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RADIO TESTREPORT

Report No.: STS2209038W01

Issued for

HELLA GmbH & Co. KGaA

Rixbecker Straße 75 59552 Lippstadt / Germany

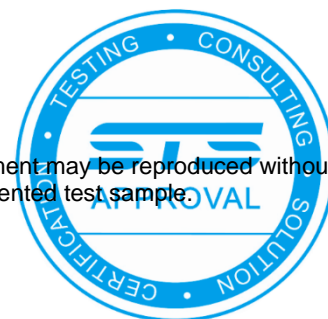
Product Name:	Passive Entry - Passive Start Radio identification device
Brand Name:	Hella
Model Name:	FS191S
Series Model:	N/A
FCC ID:	NBGFS191S
Test Standard:	FCC Part 15.231

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**TEST REPORT CERTIFICATION**

Applicant's Name.....: HELLA GmbH & Go. KGaA

Address: Rixbecker Straße 75 59552 Lippstadt / Germany

Manufacturer's Name.....: HELLA GmbH & Go. KGaA

Address: Rixbecker Straße 75 59552 Lippstadt / Germany

Product Description

Product Name.....: Passive Entry - Passive Start Radio identification device

Brand Name: Hella

Model Name: FS191S

Series Model.....: N/A

Test Standards: FCC Part 15.231

Test Procedure: ANSI C63.10-2013

This device described above has been tested by STS, the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test: 08 Sept. 2022

Date of performance of tests.....: 08 Sept. 2022 ~ 20 Sept. 2022

Date of Issue: 20 Sept. 2022

Test Result.....: **Pass**

Testing Engineer : _____

(Chris Chen)

Technical Manager : _____

(Sean she)

Authorized Signatory : _____

(Bovey Yang)





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**Revision History**

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	19 Sept. 2022	STS2209038W01	ALL	Initial Issue





1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

FCC Part 15.231, Subpart C			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	N/A	--
15.205(a)/15.209/ 15.231.(b)	Radiated Spurious Emission	PASS	--
15.231(a)(1)/ 15.231(b)(2)	Transmission requirement	PASS	--
15.231(C)	20 dB Bandwidth	PASS	--
15.203	Antenna Requirement	PASS	--

NOTE: (1) "N/A" denotes test is not applicable in this Test Report.

(2) All tests are according to ANSI C63.10-2013.

1.1 TEST FACTORY

SHENZHEN STS TEST SERVICES CO., LTD

Add. : A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ, Fuyong Sub-District, Bao'an District, Shenzhen, Guang Dong, China

FCC test Firm Registration Number: 625569

IC test Firm Registration Number: 12108A

A2LA Certificate No.: 4338.01

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately **95 %**.

No.	Item	Uncertainty
1	RF output power, conducted	$\pm 0.87\text{dB}$
2	Unwanted Emissions, conducted	$\pm 2.895\text{dB}$
3	All emissions, radiated 9K-30MHz	$\pm 3.80\text{dB}$
4	All emissions, radiated 30M-1GHz	$\pm 4.09\text{dB}$
5	All emissions, radiated 1G-6GHz	$\pm 4.92\text{dB}$
6	All emissions, radiated >6G	$\pm 5.49\text{dB}$
7	Conducted Emission (9KHz-30MHz)	$\pm 2.73\text{dB}$



2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	Passive Entry - Passive Start Radio identification device
Trade Name	Hella
Model Name	FS191S
Series Model	N/A
Model Difference	N/A
Frequency band	433.46MHz, 433.92MHz, 434.36MHz
Rating	Input: DC 3V, 0.235A
Modulation Type	FSK
Antenna Type	PCB
Gain	0dBi
Hardware version number	21
Software version number	7
Connecting I/O Port(s)	N/A

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User Manual.
2. The antenna information refers to the manufacturer's provided report, applicable only to the tested sample identified in the report. Due to the incorrect antenna information, a series of problems such as the accuracy of the test results will be borne by the customer.



2.2 DESCRIPTION OF THE TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description
Mode 1	433.46MHz TX Mode
Mode 2	433.92MHz TX Mode
Mode 3	434.36MHz TX Mode

	For Radiated Emission
Final Test Mode	Description
Mode 1	433.46MHz TX Mode
Mode 2	433.92MHz TX Mode
Mode 3	434.36MHz TX Mode

2.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

During test, Keep EUT is in continuous transmission mode, Both open button and closed button have been tested, The two keys were tested to assess and only record the worst case in the report (Open button).

E-1
EUT



2.4 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Necessary accessories

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
N/A	N/A	N/A	N/A	N/A	N/A

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
N/A	N/A	N/A	N/A	N/A	N/A

Note:

(1) For detachable type I/O cable should be specified the length in cm in 『Length』 column.



2.5 EQUIPMENTS LIST

Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2021.09.30	2022.09.29
Signal Analyzer	R&S	FSV 40-N	101823	2021.09.30	2022.09.29
Active loop Antenna	ZHINAN	ZN30900C	16035	2021.04.11	2023.04.10
Bilog Antenna	TESEQ	CBL6111D	34678	2020.10.12	2022.10.11
Horn Antenna	SCHWARZBECK	BBHA 9120D	02014	2021.10.11	2023.10.10
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	J211020657	2020.10.12	2022.10.11
Pre-Amplifier(0.1M-3G Hz)	EM	EM330	060665	2021.10.08	2022.10.07
Pre-Amplifier (1G-18GHz)	SKET	LNPA-01018G-45	SK201808090 1	2021.09.30	2022.09.29
Pre-Amplifier (18G-40GHz)	SKET	LNPA-1840-50	SK201810180 1	2021.09.28	2022.09.27
Temperature & Humidity	HH660	Mieo	N/A	2021.10.09	2022.10.08
Turn table	EM	SC100_1	60531	N/A	N/A
Antenna mast	EM	SC100	N/A	N/A	N/A
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)			

Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2021.09.30	2022.09.29
LISN	R&S	ENV216	101242	2021.09.30	2022.09.29
LISN	EMCO	3810/2NM	23625	2021.09.30	2022.09.29
Temperature & Humidity	HH660	Mieo	N/A	2021.10.09	2022.10.08
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)			



RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Power Sensor	Keysight	U2021XA	MY55520005	2021.09.30	2022.09.29
			MY55520006	2021.09.30	2022.09.29
			MY56120038	2021.09.30	2022.09.29
			MY56280002	2021.09.30	2022.09.29
Signal Analyzer	Agilent	N9020A	MY51110105	2022.03.01	2023.02.28
Temperature & Humidity	HH660	Mieo	N/A	2021.10.09	2022.10.08
Test SW	FARAD	LZ-RF /LzRf-3A3			





3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

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.

FREQUENCY (MHz)	Class B (dBuV)		Standard
	Quasi-peak	Average	
0.15 -0.5	66 - 56 *	56 - 46 *	CISPR
0.50 -5.0	56.00	46.00	CISPR
5.0 -30.0	60.00	50.00	CISPR

0.15 -0.5	66 - 56 *	56 - 46 *	FCC
0.50 -5.0	56.00	46.00	FCC
5.0 -30.0	60.00	50.00	FCC

Note:

(1) The tighter limit applies at the band edges.

(2) The limit of “ * ” marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

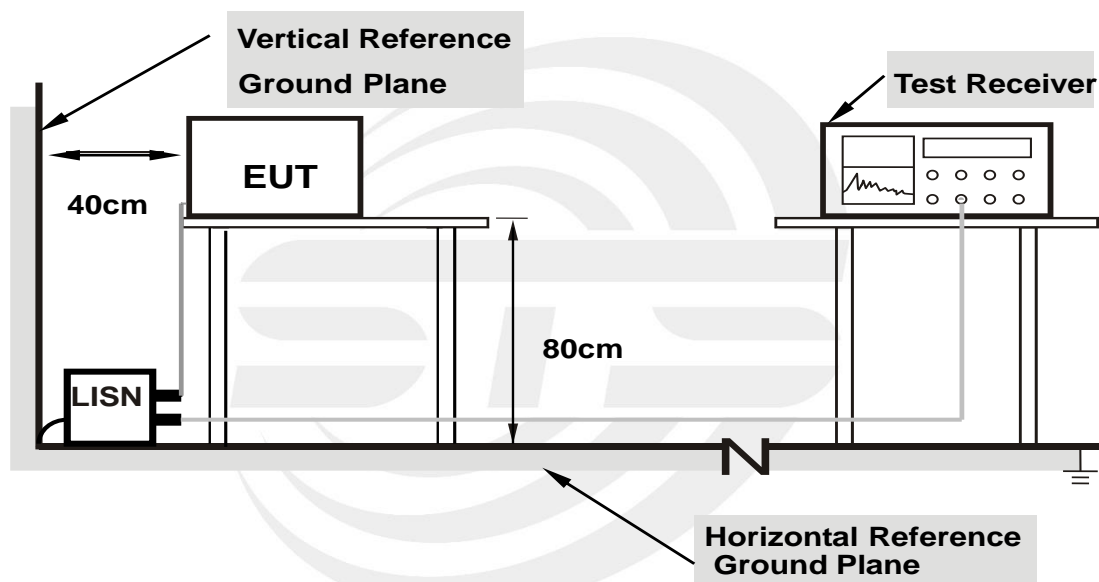
The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

3.2 TEST PROCEDURE

- The EUT is 0.8 m from the horizontal ground plane and 0.4 m from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments are powered from additional LISN(s). The LISN provides 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- LISN at least 80 cm from nearest part of EUT chassis.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.3 TEST SETUP



Note: 1. Support units were connected to second LISN.

2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes support units.

3.4 TEST RESULTS

Temperature:	26 °C	Relative Humidity:	54%
Test Voltage:	N/A	Phase :	L/N
Test Mode:	N/A		

Note: EUT is only power by DC Power, So it is not applicable for this test.



4. RADIATED EMISSION MEASUREMENT

4.1 RADIATED EMISSION LIMITS

In case the emission fall within the restricted band specified on Part 15.205(a), then the Part 15.209(a) and Part 15.231(b) limit in the table below has to be followed.

LIMITS OF RADIATED EMISSION MEASUREMENT (0.009MHz - 1000MHz)

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~40.66	100	3
40.70~70	100	3

Fundamental Frequency (MHz)	Field Strength of fundamental (microvolts/meter)	Field Strength of Unwanted Emissions (microvolts/meter)
40.66~40.70	2,250	225
70~130	1,250	125
130~174	1,250 to 3,750**	125 to 375**
174~260	3750	375
260~470	3,750 to 12,500**	375 to 1,250**
Above 470	12,500	1,250

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Class B (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

NOTE:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) Emission level (dBuV/m)=20log Emission level (uV/m).



LIMITS OF RESTRICTED FREQUENCY BANDS

FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (GHz)
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

Spectrum Parameter	Setting
Detector	Peak
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1MHz / 3MHz

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~90kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	90kHz~110kHz / RB 200Hz for QP
Start ~ Stop Frequency	110kHz~490kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	490kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP



4.2 TEST PROCEDURE

- a. The test is performed in a 3m Semi-Anechoic Chamber; the antenna factor, cable loss and so on of the site (factors) is calculated to correct the reading. The EUT is placed on a 0.8m high insulating Turn Table, and keeps 3m away from the Test Antenna, which is mounted on a variable-height antenna master tower.
During test, The table was rotated 360 degrees to determine the position of the highest radiation.
- b. In the frequency range of 9KHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
- c. In the frequency range 30MHz-1GHz, Bi-Log Test Antenna used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength. The emission levels at both horizontal and vertical polarizations should be tested.
- d. In the frequency above 1GHz, Place the measurement antenna 3m away from the EUT for each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- f. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- g. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- h. For the actual test configuration, please refer to the related Item –EUT Test Photos.

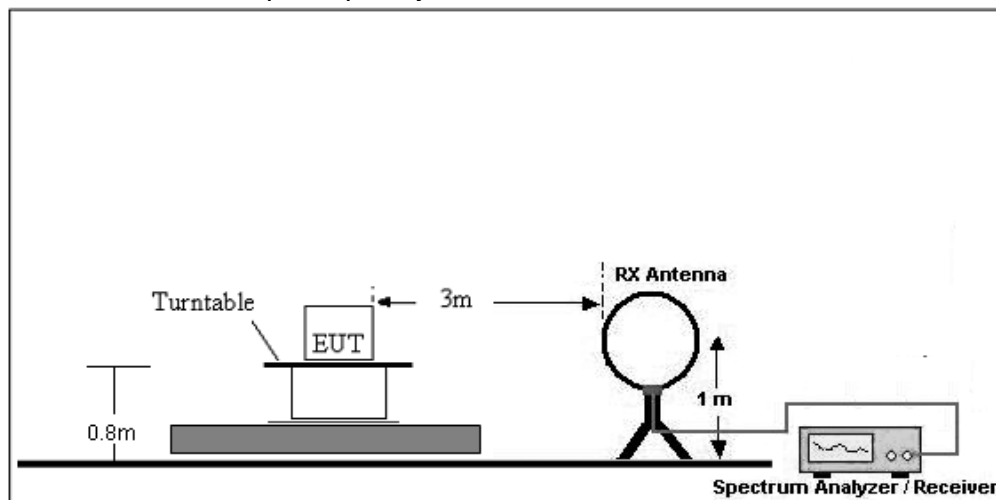
Both horizontal and vertical antenna polarities and performed pretest to three orthogonal axis were tested. The worst case emissions were reported

4.3 DEVIATION FROM TEST STANDARD

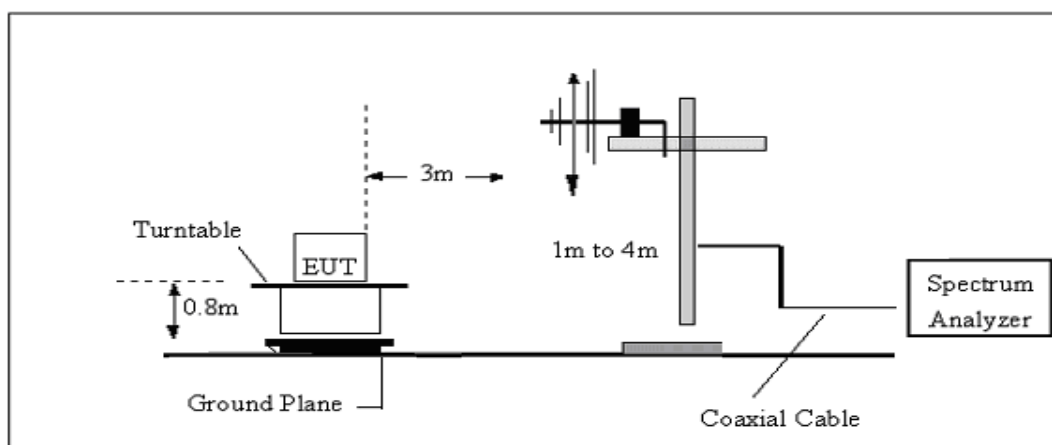
No deviation

4.4 TEST SETUP

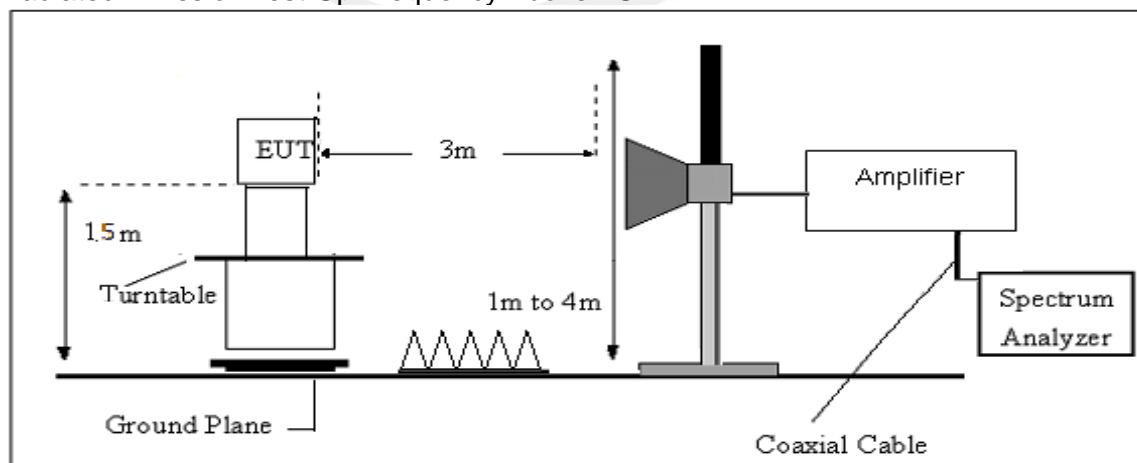
(A) Radiated Emission Test-Up Frequency Below 30MHz



(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



4.5 EUT OPERATING CONDITIONS

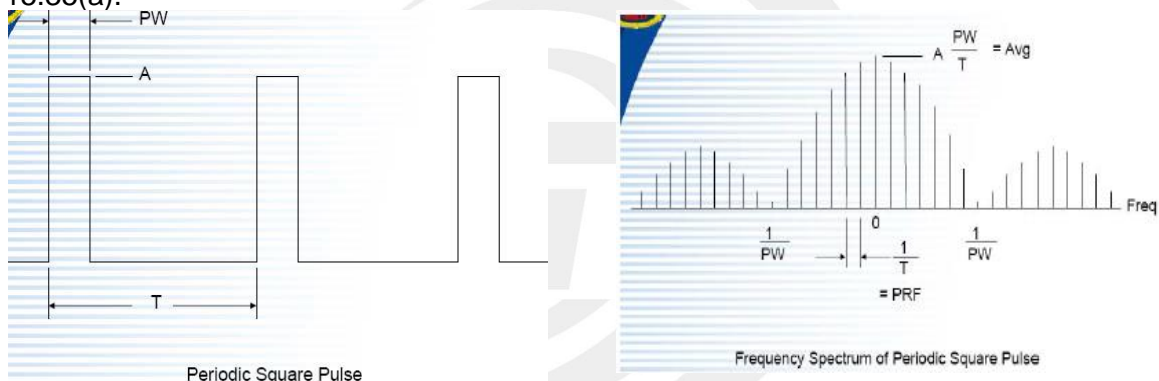
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

4.6 TEST RESULTS

INTRODUCTION TO PDCF

Reference: (§15.35 Measurement detector functions and bandwidths.)

- a. Part 15 of the FCC Rules provides for the operation of low power communication devices without an individual license (e.g., intrusion detectors, pulsed water tank level gauges, etc.), subject to certain requirements. Some of these devices use extremely narrow pulses to generate wideband emissions, which are measured to determine compliance with the rules. These measurements are typically performed with a receiver or spectrum analyzer. Depending on a number of factors (e.g., resolution bandwidth, pulsewidth, etc.), the spectrum analyzer may not always display the true peak value of the measured emission. This effect, called "pulse desensitization," relates to the capabilities of the measuring instrument. For the measurement and reporting of the true peak of pulsed emissions, it may be necessary to apply a "pulse desensitization correction factor" (PDCF) to the measured value, pursuant to 47 CFR 15.35(a).



If using spectrum analyzer to measure pulse signal, it have to make sure the RBW use is at least $2/PW$.

•When RBW is less than $2/PW$, you are able to measure the true peak level of the pulse signal. If this is the case, PDCF is required to compensate to determine true peak value.

Pulse desensitization:

$PW = 71600 \mu\text{sec}$, Period = $100000 \mu\text{sec}$, Level = A

$RBW > 2/PW = 0.028 \text{K}$, $1/T = 0.01 \text{K}$

NOTE: $2 / PW < RBW$, first don't need

- b. For the actual test, please refer to the ANSI C63.10, Annex C refer to section 6. for more detail



4.7 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where

FS = Field Strength

CL = Cable Attenuation Factor (Cable Loss)

RA = Reading Amplitude

AG = Amplifier Gain

AF = Antenna Factor

For example

Frequency	FS	RA	AF	CL	AG	Factor
(MHz)	(dB μ V/m)	(dB μ V/m)	(dB)	(dB)	(dB)	(dB)
300	40	58.1	12.2	1.6	31.9	-18.1

$$\text{Factor} = \text{AF} + \text{CL} - \text{AG}$$

4.8 TEST RESULTS

(Radiated Emission < 30MHz (9KHz-30MHz, H-field))

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	PASS
--	--	--	--	PASS

Note: The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log (\text{specific distance/test distance})$ (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.



Between 30MHz – 5000 MHz

Temperature:	23.1 °C	Relative Humidity:	60%
Test Voltage:	DC 3V	Phase:	Horizontal
Test Mode:	Mode 1		

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	35.8200	35.53	-15.91	19.62	40.00	-20.38	peak
3	612.0000	29.29	-5.50	23.79	46.00	-22.21	peak
4	733.2500	31.61	-2.35	29.26	46.00	-16.74	peak
5	866.9200	42.90	-0.49	42.41	60.81	-18.40	peak
6	984.4800	28.94	2.40	31.34	54.00	-22.66	peak

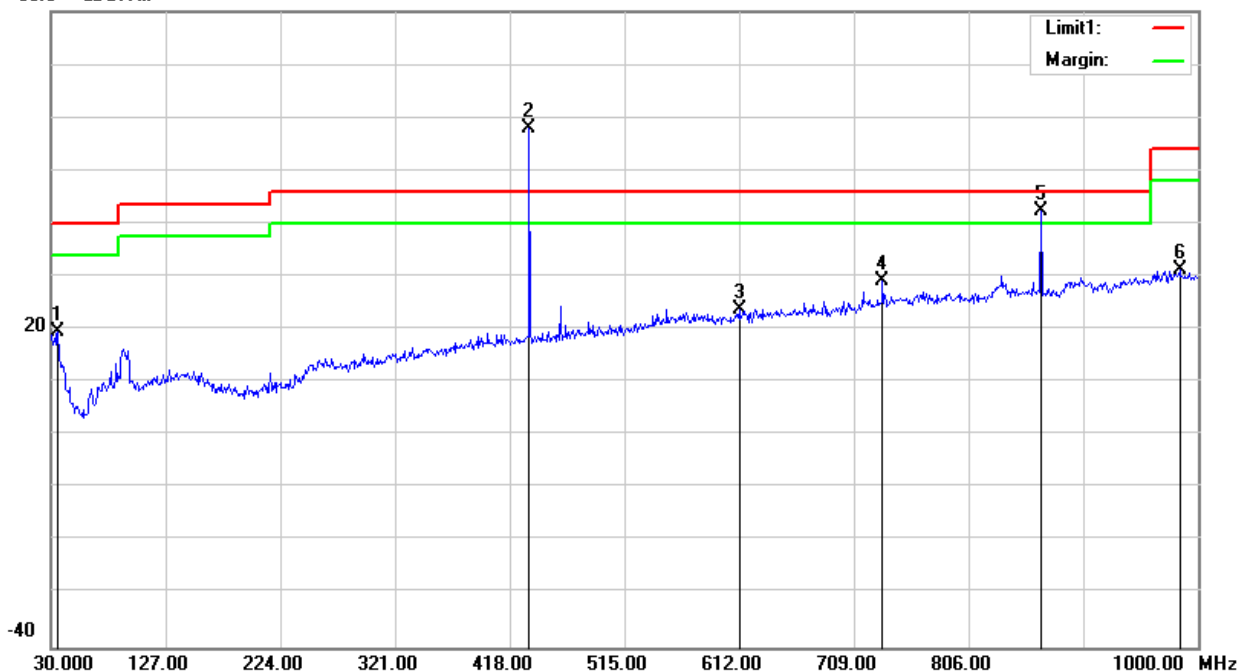
Fundamental Frequency

No.	Frequency	Reading	Correct	Duty cycle	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
2	433.4600	68.04	-10.12	-	57.92	100.81	-42.89	peak
2	433.4600	68.04	-10.12	2.90	55.02	80.81	-25.79	AVG

Remark:

1. All readings are Quasi-Peak and Average values
2. Margin = Result (Result = Reading + Factor) – Limit
3. Factor=LISN factor+Cable loss+Limiter (10dB)

80.0 dBuV/m





Temperature:	23.1 °C	Relative Humidity:	60%
Test Voltage:	DC 3V	Phase:	Vertical
Test Mode:	Mode 1		

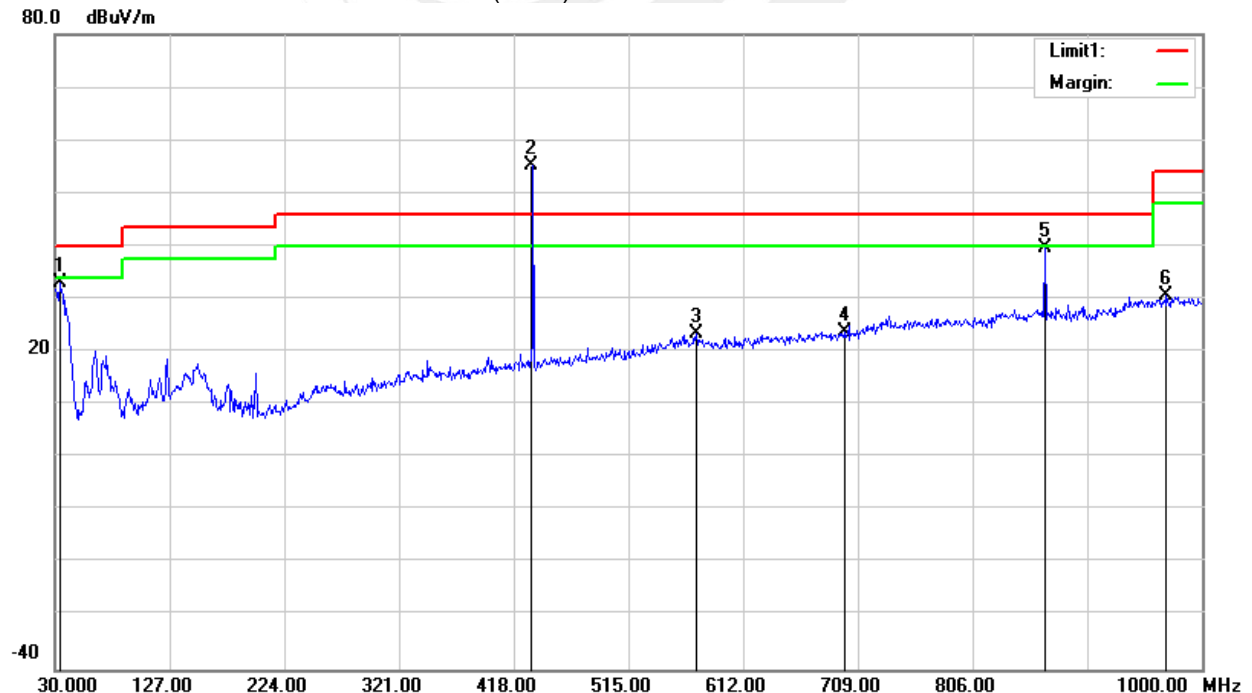
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	33.8800	47.94	-14.80	33.14	40.00	-6.86	peak
3	572.2300	29.02	-5.63	23.39	46.00	-22.61	peak
4	697.3600	28.09	-4.22	23.87	46.00	-22.13	peak
5	866.9200	40.16	-0.49	39.67	60.81	-21.14	peak
6	969.9300	28.57	2.00	30.57	54.00	-23.43	peak

Fundamental Frequency

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Duty cycle Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
2	433.4600	65.45	-10.13	-	55.32	100.81	-45.49	peak
2	433.4600	65.45	-10.13	2.90	52.42	80.81	-28.39	AVG

Remark:

1. All readings are Quasi-Peak and Average values
2. Margin = Result (Result = Reading + Factor) - Limit
3. Factor = LISN factor + Cable loss + Limiter (10dB)





Temperature:	23.1 °C	Relative Humidity:	60%
Test Voltage:	DC 3V	Phase:	Horizontal
Test Mode:	Mode 2		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	34.8500	34.30	-15.34	18.96	40.00	-21.04	peak
2	141.5500	35.06	-18.11	16.95	43.50	-26.55	peak
4	733.2500	31.57	-2.35	29.22	46.00	-16.78	peak
5	867.8400	43.09	-0.51	42.58	60.83	-18.25	peak
6	952.4700	29.31	1.63	30.94	46.00	-15.06	peak

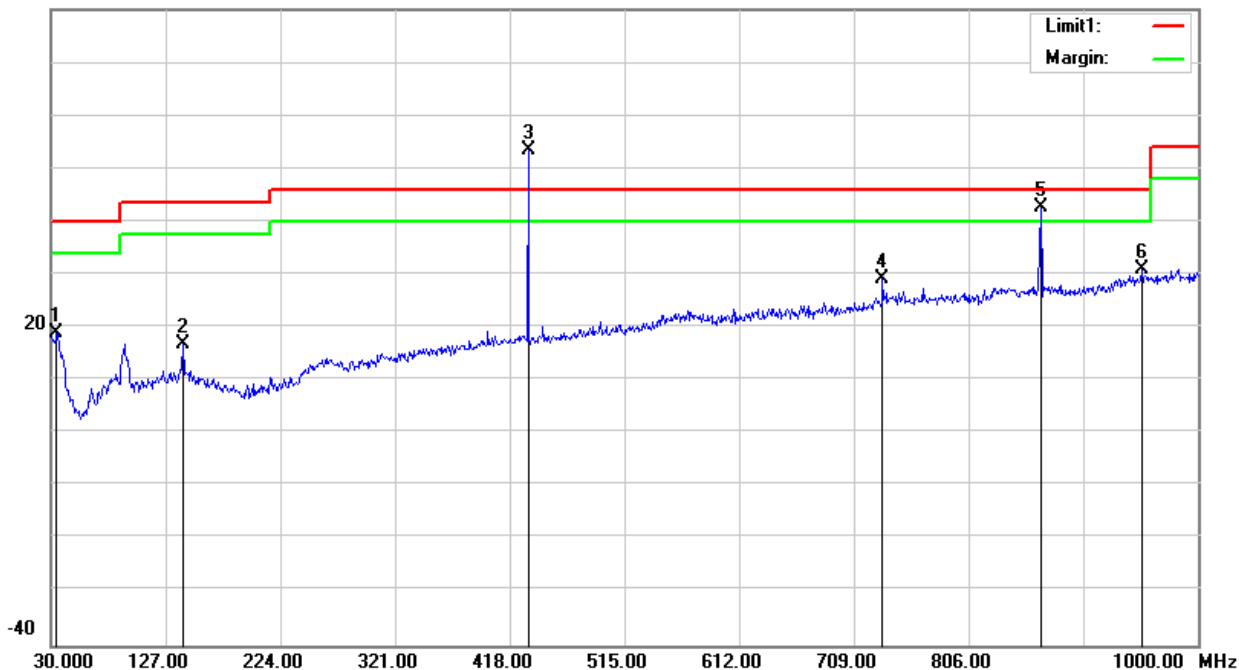
Fundamental Frequency

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Duty cycle Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
3	433.9200	63.59	-10.12	-	53.47	100.83	-47.36	peak
3	433.9200	63.59	-10.12	2.90	50.57	80.83	-30.26	AVG

Remark:

1. All readings are Quasi-Peak and Average values
2. Margin = Result (Result = Reading + Factor) - Limit
3. Factor = LISN factor + Cable loss + Limiter (10dB)

80.0 dBuV/m





Temperature:	23.1 °C	Relative Humidity:	60%
Test Voltage:	DC 3V	Phase:	Vertical
Test Mode:	Mode 2		

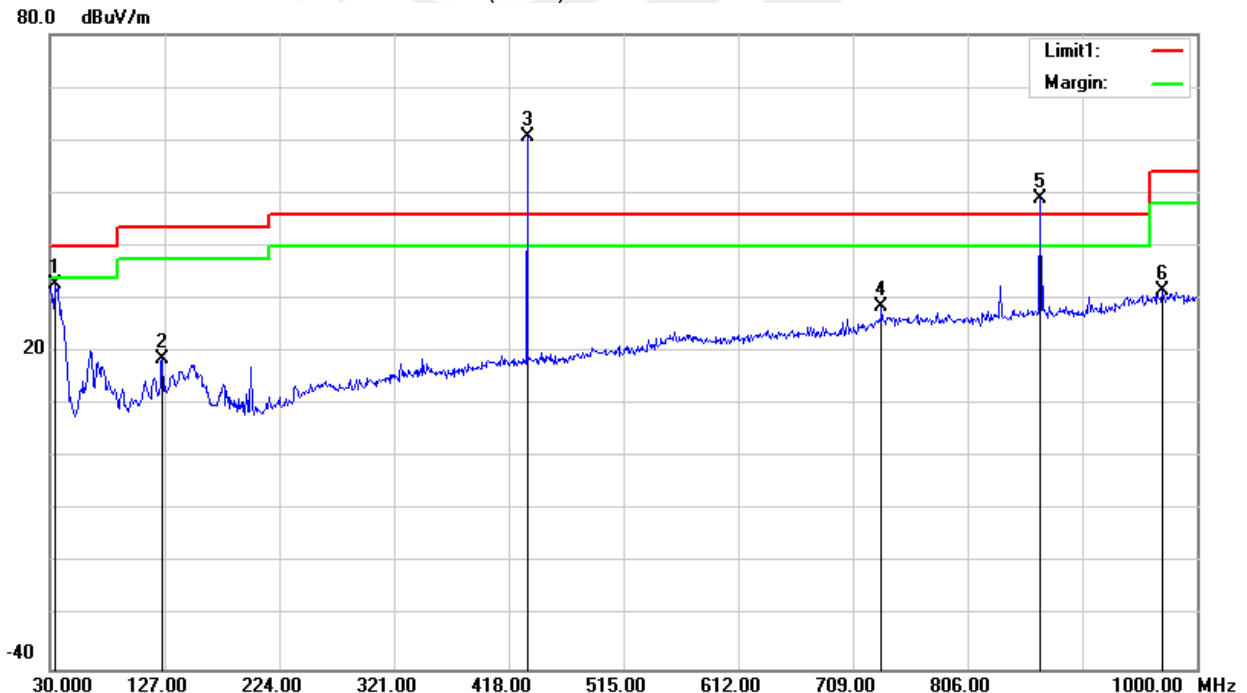
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	34.8500	48.01	-15.34	32.67	40.00	-7.33	peak
2	125.0600	36.86	-18.22	18.64	43.50	-24.86	peak
4	733.2500	30.80	-2.35	28.45	46.00	-17.55	peak
5	867.8400	49.41	-0.51	48.90	60.83	-11.93	peak
6	970.9000	29.62	2.06	31.68	54.00	-22.32	peak

Fundamental Frequency

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Duty cycle Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
3	433.9200	70.73	-10.12	-	60.61	100.83	-40.22	peak
3	433.9200	70.73	-10.12	2.90	57.71	80.83	-23.12	AVG

Remark:

1. All readings are Quasi-Peak and Average values
2. Margin = Result (Result = Reading + Factor) - Limit
3. Factor = LISN factor + Cable loss + Limiter (10dB)





Temperature:	23.1 °C	Relative Humidity:	60%
Test Voltage:	DC 3V	Phase:	Horizontal
Test Mode:	Mode 3		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	34.8500	36.18	-15.34	20.84	40.00	-19.16	peak
2	90.1400	37.58	-21.42	16.16	43.50	-27.34	peak
4	733.2500	31.19	-2.35	28.84	46.00	-17.16	peak
5	868.7200	48.95	-0.52	48.43	60.84	-16.29	peak
6	982.5400	28.62	2.52	31.14	54.00	-22.86	peak

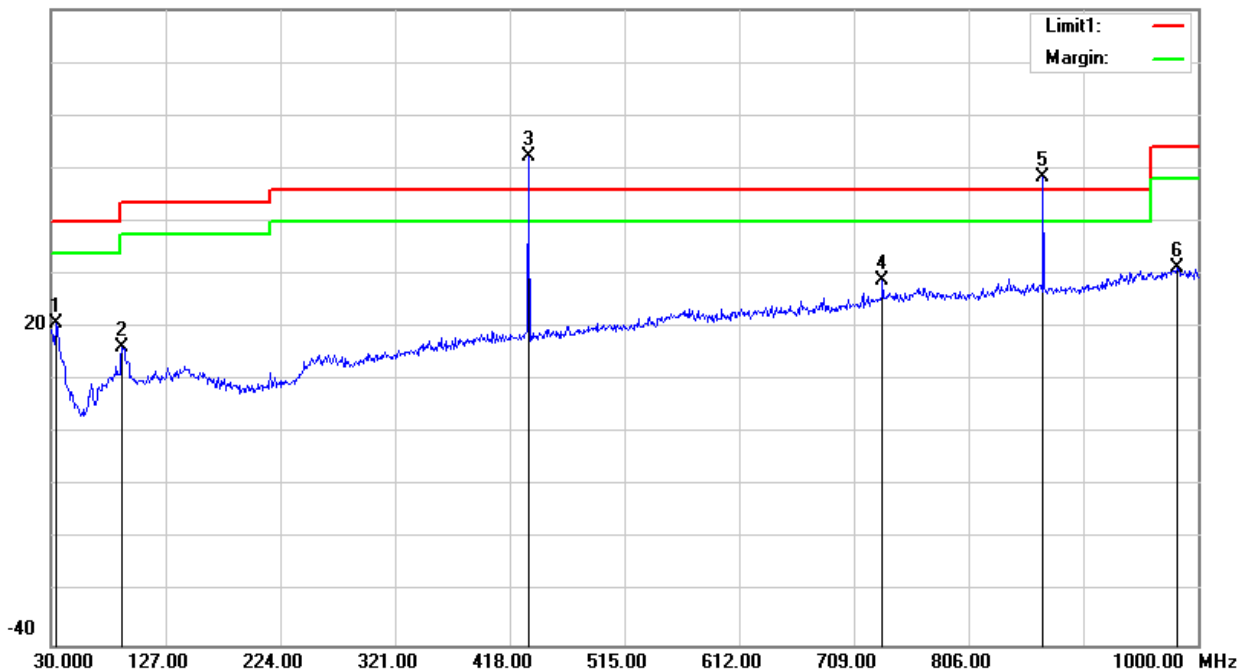
Fundamental Frequency

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Duty cycle Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
3	434.3600	62.48	-10.13	-	52.35	100.84	-48.49	peak
3	434.3600	62.48	-10.13	2.90	49.45	80.84	-31.39	AVG

Remark:

1. All readings are Quasi-Peak and Average values
2. Margin = Result (Result = Reading + Factor) - Limit
3. Factor = LISN factor + Cable loss + Limiter (10dB)

80.0 dBuV/m





Temperature:	23.1 °C	Relative Humidity:	60%
Test Voltage:	DC 3V	Phase:	Vertical
Test Mode:	Mode 3		

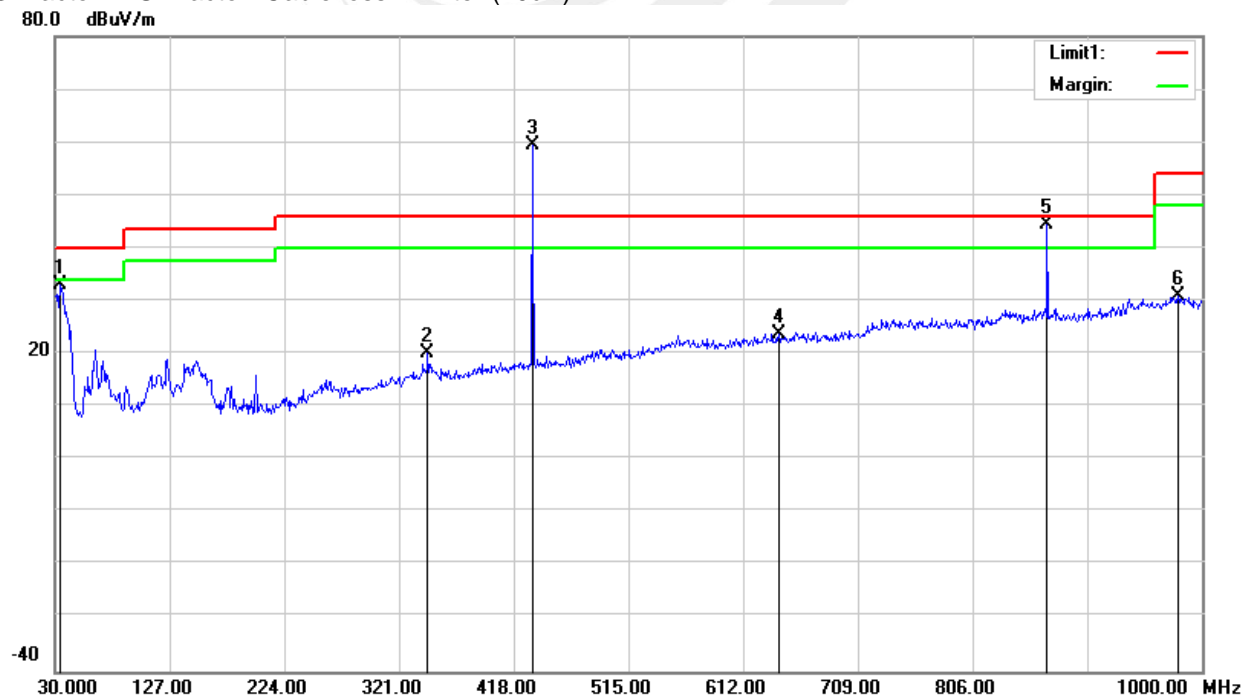
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	34.8500	48.40	-15.34	33.06	40.00	-6.94	peak
2	345.2500	33.36	-13.23	20.13	46.00	-25.87	peak
4	642.0700	28.49	-4.85	23.64	46.00	-22.36	peak
5	868.7200	45.07	-0.52	44.55	60.84	-16.29	peak
6	979.6300	28.32	2.65	30.97	54.00	-23.03	peak

Fundamental Frequency

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Duty cycle Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
3	434.3600	69.64	-10.13	-	59.51	100.84	-41.33	peak
3	434.3600	69.64	-10.13	2.90	56.61	80.84	-24.23	AVG

Remark:

1. All readings are Quasi-Peak and Average values
2. Margin = Result (Result = Reading + Factor) - Limit
3. Factor = LISN factor + Cable loss + Limiter (10dB)





PEAK TEST RESULTS:

Mode 1

Frequency	Reading	Detector	Amplifier	Loss	Antenna Factor	Corrected Factor	Corrected Amplitude	FCC Part 15.231/15.209/205		RX Antenna
								Limit	Margin	Polar
(MHz)	(dBμV/m)	(PK/QP/AV)	(dB)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(H/V)
1299.98	64.91	PK	45.1	4.0	25.1	-16.00	48.91	74	-25.09	H
1299.98	65.73	PK	45.1	4.0	25.1	-16.00	49.73	74	-24.27	V
1733.49	62.71	PK	44.1	5.3	25	-13.80	48.91	74	-25.09	H
1733.49	64.30	PK	44.1	5.3	25	-13.80	50.50	74	-23.50	V
2166.81	61.66	PK	43.8	5.4	25.9	-12.47	49.20	74	-24.80	H
2166.81	62.18	PK	43.8	5.4	25.9	-12.47	49.71	74	-24.29	V
2600.17	57.18	PK	44.4	6.0	27.6	-10.77	46.42	74	-27.58	H
2600.17	57.45	PK	44.4	6.0	27.6	-10.77	46.69	74	-27.31	V

Mode 2

Frequency	Reading	Detector	Amplifier	Loss	Antenna Factor	Corrected Factor	Corrected Amplitude	FCC Part 15.231/15.209/205		RX Antenna
								Limit	Margin	Polar
(MHz)	(dBμV/m)	(PK/QP/AV)	(dB)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(H/V)
1301.66	64.96	PK	45.1	4.0	25.1	-16.00	48.96	74	-25.04	H
1301.66	65.72	PK	45.1	4.0	25.1	-16.00	49.72	74	-24.28	V
1735.73	62.75	PK	44.1	5.3	25	-13.80	48.95	74	-25.05	H
1735.73	64.32	PK	44.1	5.3	25	-13.80	50.52	74	-23.48	V
2169.61	61.61	PK	43.8	5.4	25.9	-12.47	49.14	74	-24.86	H
2169.61	62.12	PK	43.8	5.4	25.9	-12.47	49.66	74	-24.34	V
2603.53	57.12	PK	44.4	6.0	27.6	-10.77	46.36	74	-27.64	H
2603.53	57.39	PK	44.4	6.0	27.6	-10.77	46.62	74	-27.38	V



Mode 3

Frequency	Reading	Detector	Amplifier	Loss	Antenna Factor	Corrected Factor	Corrected Amplitude	FCC Part 15.231/15.209/205		RX Antenna
								Limit	Margin	Polar
(MHz)	(dBμV/m)	(PK/QP/AV)	(dB)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(H/V)
1302.98	64.97	PK	45.1	4.0	25.1	-16.00	48.97	74	-25.03	H
1302.98	65.72	PK	45.1	4.0	25.1	-16.00	49.72	74	-24.28	V
1737.49	62.76	PK	44.1	5.3	25	-13.80	48.96	74	-25.04	H
1737.49	64.38	PK	44.1	5.3	25	-13.80	50.58	74	-23.42	V
2171.81	61.56	PK	43.8	5.4	25.9	-12.47	49.10	74	-24.90	H
2171.81	62.20	PK	43.8	5.4	25.9	-12.47	49.73	74	-24.27	V
2606.17	57.10	PK	44.4	6.0	27.6	-10.77	46.34	74	-27.66	H
2606.17	57.38	PK	44.4	6.0	27.6	-10.77	46.61	74	-27.39	V

Note:

1. Above 2.6 GHz the amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
2. The peak value is less than the AV limit, so AV data does not need to be tested.



5. BANDWIDTH TEST

5.1 LIMIT

FCC Part15.231,Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.231(C)	20 Bandwidth	The 20dB bandwidth of the emissions shall not exceed 0.25% of the center frequency	433.46-434.36	PASS

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> Measurement Bandwidth
RB	1% to 5% of the OBW
VB	$\geq 3\text{RBW}$
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

5.2 TEST REQUIREMENTS

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.

5.3 TEST PROCEDURE

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- Spectrum Setting: RBW= 1% to 5% of the OBW, VBW $\geq 3\text{RBW}$, Sweep time = Auto.

5.4 TEST SETUP



5.5 EUT OPERATION CONDITIONS

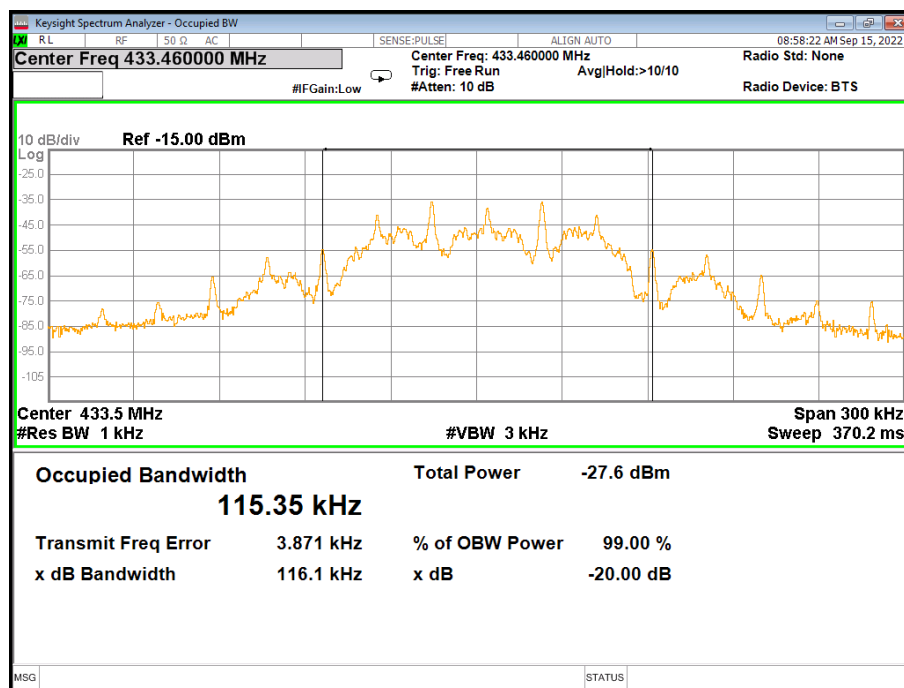
TX mode.



5.6 TEST RESULTS

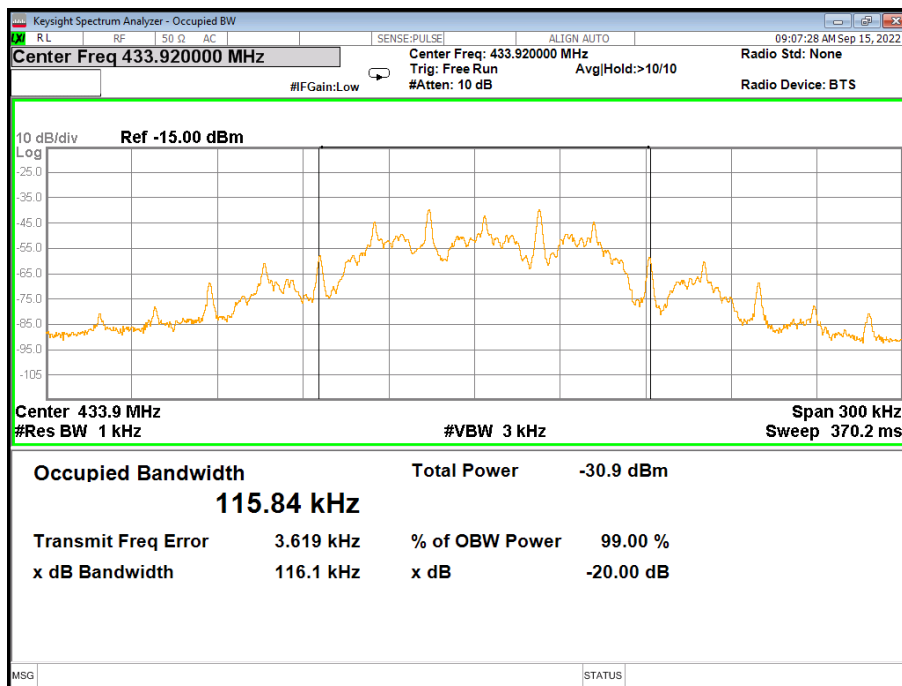
Centre Frequency	Measurement		
	20dB Bandwidth (KHz)	Limit(kHz)	Frequency Range (MHz)
433.46	116.1	1083.65	PASS
433.92	116.1	1084.8	PASS
434.36	115.9	1085.9	PASS

433.46MHz

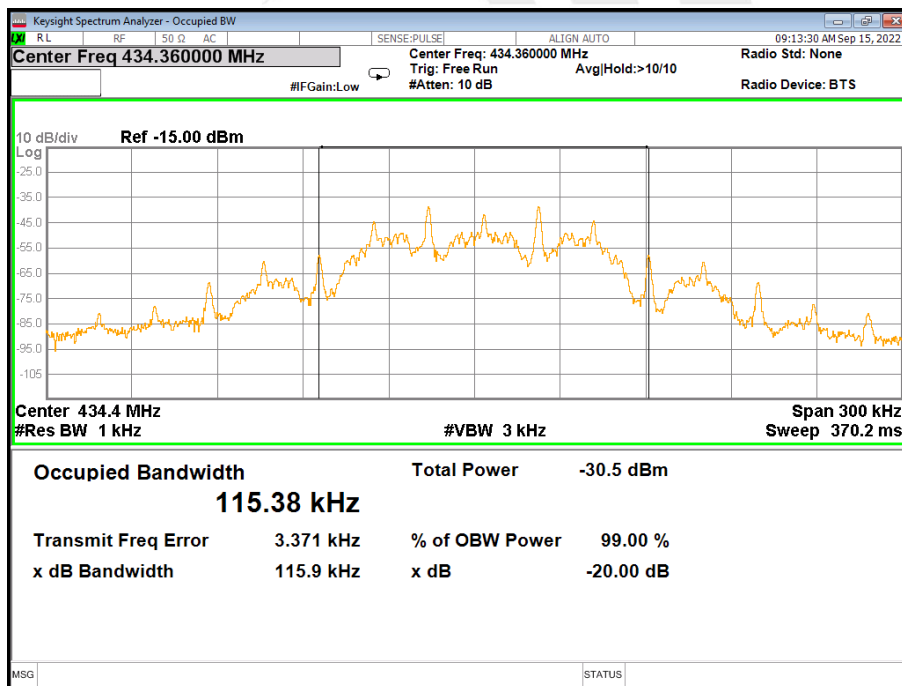




433.92MHz



434.36MHz



6. DUTY CYCLE

6.1 TEST PROCEDURE

The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.

The Duty Cycle Was Determined By The Following Equation: To Calculate The Actual Field Intensity, The Duty Cycle Correction Factor In Decibel Is Needed For Later Use And Can Be Obtained From Following Conversion

Duty Cycle(%)=Total On Interval In A Complete Pulse Train/ Length Of A Complete Pulse Train * %

Duty Cycle Correction Factor(dB)=20 * Log10(Duty Cycle(%))

6.2 TEST SETUP



6.3 EUT OPERATION CONDITIONS

TX mode.



6.4 TEST RESULTS

FCC Part15.231(a)	
Total On interval in a complete pulse train(ms)	71.6
Length of a complete pulse train(ms)	100
Duty Cycle (%)	71.60%
Duty Cycle Correction Factor(dB)	2.90

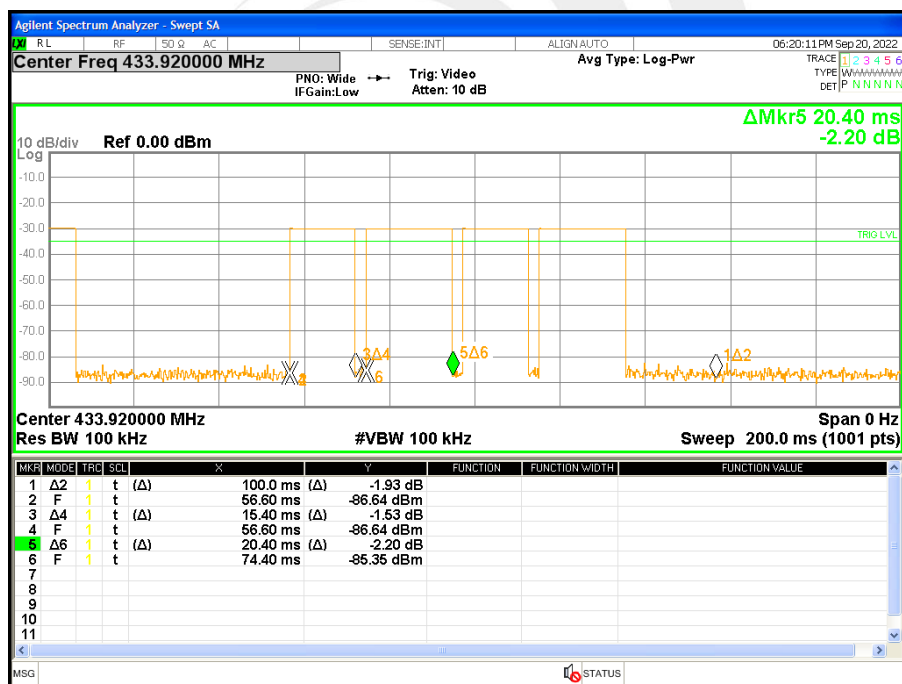
Refer to the duty cycle plot (as below), This device meets the FCC requirement. Length of a complete pulse train

Remark:FCC part15.35(c) required that a complete pulse train is more than 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.

Note: Number of pulse train 1 = 2, Time of single pulse train 1 = 15.4ms;

Number of pulse train 2 = 2, Time of single pulse train 2 = 20.4ms;

Total on interval in a complete pulse train= Number of pulse train 1x Time of single pulse train 1+
Number of pulse train 2x Time of single pulse train 2=2x15.4+2x20.4=71.6ms



7. AUTOMATICALLY DEACTIVATE

7.1 STANDARD REQUIREMENT

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

7.2 TEST PROCEDURE

The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.

Spectrum Setting: RBW= 100KHz, VBW=300KHz, Sweep time = Auto.

Note: Only press launch about 0.15 s

Note:

(1)Refer to the plot (As Below), We find a manually operated transmitter shall employ a switch that will automatically deactivate the transmitteri immediately, within not more than 5 seconds of being released.

(2)The EUT is comply with FCC PART 15 clause 15.231(a)(1) manually working mode are pre-tested and only the worst result is reported.

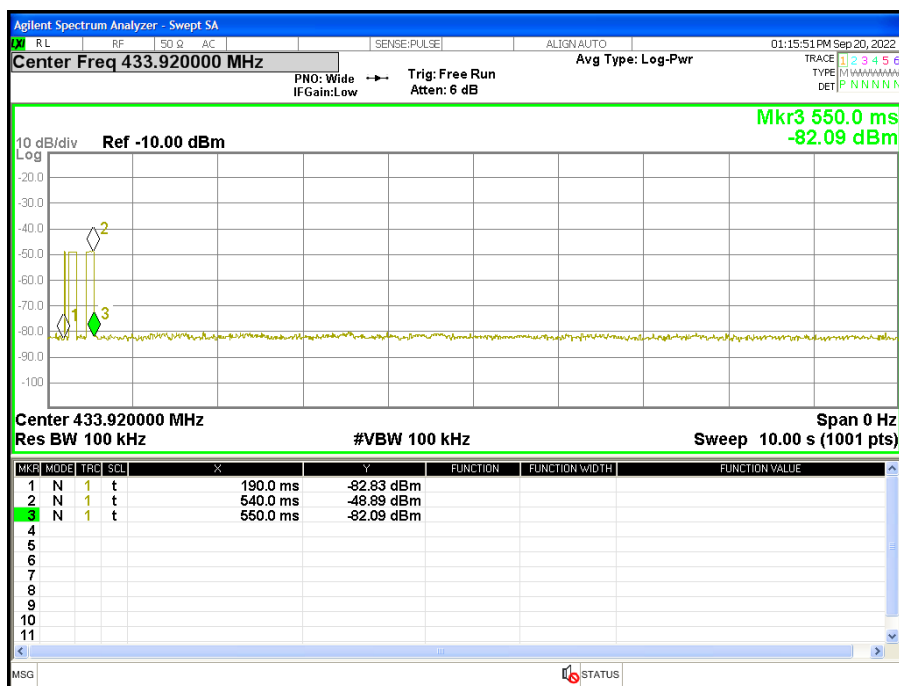
7.3 TEST SETUP





7.4 TEST RESULTS

Activation time	Limit(Sec)	Result
360 ms	5 s	Pass



Mark 1: Hold down the Key(Start transmitting)

Mark 2: Loose the Key

Mark 3: Stop transmitting

Activation time= Mark 3- Mark 1=550-190=360 ms



8. ANTENNA REQUIREMENT

8.1 STANDARD REQUIREMENT

According to the FCC Part 15 Paragraph 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 to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

8.2 EUT ANTENNA

The EUT antenna is PCB Antenna. It conforms to the standard requirements.





APPENDIX 1-PHOTOS OF TEST SETUP

Note: See test photos in setup photo document for the actual connections between Product and support equipment.

※※※※※END OF THE REPORT※※※※※

