SK TECH CO., LTD.

Certificate of Compliance

Test Report No.:	SKTTRT-071019-026		
KOLAS NO.:	KT191		
Applicant:	S&T Daewoo Co., Ltd.		
Applicant Address:	5, Songjeong-ri, Cholma-myon,Kijang-gun, Busan, Korea		
Manufacturer:	S&T Daewoo Co., Ltd.		
Manufacturer Address:	5, Songjeong-ri, Cholma-myon,Kijang-gun, Busan, Korea		
Device Under Test:	**Control unit A-RKE & ATAS**		
FCC ID: **IC:**	**VQQ-RK960NAT** **7313A-RK960NAT**	**Model No.:**	RK960NAT
Receipt No.:	SKTEU07-0966	**Date of receipt:**	September 20, 2007
Date of Issue:	October 19, 2007		
Location of Testing:	**SK TECH CO., LTD.** 820-2, Wolmoon-Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea		
Test Procedure:	ANSI C63.4 / 2003		
Test Specification:	FCC Part 15 Rules, RSS-210 Issue 7		
Equipment Class: **IC Equipment Category:**	DSC - Part 15 Security/Remote Control Transmitter RSS-210 Issue 7: Category I Equipment, Annex 1		
Test Result:	The above-mentioned device has been tested and passed.		

Tested & Reported by: *Seong-Baek, Ko*

2007. 10. 19

Signature *Date*

Approved by: *Jong-Soo, Yoon*

2007. 10. 19

Signature *Date*

Other Aspects:	
Abbreviations:	**· OK, Pass = passed · Fail = failed · N/A = not applicable**

☞
- **The above test certificate is the accredited test results by Korea Laboratory Accreditation Scheme, which signed the ILAC-MRA.**
- **This test report is not permitted to copy partly without our permission.**
- **This test result is dependent on only equipment to be used.**
- **This test result is based on a single evaluation of one sample of the above mentioned.**
- **We certify that this test report has been based on the measurement standards that is traceable to the national or International standards.**

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1. GENERAL

These tests were performed using the test procedure outlined in ANSI C63.4, 2003 for intentional radiators, and in accordance with the limits set forth in FCC Part 15.231 for periodic transmitter.
The EUT (Equipment Under Test) has been shown to be capable of compliance with the applicable technical standards.

We attest to the accuracy of data. All measurements reported herein were performed by SK TECH CO., LTD. and were made under Chief Engineer's supervision.
We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

2. TEST SITE

SK TECH CO., LTD.

2.1 Location

820-2, Wolmoon-Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea
(FCC Registered Test Site Number: 90752)

This test site is in compliance with ISO/IEC 17025 for general requirements for the competence of testing and calibration laboratories.
This laboratory is recognized as a Conformity Assessment Body(CAB) for CAB's Designation Number: **KR0007** by FCC, is accredited by NVLAP for NVLAP Lab. Code: **200220-0**, DATech for DAR-Registration No.: **DAT-P-076/97-01** and KOLAS for Accreditation No. : **KT191**.

2.2 List of Test and Measurement Instruments

No.	Description	Manufacturer	Model #	Serial #	Calibrated until	Used
1	Spectrum Analyzer	Agilent	E4405B	US40520856	2008.07.23	☐
2	EMC Spectrum Analyzer	Agilent	E7405A	US40240203	2008.02.02	☒
3	EMI Test Receiver	Rohde&Schwarz	ESIB40	100277	2008.07.23	☒
4	EMI Test Receiver	Rohde&Schwarz	ESVS10	825120/008	2008.07.24	☐
5	EMI Test Receiver	Rohde&Schwarz	ESHS10	862970/019	2008.07.24	☐
6	Artificial Mains Network	Rohde&Schwarz	ESH2-Z5	834549/011	2008.07.25	☐
7	Pre-amplifier	HP	8447F	3113A05153	2008.02.23	☒
8	Pre-amplifier	MITEQ	AFS44	1116321	2008.03.07	☒
9	Pre-amplifier	MITEQ	AFS44	1116322	2008.02.06	☐
10	Power Meter	Agilent	E4417A	MY45100426	2008.07.24	☐
11	Power Sensor	Agilent	E9327A	MY44420696	2008.07.24	☐
12	Attenuator (10dB)	HP	8491B	38067	2008.07.25	☒
13	Oscilloscope	Agilent	54820A	US40240160	2008.03.06	☐
14	Diode detector	Agilent	8473C	1882A03173	2008.02.06	☐
15	High Pass Filter	Wainwright	WHKX3.0/18G	8	2008.07.25	☐
16	VHF Precision Dipole Antenna (TX/RX)	Schwarzbeck	VHAP	1014 / 1015	2007.11.27	☐
17	UHF Precision Dipole Antenna (TX/RX)	Schwarzbeck	UHAP	989 / 990	2007.11.27	☐
18	Loop Antenna	Schwarzbeck	HFH2-Z2	863048/019	2007.12.01	☐
19	TRILOG Broadband Antenna	Schwarzbeck	VULB9160	3141	2008.05.29	☒
20	Horn Antenna	AH Systems	SAS-200/571	304	N/A	☐
21	Horn Antenna	EMCO	3115	00040723	2008.03.15	☒
22	Horn Antenna	EMCO	3115	00056768	2008.07.24	☐
23	Vector Signal Generator	Agilent	E4438C	MY42080359	2008.07.25	☐
24	PSG analog signal generator	Agilent	E8257D-520	MY45141255	2008.07.25	☐
25	DC Power Supply	HP	6622A	3448A03950	2008.07.23	☐
26	DC Power Supply	HP	6268B	2542A-07856	2008.07.23	☐
27	Digital Multimeter	HP	HP3458A	2328A14389	2008.03.07	☐
28	PCS Interface	HP	83236B	3711J00881	2008.03.09	☐
29	CDMA Mobile Test Set	HP	8924C	US35360253	2008.03.09	☐
30	Hygro/Thermo Graph	SATO	PC-5000TRH-II	-	2008.04.09	☒
31	Temperature/Humidity Chamber	All Three	ATM-50M	20030425	2008.03.06	☐
32	Temperature/Humidity Chamber	DAEJIN	DJ-THC02	06071	2008.03.07	☐

2.3 Test Date

Date of Application: September 20, 2007

Date of Test: October 15, 2007 ~ October 18, 2007

2.4 Test Environment

See each test item's description.

3. DESCRIPTION OF THE EQUIPMENT UNDER TEST

The EUT is a small remote transmitter that has three buttons intended to transmit control signals to the receiver in vehicles. The EUT is manually operated and deactivated automatically within five seconds after transmitting the appropriate control code.

3.1 Rating and Physical Characteristics

	Remote Keyless Entry System	
	Transmitter	Receiver [*1]
Model Name	RK960NAT	RK960NAR
Type	NTP: Non Transponder [*2]	-
	WTP: With Transponder [*2]	-
	-	HB: Hatch Back
	-	NB: Notch Back
Power Source	DC 3 V, Lithium battery	DC 12 V from the vehicle
Consumption current	standby: Max. 1 uA operating: Max. 10 mA	standby: Max. 5 mA
Local Oscillator	9.84375 MHz	10.17813 MHz
Operating frequency	315 MHz	
Type of modulation	FSK	-
Output power	Under 75 dBuV/m(@ 3 m)	-
Antenna	PCB Pattern Antenna	Internal Herical antenna
Sensitivity	-	- 100 dBm(Min.)

[*1]: The test report for the receiver should be separately issued with FCC ID: VQQ-RK960NAR, IC: 7313A-RK960NAR.
[*2]: The type of transmitter is identical to the electrical character. So the compliance test was performed about the type of WTP only.

3.2 Equipment Modifications

None.

3.3 Submitted Documents

Block diagram

Schematic diagram

Part List

User manual

4. MEASUREMENT CONDITIONS

4.1 Description of test configuration

The EUT was tested in a typical fashion. During preliminary emission tests, all transmitter codes were investigated to find worst-case emission mode. Pressing the "UNLOCK" button was found to be the worst-case emission mode. Therefore, final qualification testing was completed with EUT activated with the "UNLOCK" button.

4.2 List of Peripherals

Equipment Type	Manufacture	Model	Cable Description
-	-	-	-

The EUT was tested as stand alone equipment.

4.3 Type of Used Cables

Equipment Type	Manufacture	Model	Cable Description
-	-	-	-

4.4 Uncertainty

Measurement Item	Combined Standard Uncertainty Uc	Expanded Uncertainty U = KUc (K = 2)
Radiated disturbance	± 2.30 dB	±4.60 dB
Conducted disturbance	± 1.47 dB	±2.94 dB

5. TEST AND MEASUREMENTS

Summary of Test Results

Requirement	CFR Section	RSS Standards	Report Section	Test Result
Antenna Requirement	15.203	RSS-Gen, 7.1.4	5.1	PASS
Periodic Operation Characteristics	15.231(a)	RSS-210, A1.1.1	5.2	PASS
Radiated Emission - Field Strength	15.231(b), 15.209(a)	RSS-210, A1.1.2 RSS-210, 2.6	5.3	PASS
Occupied Bandwidth	15.231(c)	RSS-210, A1.1.3	5.4	PASS
Frequency Stability (devices operating at 40.66 MHz – 40.70 MHz)	15.231(d)	RSS-210, A1.1.4	N/A	N/A*
Reduced Field Strength Operation	15.231(e)	RSS-210, A1.1.5	N/A	N/A*
Receiver Spurious Emissions	15.109(a)	RSS-Gen, 7.2.3	N/A	N/A*
Conducted Emission	15.207(a)	RSS-Gen, 7.2.2	N/A	N/A**

* Not required, the EUT is the transmitter for RKE System.

** Not required, the EUT is only battery powered.

5.1 ANTENNA REQUIREMENT

5.1.1 Regulation

FCC 47 CFR section 15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of Part 15C. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31 (d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

RSS-Gen, Issue 2 – 7.1.4

A transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest-gain antenna of each combination of transmitter and antenna type for which certification is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type and having equal or lesser gain as an antenna that had been successfully tested for certification with the transmitter, will also be considered certified with the transmitter, and may be used and marketed with the transmitter. The manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. Any antenna gain in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power before using the power limits specified in RSS-210 or RSS-310 for devices of RF output powers of 10 milliwatts or less. For devices of output powers greater than 10 milliwatts, except devices subject to RSS-210 Annex 8 (Frequency Hopping and Digital Modulation Systems Operating in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz Bands) or RSS-210 Annex 9 (Local Area Network Devices), the total antenna gain shall be added to the measured RF output power before using the specified power limits. For devices subject to RSS-210 Annex 8 or Annex 9, the antenna gain shall not be added.

5.1.2 Result: PASS

The EUT has an integral PCB Pattern antenna and meets the requirements of this section.

5.2 PERIODIC OPERATION CHARACTERISTICS

5.2.1 Regulation

FCC 47 CFR section 15.231(a)

(a) The provisions of this Section are restricted to periodic operation within the band 40.66 -40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this Section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal.

The following conditions shall be met to comply with the provisions for this periodic operation:

(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

(4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.

(5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmission are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

RSS-210, Issue 7 – Annex A1.1.1 Type of Momentary Signals

The frequency bands and field strength limits in Tables 4 and 5 are only for the transmission of a control signal such as that used with alarm systems, door openers, remote switches, etc. Radio control of toys or model aircraft, and continuous transmissions, such as voice or video are not permitted except as provided in A1.1.5. Data is permitted to be sent with a control signal.

The following conditions shall be met to comply with the provisions for momentary operation:

(1) A manually operated transmitter shall employ a push-to-operate switch and be under manual control at all transmission times. When released, the transmitter shall cease transmission (holdover time of up to 5 seconds is permitted).

(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation, (i.e. maximum 5 seconds of operation).

(3) Periodic transmissions at regular predetermined intervals are not permitted, except as provided in A.1.1.5. However, polling or supervision transmissions, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmission does not exceed 2 seconds per hour for each transmitter.

(4) Intentional radiators employed for radio control purposes during emergencies involving fire, security of goods (e.g. burglar alarms), and safety-of-life, when activated to signal an alarm, may operate during the interval of the alarm condition.

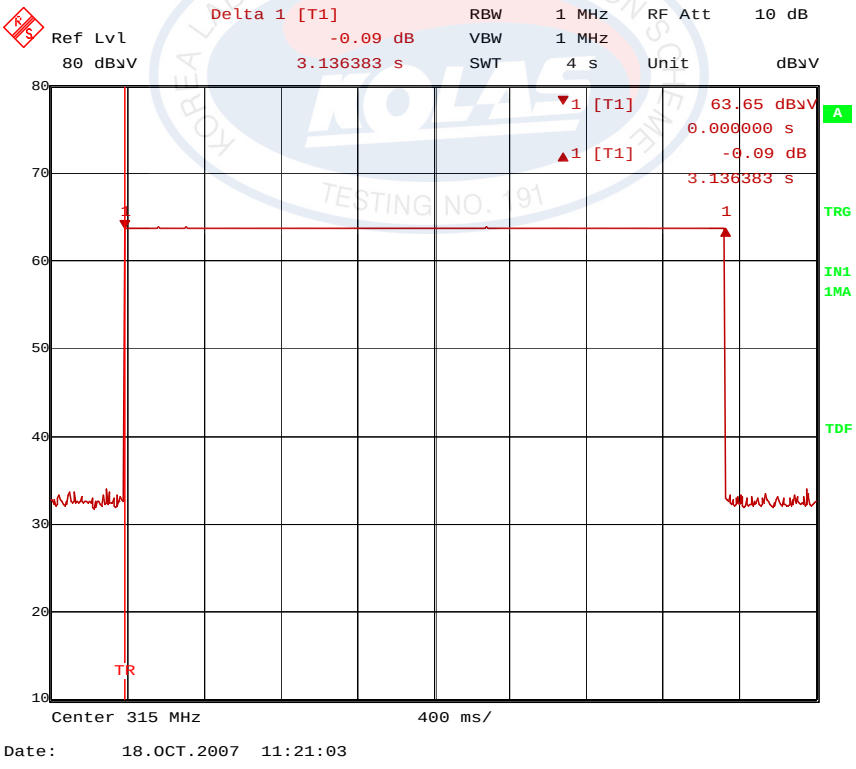
5.2.2 Test Results: **PASS**

The EUT is intended to transmit activation code, LOCK/UNLOCK the door and TRUNK open(for receiver type NB) or PANIC for blinking Horn and Hazard lamp(for receiver type HB), to the receiver in the vehicles. The EUT is manually operated and deactivated automatically after transmitting the pre-programmed activation code.

The result of the transmission duration is shown in Figure 1.

The worst-case transmission duration is **3.14 sec** when "UNLOCK" button is pressed.

Figure 1: Measured value of the transmission duration



5.3 RADIATED EMISSIONS

5.3.1 Regulation

FCC 47 CFR section 15.231(b)

In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (uV/m @ 3m)	Field strength of Spurious Emissions (uV/m @ 3m)
40.66 ~ 40.70	2250	225
70 ~ 130	1250	125
130 ~ 174	1250 to 3750 **	125 to 375 **
174 ~ 260	3750	375
260 ~ 470	3750 to 12500**	375 to 1250**
Above 470	12500	1250

** Linear interpolations

(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(2) Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in Section 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of Section 15.205 shall be demonstrated using the measurement instrumentation specified in that section.

(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in Section 15.209, whichever limit permits a higher field strength.

Any emissions that fall within the restricted bands specified in FCC Section 15.205 shall not exceed the following limits according to §15.209:

Frequency (MHz)	Field strength (uV/m @ 3m)	Field strength (dBuV/m @ 3m)
30 – 88	100	40.0
88 – 216	150	43.5
216 – 960	200	46.0
Above 960	500	54.0

RSS-210, Issue 7 – A1.1.2 Field Strengths and Frequency Bands

[REMARK: THE SAME AS THE FIELD STRENGTH LIMITS SPECIFIED IN FCC PART 15.231(b)]

(1) The field strength of emissions from momentarily operated intentional radiators shall not exceed the limits in Table 4.

(2) Intentional radiators shall demonstrate compliance with the limits on the field strength of emissions, as shown in Table 4, based on the average value of the measured emissions. As an alternative, compliance with the limit in Table 4, may be demonstrated using a CISPR quasi-peak detector. If average emission measurements are employed, the provisions in Section 4.3 (Pulsed Operation) of RSS-Gen for averaging pulsed emissions and for limiting peak emissions apply.

(3) The limits on the field strength of unwanted emissions in Table 4 are based on the fundamental frequency of the intentional radiator. Unwanted emissions shall be attenuated to the limits shown in Table 2 or to the limits shown in Table 4, whichever is the less stringent.

5.3.2 Test Procedure

1. Preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters.
2. The EUT was placed on the top of the 0.8 meter high, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360 °.
3. The antenna polarization was also changed from vertical to horizontal. The spectrum analyzer was scanned from 30 to 1000 MHz using the Bi-Log antenna. Above 1 GHz, linearly polarized double ridge horn antenna was used.
4. To obtain the final test data, the EUT was arranged on a turntable situated on a 4 × 4 meter at the Open Area Test Site. The EUT was tested at a 3 meter test distance.
5. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
6. The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT. The EUT was operated in transmitting mode.

5.3.3 Calculation of the field strength limits by linear interpolation

Field strength limit of the fundamental frequency:

Limit = (F-260)×(12500-3750)/(470-260) + 3750 = 6041.7uV/m = 75.6 dBuV/m

Field strength limit of spurious emissions:

Limit = (F-260)×(1250-375)/(470-260) + 375 = 604.2uV/m = 55.6 dBuV/m

5.3.4 Calculation of Average Correction Factor

The average correction factor is computed by analyzing the "worst case" on time in any 100 ms time period and using the formula:

Correction Factor = 20 log (worst case on time/ 100 ms).

The maximum correction factor to be applied is 20 dB per section 15.35 of FCC rules.

All following emission measurements were performed using the test receiver's average and peak detectors and "Max Hold" mode, the average and peak values were measured directly without the necessity of additional average correction factor.

5.3.5 Test Results: **PASS**

Table 1: Measured values of the Field strength

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Antenna Height [m]	Reading [dB(μV)]	Amp Gain [dB]	ATT [dB]	AF [dB/m]	CL [dB]	Actual [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
AVERAGE data											
315	120	H	1.0	76.62	27.0	0.0	12.9	1.6	64.1	75.6	11.5
630	120	H	1.5	39.62	28.5	0.0	19.4	2.3	32.9	55.6	22.7
945	120	H	1.1	32.37	27.8	0.0	23.3	2.7	30.6	55.6	25.1
PEAK data											
315	120	H	1.0	77.04	27.0	0.0	12.9	1.6	64.6	95.6	31.0
630	120	H	1.5	42.60	28.5	0.0	19.4	2.3	35.8	75.6	39.8
945	120	H	1.1	37.73	27.8	0.0	23.3	2.7	35.9	75.6	39.7

Note

1. *H = Horizontal, V = Vertical Polarization*
2. *AF = Antenna Factor*
3. *CL = Cable Loss*
4. *ATT = Attenuator*
5. *The frequency range was scanned from 25 MHz to 4 GHz. All emissions not reported were more than 20 dB below the specified limit or in the noise floor.*

6. *Field strength limit of the fundamental frequency:*

   Limit = (F-260)(12500-3750)/(470-260) + 3750 = 6041.7 uV/m = 75.6 dBuV/m*

   Field strength limit of spurious emissions:

   Limit = (F-260) (1250-375)/(470-260) + 375 = 604.1 uV/m = 55.6 dBuV/m*

Margin (dB) = Limit – Actual

Actual = Reading – Amp Gain + ATT + AF + CL

5.4 OCCUPIED BANDWIDTH

5.4.1 Regulation

FCC 47CFR15 – 15.231(c)

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

RSS-210, Issue 7 – A1.1.3 Bandwidth of Momentary Signals

For the purpose of Section A1.1, the 99% bandwidth shall be no wider than 0.25% of the centre frequency for devices operating between 70-900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the centre frequency.

5.4.2 Calculation of Occupied Bandwidth Limit (F=315MHz)

The 20 dB bandwidth limit = F × 0.0025 = 315 MHz X 0.0025 = 787.5 kHz
The 99 % bandwidth limit = F × 0.0025 = 315 MHz X 0.0025 = 787.5 kHz

5.4.3 Test Procedure

FCC 47CFR15 – 15.231(c)

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical. Once the reference level is established, the equipment is conditioned with typical modulating signals to produce worst-case (i.e., the widest) bandwidth.
The measurement was performed at the operating frequency, 315MHz. The spectrum trace data around fundamental frequency of the EUT was obtained with the spectrum analyzer in “Max Hold” mode. The bandwidth value was determined between the two points of 20dB down from the modulated carrier.

RSS-210, Issue 7 – A1.1.3 Bandwidth of Momentary Signals

1. Connect the antenna port of the EUT to RF input on the spectrum analyzer.
2. Set the SPAN to capture all products of the modulation process, including the emission skirts.
3. Set the RBW to as close to 1% of the selected span as is possible without being below 1%.
4. Set the DETECTOR to sample where practical. [REMARK: the function of the PEAK HOLD was used]
5. Measure the 99% occupied bandwidth.

5.4.4. Test Results: PASS

Operating frequency (MHz)	RBW (kHz)	20dB BW (kHz)	Limit (kHz)
315	10	110.0	787.5

Operating frequency (MHz)	RBW (kHz)	99 % BW (kHz)	Limit (kHz)
315	3	108.8	787.5

Figure 2: Measured value of the Occupied bandwidth(20 dB Bandwidth)

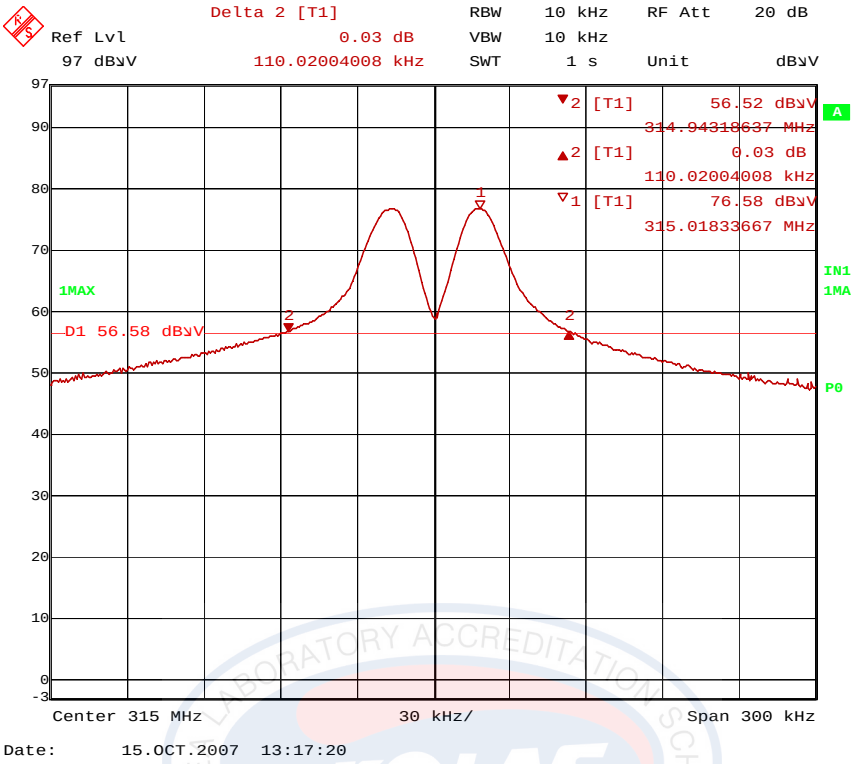


Figure 3: Measured value of the Occupied bandwidth(99 % Bandwidth)