

TEST REPORT



DT&C Co., Ltd.

42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17042
Tel : 031-321-2664, Fax : 031-321-1664

1. Report No : DRTFCC2009-0294

2. Customer

- Name : SeMyeong
- Address : 260, Seonggeo-gil, Seonggeo-eup Seobuk-gu, Cheonan-si, Chungcheongnam-do, South Korea

3. Use of Report : FCC Original Grant

4. Product Name / Model Name : PCB PACKAGE ASSY – SWC / SWC20

FCC ID : 2AXJ5-SWC20

5. FCC Regulation(s): Part 15.231

Test Method Used : ANSI C63.10-2013

6. Date of Test : 2020.08.27 ~ 2020.09.07

7. Testing Environment : See appended test report.

8. Test Result : Refer to the attached test result.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

Affirmation	Tested by	Reviewed by
	Name : JaeHyeok Bang 	Name : JaeJin Lee  (Signature)

2020 . 09 . 18 .

DT&C Co., Ltd.

Unconnected with KS Q ISO / IEC 17025 and KOLAS accreditation

If this report is required to confirmation of authenticity, please contact to report@dtnc.net

Test Report Version

Test Report No.	Date	Description	Revised by	Reviewed by
DRTFCC2009-0294	Sep. 18, 2020	Initial issue	JaeHyeok Bang	JaeJin Lee

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1. General Information

1.1. Testing Laboratory

DT&C Co., Ltd.		
The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042. The test site complies with the requirements of § 2.948 according to ANSI C63.4-2014.		
- FCC & IC MRA Designation No. : KR0034		
- ISED #: 5740A		
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1.2. Testing Environment

Ambient Condition	
▪ Temperature	+21 °C ~ +23 °C
▪ Relative Humidity	35 % ~ 38 %

1.3. Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95 % level of confidence.

Test items	Measurement uncertainty
Radiated emission (1 GHz Below)	4.9 dB (The confidence level is about 95 %, $k = 2$)
Radiated emission (1 GHz ~ 18 GHz)	5.1 dB (The confidence level is about 95 %, $k = 2$)

1.4. Description of EUT

FCC Equipment Class	Part 15 Security / Remote Control Transmitter
EUT	PCB PACKAGE ASSY – SWC
Model Name	SWC20
Hardware version	1.0
Software version	1.0
Power Supply	DC 3 V
Frequency Band	433.92 MHz
Modulation Type	FSK
Antenna type	PCB Pattern Antenna

2. Information about test items

2.1 Operating mode

Operating Mode 1	This device was tested with continuous TX mode for field strength and 20dB Bandwidth measurements.
Operating Mode 2	Normal operating mode was used for measurement the deactivation measurement.

2.2 Tested frequency

Mode	Frequency(MHz)
Transmitting mode	433.92
-	-

2.3 Auxiliary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-

2.4 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing
 → None

3. Test Report

3.1 Summary of tests

FCC Part Section(s)	Parameter	Test Condition	Status Note 1
15.231(b)	Field strength of fundamental and spurious emissions	Radiated	C Note 3
15.205 15.209	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)		C Note 3
15.231(a)	Deactivation	Conducted	C
15.231(c)	20dB bandwidth		C
15.207	AC Power Line Conducted Emission	AC Line Conducted	NA Note 4
15.203	Antenna Requirements	-	C
Note 1: C =Comply NC =Not Comply NT =Not Tested NA =Not Applicable Note 2: For radiated emission tests below 30 MHz were performed on semi-anechoic chamber which is correlated with OATS. Note 3: This test item was performed in each axis and the worst case data was reported. Note 4: This device is used Battery for power supplying only. Therefore this test item was not performed.			

3.2 Transmitter requirements

3.2.1 20 dB

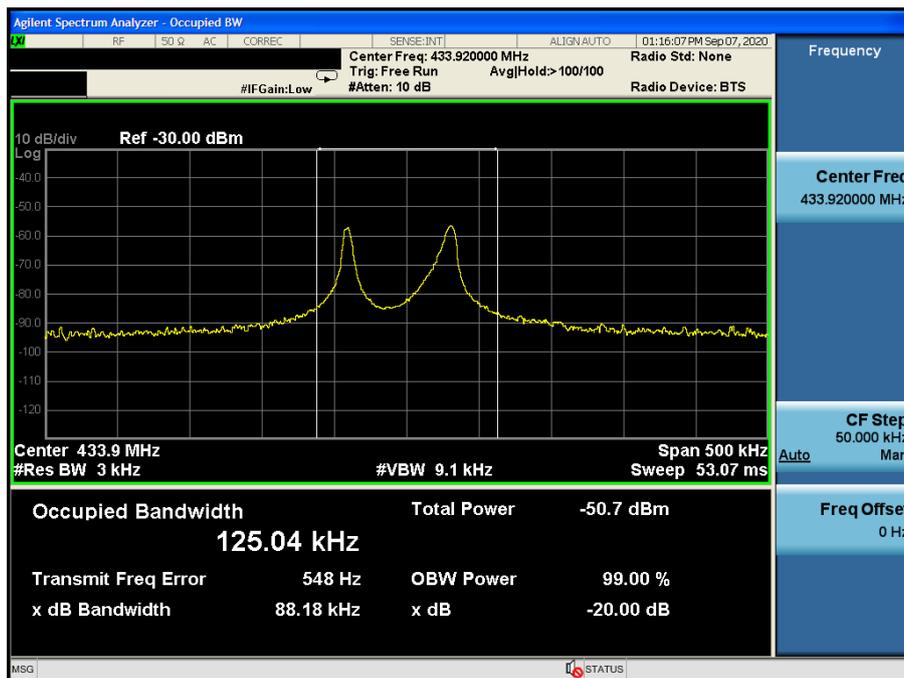
- Procedure:

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of **ANIS C63.10-2013**.

- RBW: 1 % to 5 % of the OBW
- VBW: Approximately three times the RBW
- Detector: Peak
- Trace: Max hold
- Sweep: Auto couple

- Measurement Data: Comply

Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)
433.92	88.20	1 084.80

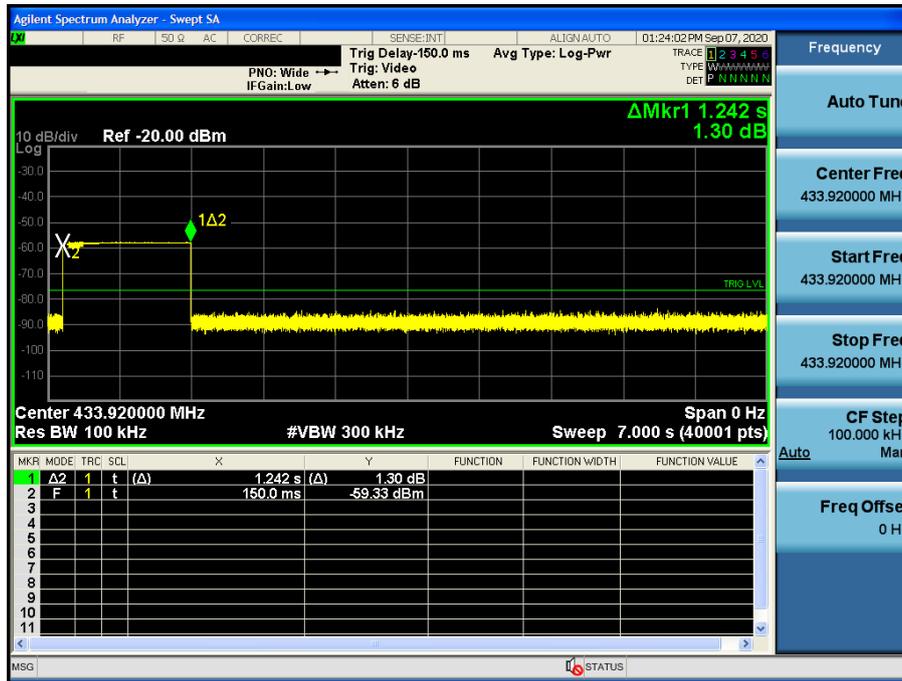


- Limit: § 15.209(c)

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.

3.2.2 Automatically deactivate

- Measurement Data:



Deactivation time (s)	Limit (s)
1.242	5.0

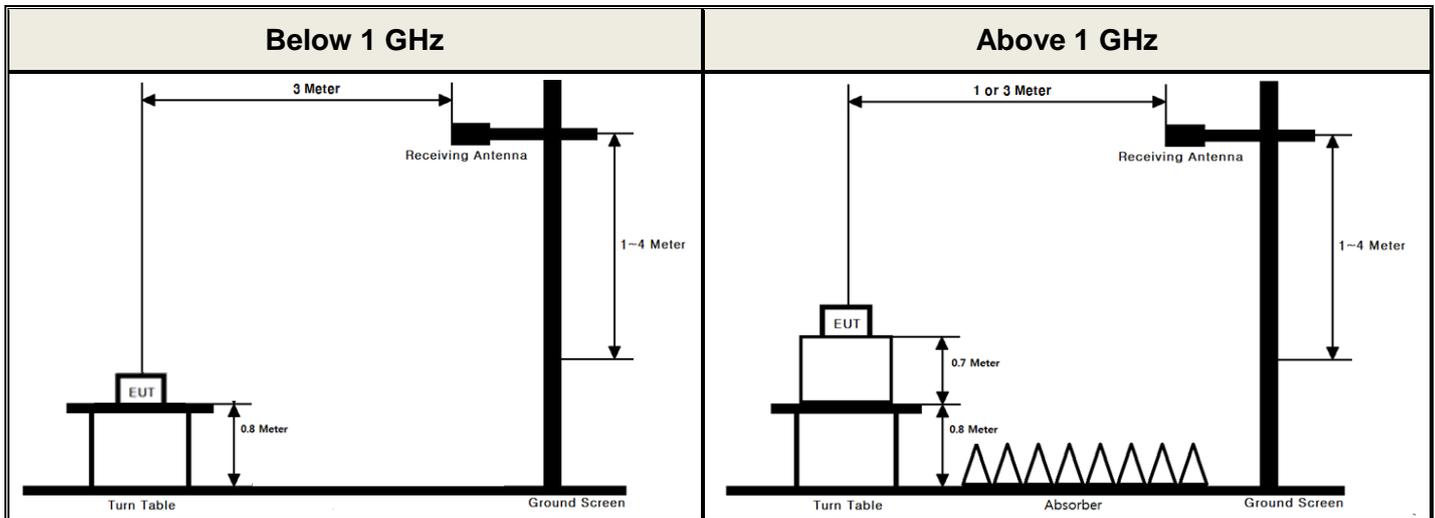
- Limit: § 15.231(a)

(a) The provisions of this section are restricted to periodic operation within the band 40.66 MHz - 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 transmissions 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.

3.2.3 Field strength of fundamental and spurious emissions

- Test set up diagrams:



- Procedure:

1. The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m.
2. The table was rotated 360 degrees to determine the position of the highest radiation.
3. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 1 or 3 meter away from the interference-receiving antenna.
4. For measurements above 1GHz absorbers are placed on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1 GHz, the absorbers are removed.
5. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
6. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
7. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
8. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Measurement Instrument Setting

1. Frequency Range Below 1 GHz
RBW = 100 or 120 kHz, VBW = 3 x RBW, Detector = Peak or Quasi Peak
2. Frequency Range > 1 GHz
Peak Measurement
RBW = 1 MHz, VBW = 3 MHz, Detector = Peak, Sweep time = Auto, Trace mode = Max Hold until the trace stabilizes
Average Measurement > 1GHz
RBW = 1MHz, VBW ≥ 1/T, Detector = Peak, Sweep Time = Auto, Trace Mode = Max Hold until the trace stabilizes

Note: For fundamental field strength measurements, the RBW(200kHz) was set enough larger than occupied bandwidth.

- Limit:

§ 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:

Frequency [MHz]	Field Strength of Fundamental Frequency [uV/m]	Field Strength of Spurious Emissions [uV/m]
40.66 ~ 40.70	2,250	225
70 ~ 130	1,250	125
130 ~ 174	¹ 1,250 to 3,750	¹ 125 to 375
174 ~ 260	3,750	375
260 ~ 470	¹ 3,750 to 12,500	¹ 375 to 1,250
Above 470	12,500	1,250

¹Linear 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 §15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of §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 §15.209, whichever limit permits a higher field strength.

§ 15.205(a) and (b), only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.009 ~ 0.110	16.42 ~ 16.423	399.90 ~ 410	4.5 ~ 5.15
0.495 ~ 0.505	16.694 75 ~ 16.695 25	608 ~ 614	5.35 ~ 5.46
2.173 5 ~ 2.190 5	16.804 25 ~ 16.804 75	960 ~ 1 240	7.25 ~ 7.75
4.125 ~ 4.128	25.5 ~ 25.67	1 300 ~ 1 427	8.025 ~ 8.5
4.177 25 ~ 4.177 75	37.5 ~ 38.25	1 435 ~ 1 626.5	9.0 ~ 9.2
4.207 25 ~ 4.207 75	73 ~ 74.6	1 645.5 ~ 1 646.5	9.3 ~ 9.5
6.215 ~ 6.218	74.8 ~ 75.2	1 660 ~ 1 710	10.6 ~ 12.7
6.267 75 ~ 6.268 25	108 ~ 121.94	1 718.8 ~ 1 722.2	13.25 ~ 13.4
6.311 75 ~ 6.312 25	123 ~ 138	2 200 ~ 2 300	14.47 ~ 14.5
8.291 ~ 8.294	149.9 ~ 150.05	2 310 ~ 2 390	15.35 ~ 16.2
8.362 ~ 8.366	156.524 75 ~ 156.525 25	2 483.5 ~ 2 500	17.7 ~ 21.4
8.376 25 ~ 8.386 75	156.7 ~ 156.9	2 690 ~ 2 900	22.01 ~ 23.12
8.414 25 ~ 8.414 75	162.012 5 ~ 167.17	3 260 ~ 3 267	23.6 ~ 24.0
12.29 ~ 12.293	167.72 ~ 173.2	3 332 ~ 3 339	31.2 ~ 31.8
12.519 75 ~ 12.520 25	240 ~ 285	3 345.8 ~ 3 358	36.43 ~ 36.5
12.576 75 ~ 12.577 25	322 ~ 335.4	3 600 ~ 4 400	Above 38.6
13.36 ~ 13.41			

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1 000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1 000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

§ 15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency [MHz]	Field Strength of Fundamental Frequency [uV/m]	Measurement Distance [m]
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 MHz - 72 MHz, 76 MHz - 88 MHz, 174 MHz - 216 MHz or 470 MHz - 806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

- Measurement Data: Comply

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*433.947	V	Y	PK	61.12	-2.37	NA	NA	58.75	100.82	42.07
*433.921	V	Y	AV	60.59	-2.37	NA	NA	58.22	80.82	22.60
867.906	H	Z	PK	37.85	4.86	NA	NA	42.71	80.82	38.11
867.878	H	Z	AV	31.99	4.86	NA	NA	36.85	60.82	23.97
1 301.838	H	X	PK	48.69	-1.86	NA	NA	46.83	74.00	27.17
1 301.778	H	X	AV	44.25	-1.86	NA	NA	42.39	54.00	11.61
1 735.458	H	X	PK	52.31	-0.54	NA	NA	51.77	80.82	29.05
1 735.673	H	X	AV	49.24	-0.54	NA	NA	48.70	60.82	12.12
2 169.590	V	Z	PK	53.62	1.36	NA	NA	54.98	80.82	25.84
2 169.590	V	Z	AV	50.33	1.36	NA	NA	51.69	60.82	9.13
2 602.920	H	X	PK	55.82	2.71	NA	NA	58.53	80.82	22.29
2 603.510	H	X	AV	52.81	2.71	NA	NA	55.52	60.82	5.30
3 037.990	H	X	PK	51.02	2.73	NA	NA	53.75	80.82	27.07
3 037.410	H	X	AV	46.23	2.73	NA	NA	48.96	60.82	11.86
3 471.457	H	Y	PK	46.09	3.15	NA	NA	49.24	80.82	31.58
3 471.347	H	Y	AV	38.48	3.15	NA	NA	41.63	60.82	19.19
3 904.377	H	X	PK	43.39	3.97	NA	NA	47.36	74.00	26.64
3 905.157	H	X	AV	32.32	3.97	NA	NA	36.29	54.00	17.71

Note 1. The radiated emissions were investigated 9 kHz to 10th harmonic of highest fundamental frequency.

Note 2. * is fundamental frequency.

Note 3. No other spurious and harmonic emissions were reported greater than listed emissions above table.

Note 4 Information of Distance Factor

For finding emissions, measurements may be performed at a distance closer than that specified in the regulations.

In this case, the distance factor is applied to the result.

- Calculation of distance factor

At frequencies below 30 MHz = $40 \log(\text{tested distance} / \text{specified distance})$

At frequencies at or above 30 MHz = $20 \log(\text{tested distance} / \text{specified distance})$

When distance factor is "N/A", the measurements were performed at the specified distance and distance factor is not applied.

Note 5. Sample calculation

Result(Field Strength) = Reading + T.F + DCCF + DCF

Margin = Limit – Result

T.F = AF + CL – AG

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor

3.2.4 AC power line conducted emission

- Procedure:

1. The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

- Measurement Data: NA

- Limit:

According to §15.207(a) for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network(LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5.0	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

3.2.5 Antenna requirement

- According to FCC 47 CFR §15.203:

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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 this section.

**The antenna is permanently attached on the device.
Therefore this E.U.T Complies with the requirement of §15.203**

APPENDIX I

TEST EQUIPMENT FOR TESTS

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	19/12/16	20/12/16	MY50410357
Spectrum Analyzer	Agilent Technologies	N9020A	20/06/24	21/06/24	US47360812
Loop Antenna	ETS-Lindgren	6502	19/09/18	21/09/18	00226186
BILOG ANTENNA	Schwarzbeck	VULB 9160	19/04/23	21/04/23	9160-3362
Horn Antenna	ETS-LINDGREN	3117	20/04/24	21/04/24	00140394
PreAmplifier	TSJ	8447D	19/12/16	20/12/16	2944A07774
PreAmplifier	Agilent	8449B	20/06/24	21/06/24	3008A02108
Signal Generator	Rohde Schwarz	SMBV100A	19/12/16	20/12/16	255571
Multimeter	FLUKE	17B+	19/12/16	20/12/16	36390701WS
Thermohygrometer	BODYCOM	BJ5478	19/12/18	20/12/18	120612-1
Thermohygrometer	BODYCOM	BJ5478	19/12/18	20/12/18	120612-2
High-pass filter	Wainwright	WHKX12-935-1000-15000-40SS	20/06/24	21/06/24	7
CABLE	Radiall	TESTPRO3	20/01/16	21/01/16	M-01
CABLE	HUBER+SUHNER	SUCOFLEX103	20/01/16	21/01/16	M-03
CABLE	DTNC	CABLE	20/01/16	21/01/16	M-05
CABLE	DTNC	CABLE	20/01/13	21/01/13	RF-18

Note 1: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017.

Note 2: The cable is not a regular calibration item, so it has been calibrated by DT & C itself.

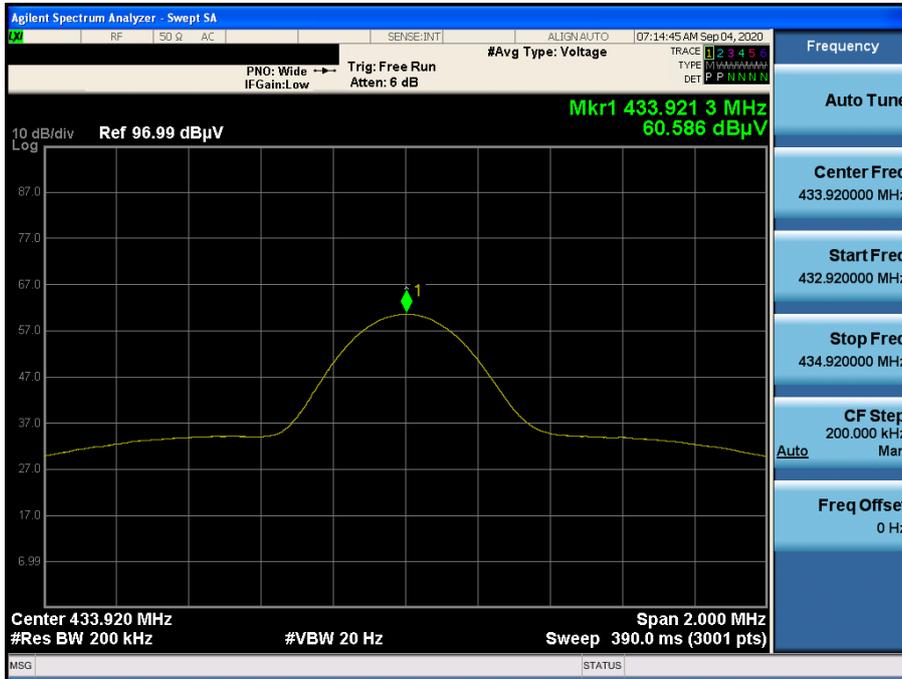
APPENDIX II

Worst data plot of radiated test (Reading Value)

Field strength of fundamental

Y axis & Ver

Detector Mode : AV



Unwanted emissions

X axis & Hor

Detector Mode : AV

