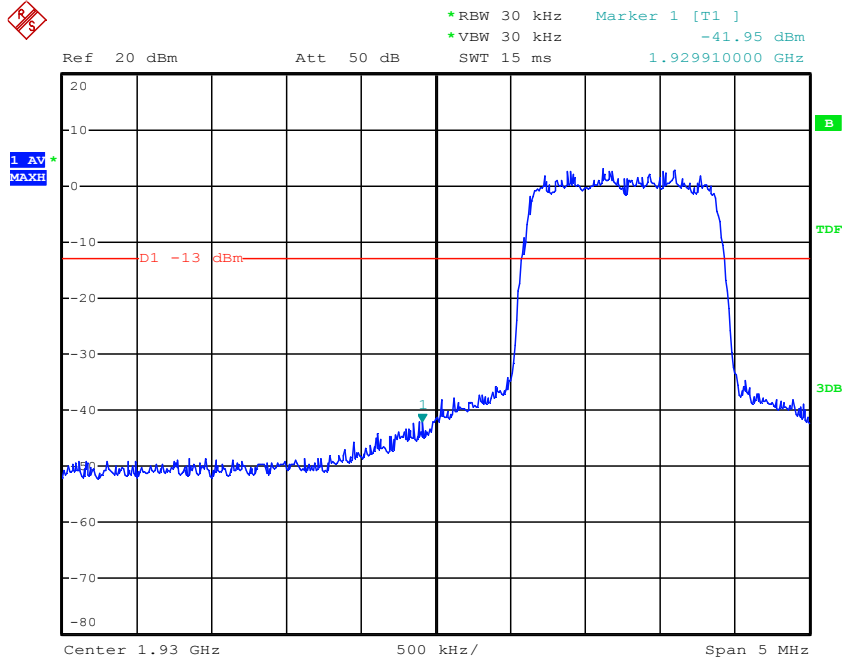
5.3.2.4 Conducted Spurious Test Result- DO RTT
- Conducted Spurious ch .600



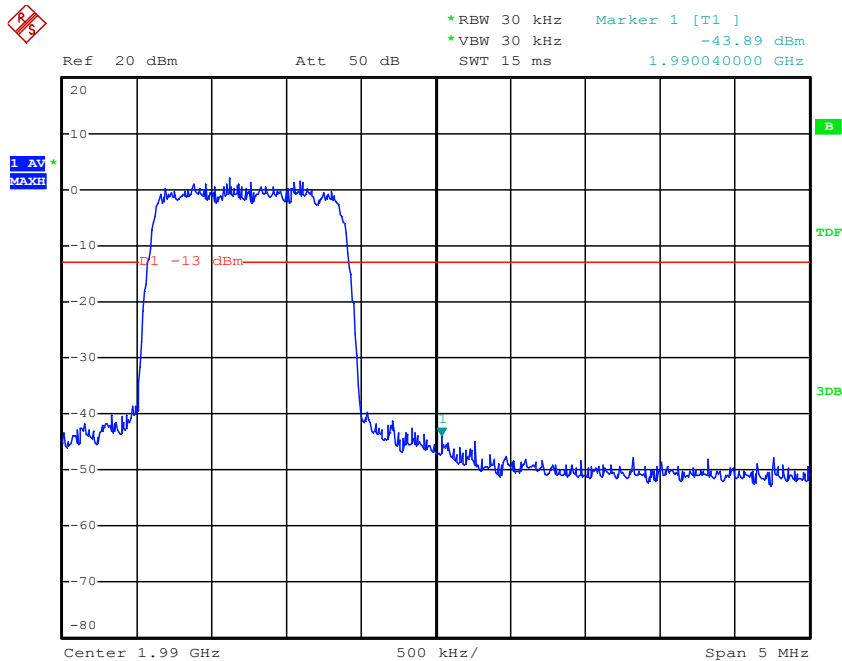
5.3.2.4 Conducted Spurious Test Result- DO RTT
- Conducted Spurious ch .1175



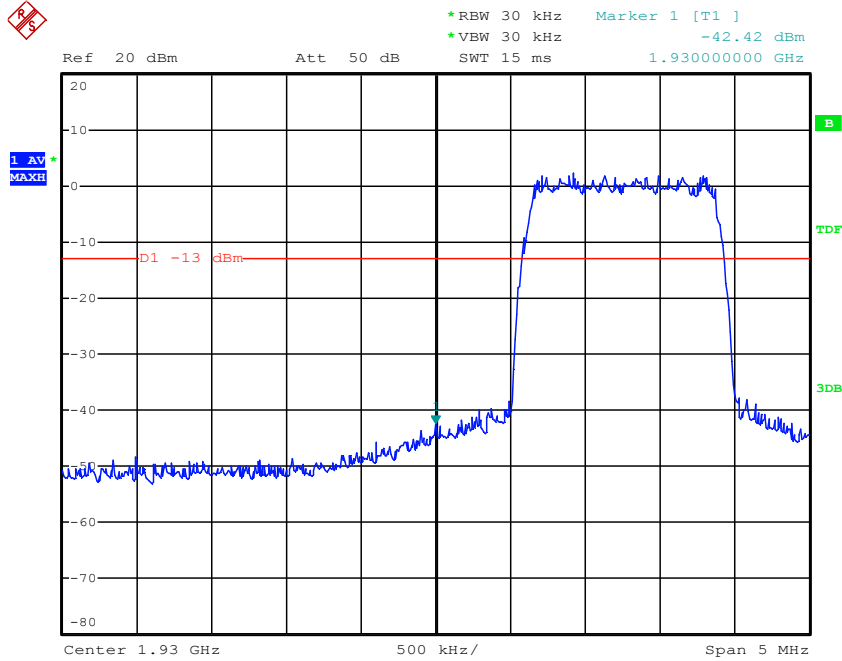
5.3.2.5 Bandedge Test Result-1X RTT
- Bandedge ch .25



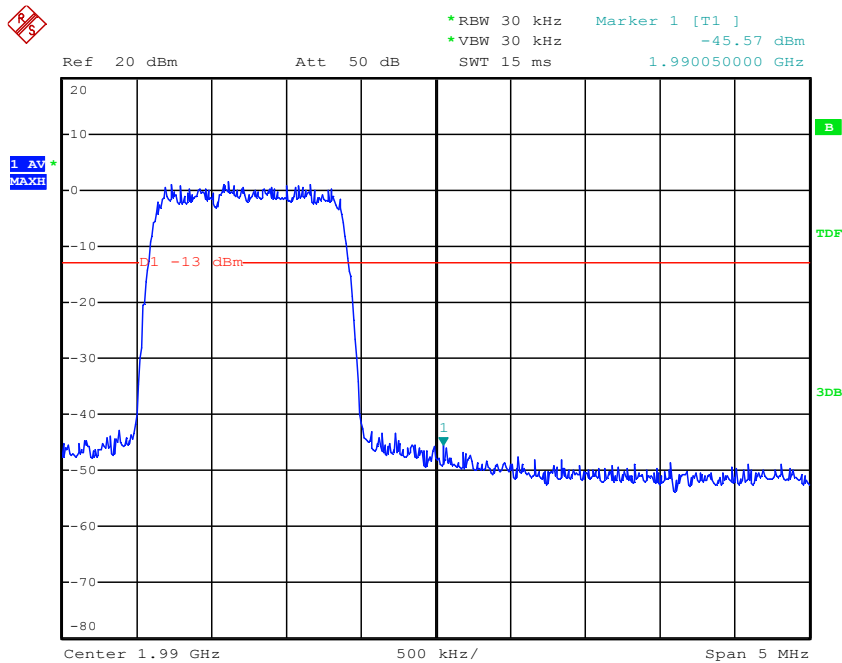
- Bandedge ch .1175



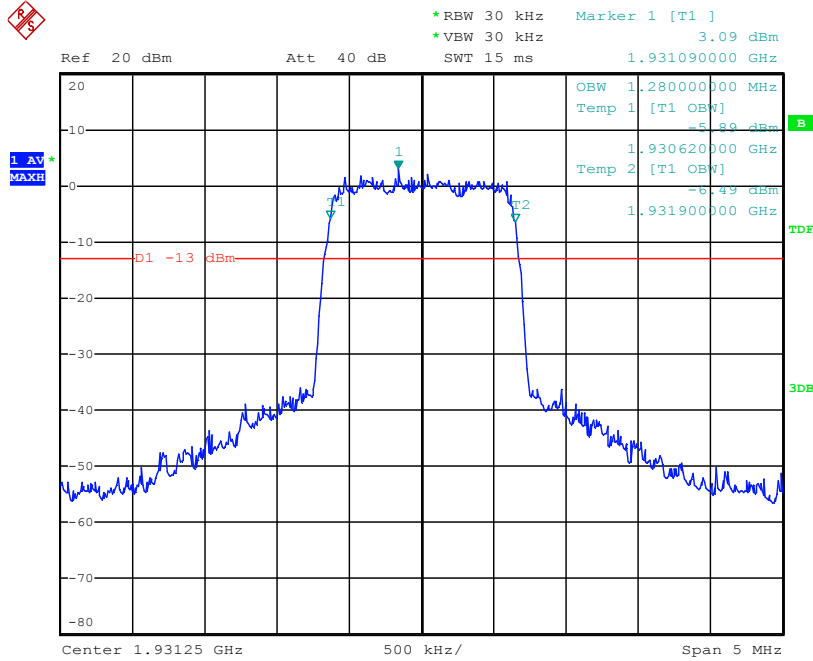
5.3.2.6 Bandedge Test Result- DO RTT
- Bandedge ch .25



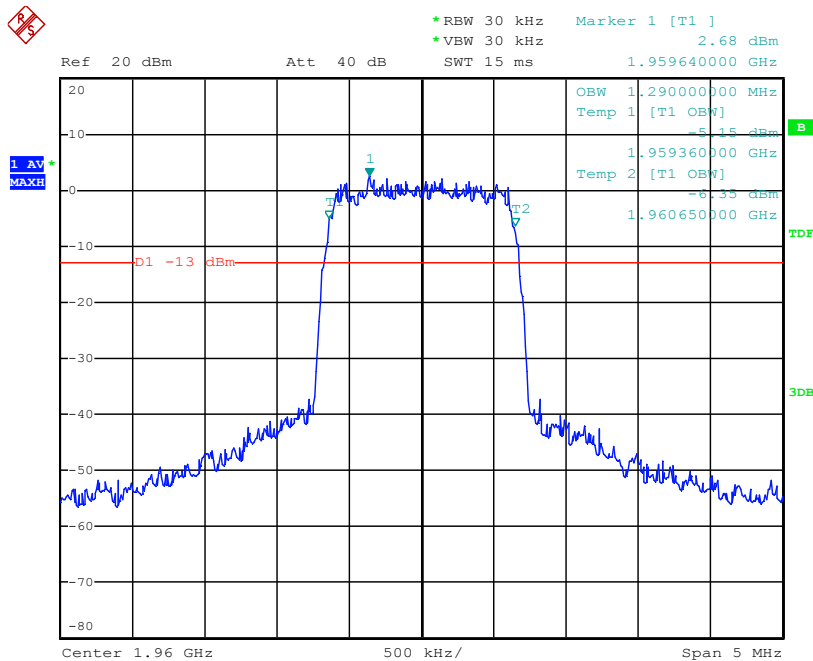
- Bandedge ch .1175



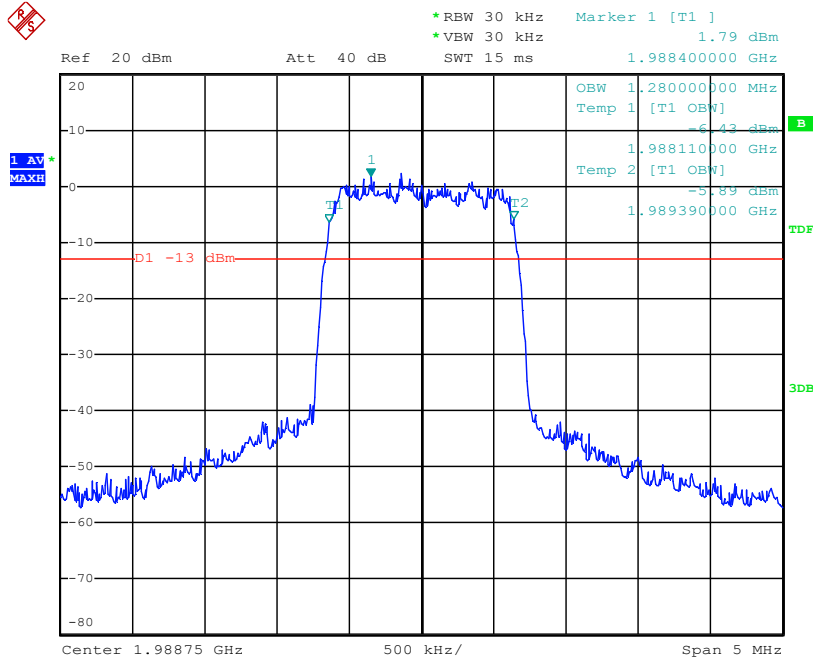
**5.3.2.6 Occupied bandwidth Test Result- 1X RTT
 - OBW ch .25**



- OBW ch .600

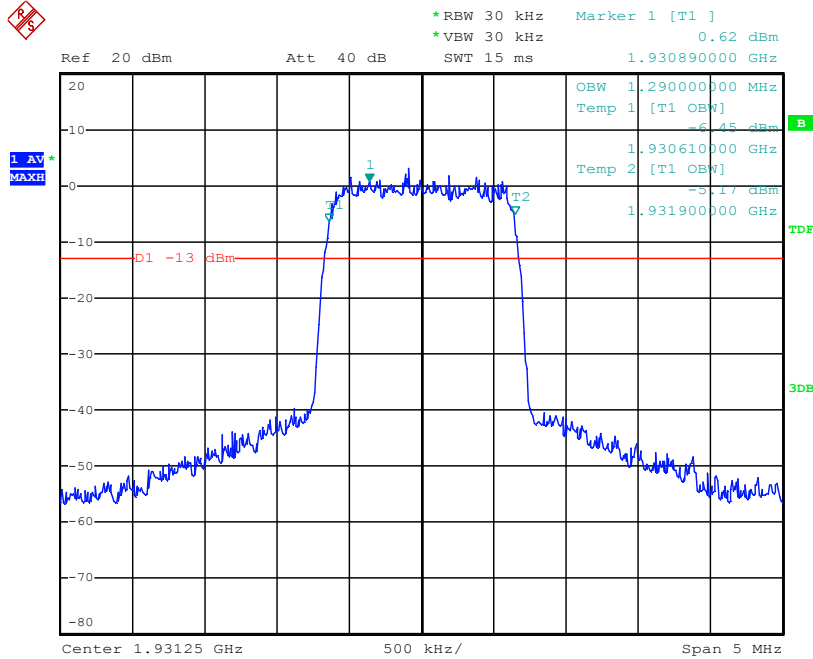


- OBW ch .1175

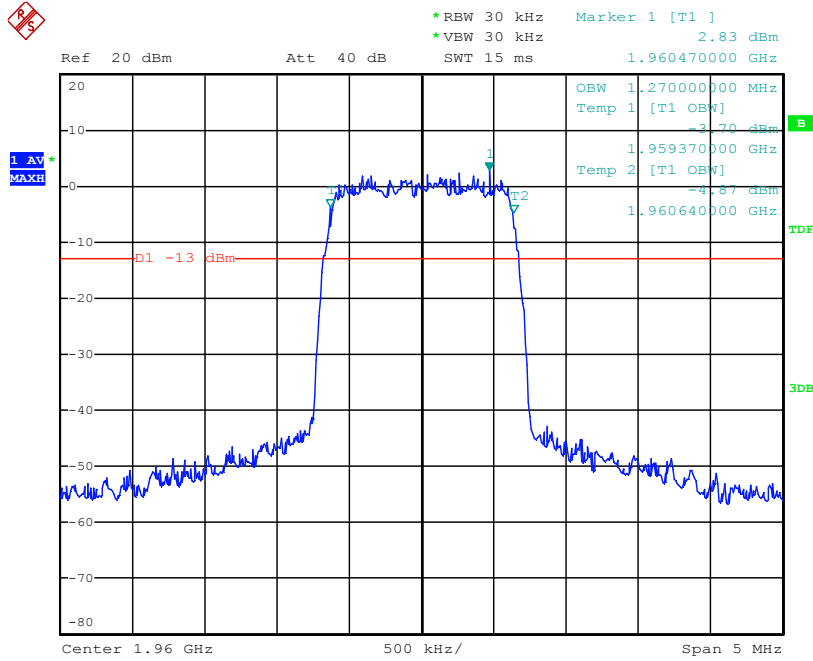


5.3.2.7 Occupied bandwidth Test Result- DO RTT

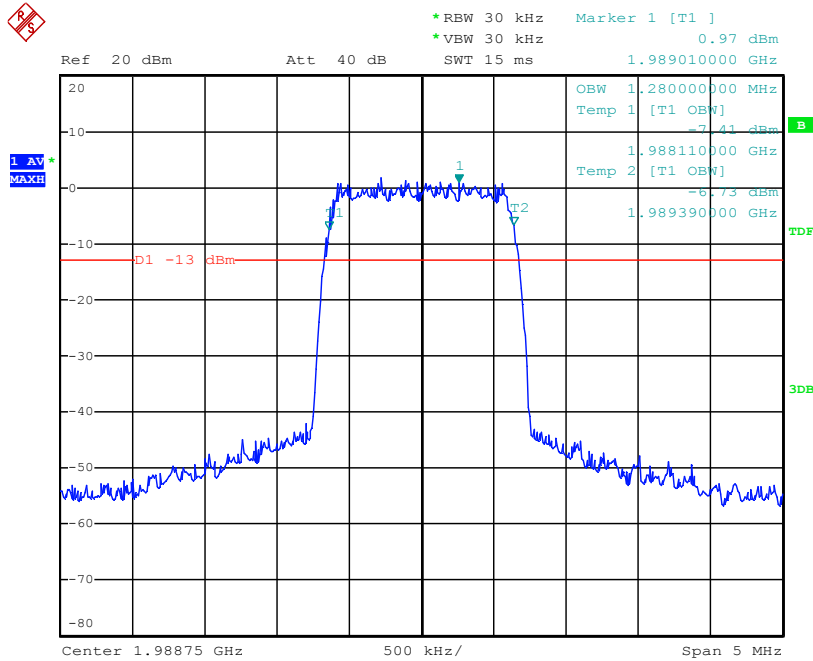
- OBW ch .25



- OBW ch .600



- OBW ch .1175



5.4 Frequency Stability

5.4.1 Regulation

FCC Part 2.1055

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From -30 to +50 centigrade for all equipment except that specified in subpara-graphs (2) and (3) of this paragraph.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10 centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown. (e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c) and (d) of this section. (For example, measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment.)

FCC Part 24.235 Limit

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

5.4.2 Test Result

-complied

5.4.2.1 Test Result- 1X RTT

Frequency [MHz]:	1960.00
Channel No.:	600
Test Mode:	1X RTT
Reference Voltage [VAC]	110
Limit [ppm]	2.5

Voltage(%)	Power(V)	Temp	Frequency	Deviation(%)	Deviation(ppm)	Limit(ppm)
100	110	25(REF)	1959998193	0.000000	0.00	2.5
100		-30	1959996220	-0.000101	-1.01	2.5
100		-20	1959996551	-0.000084	-0.84	2.5
100		-10	1959997012	-0.000060	-0.60	2.5
100		0	1959997523	-0.000034	-0.34	2.5
100		10	1959997840	-0.000018	-0.18	2.5
100		20	1959997988	-0.000010	-0.10	2.5
100		25	1959998201	0.000000	0.00	2.5
100		30	1959998447	0.000013	0.13	2.5
100		40	1959998870	0.000035	0.35	2.5
100		50	1959999035	0.000043	0.43	2.5
100		60	1959999308	0.000057	0.57	2.5
85	93.5	25	1959998245	0.000003	0.03	2.5
115	126.5	25	1959998226	0.000002	0.02	2.5

5.4.2.2 Test Result- DO RTT

Frequency [MHz]:	1960.00
Channel No.:	600
Test Mode:	1X RTT
Reference Voltage [VAC]	110
Limit [ppm]	2.5

Voltage(%)	Power(V)	Temp	Frequency	Deviation(%)	Deviation(ppm)	Limit(ppm)
100	110	25(REF)	1959998196	0.000000	0.00	2.5
100		-30	1959996225	-0.000101	-1.01	2.5
100		-20	1959996608	-0.000081	-0.81	2.5
100		-10	1959997022	-0.000060	-0.60	2.5
100		0	1959997538	-0.000034	-0.34	2.5
100		10	1959997846	-0.000018	-0.18	2.5
100		20	1959997988	-0.000011	-0.11	2.5
100		25	1959998201	0.000000	0.00	2.5
100		30	1959998456	0.000013	0.13	2.5
100		40	1959998905	0.000036	0.36	2.5
100		50	1959999046	0.000043	0.43	2.5
100		60	1959999318	0.000057	0.57	2.5
85		93.5	25	1959998256	0.000003	0.03
115	126.5	25	1959998235	0.000002	0.02	2.5

6. Test equipment used for test

	Description	Manufacture	Model No.	Serial No.	Next Cal Date.
<input type="checkbox"/>	Temp & humidity chamber	taekwang	TK-04	TK001	11.12.10
<input checked="" type="checkbox"/>	Temp & humidity chamber	taekwang	TK-500	TK002	12.09.05
<input type="checkbox"/>	Power Meter	Agilent	E4416A	GB41292365	12.10.26
<input checked="" type="checkbox"/>	Frequency Counter	HP	53150A	US39250565	12.09.07
<input checked="" type="checkbox"/>	Spectrum Analyzer	Agilent	E4407B	US39010142	12.10.26
<input checked="" type="checkbox"/>	Spectrum Analyzer	R & S	FSP40	100209	12.10.26
<input checked="" type="checkbox"/>	Signal Generator	HP	E4432B	GB39340611	12.10.26
<input type="checkbox"/>	Modulation Analyzer	HP	8901B	3538A05527	12.10.26
<input type="checkbox"/>	Audio Analyzer	HP	8903B	3729A19213	12.01.11
<input checked="" type="checkbox"/>	AC Power Supply	KIKUSUI	PCR2000W	GB001619	12.10.25
<input type="checkbox"/>	DC Power Supply	Tektronix	PS2520G	TW50517	12.02.18
<input checked="" type="checkbox"/>	DC Power Supply	Tektronix	PS2521G	TW53135	12.10.25
<input type="checkbox"/>	Dummy Load	BIRD	8141	7560	12.09.16
<input type="checkbox"/>	Dummy Load	BIRD	8401-025	799	12.09.16
<input checked="" type="checkbox"/>	EMI Test Receiver	R&S	ESCI	100001	12.07.11
<input type="checkbox"/>	Attenuator	HP	8494A	2631A09825	12.10.26
<input type="checkbox"/>	Attenuator	HP	8496A	3308A16640	12.10.26
<input type="checkbox"/>	Attenuator	R&S	RBS1000	D67079	12.10.26
<input type="checkbox"/>	Power sensor	Agilent	E9325A	US40420186	12.10.26
<input type="checkbox"/>	LOOP Antenna	EMCO	EMCO6502	9205-2745	13.05.23
<input checked="" type="checkbox"/>	BILOG Antenna	Schwarzbeck	VULB 9168	375	11.11.30
<input checked="" type="checkbox"/>	BILOG Antenna	Schwarzbeck	VULB 9168	375	11.11.30
<input checked="" type="checkbox"/>	HORN Antenna	ETS	3115	00062589	11.12.22
<input checked="" type="checkbox"/>	HORN Antenna	ETS	31	00062589	11.12.22
<input checked="" type="checkbox"/>	HORN Antenna	ETS	3116	00086632	11.12.17
<input checked="" type="checkbox"/>	HORN Antenna	ETS	3116	00086632	11.12.17
<input checked="" type="checkbox"/>	Signal Generator	HP	E4432B	GB39340611	12.10.26
<input type="checkbox"/>	Power Divider	Weinschel	1580-1	NX375	12.10.26
<input type="checkbox"/>	Power Divider	Weinschel	1580-1	NX380	12.09.14
<input type="checkbox"/>	Power Divider	Weinschel	1594	671	12.09.14
<input type="checkbox"/>	Test Receiver	R&S	ESHS30	844827/011	12.08.16
<input type="checkbox"/>	LISN	R&S	ESH3-Z5	846125/024	12.08.04
<input type="checkbox"/>	LISN	PMM	L3-32	0120J20305	-