

FCC Radio Test Report

FCC ID: OMOTX191TH

This report concerns: ☒ Original Grant

Project No. : 1907C198
Equipment : OUTDOOR SENSOR
Brand Name : LA CROSSE
Test Model : TX191TH
Series Model : TX191TH-INT, TX191THvX, TX191THvX-INT, TX191TH-XX, TX191TH-XX-INT (X can be 0~9, the difference for different version are the product shell color, software, and packaging upgrade version number, when upgrade a version the number progressed to next number.)
Applicant : La Crosse Technology Ltd.
Address : 2809 Losey Blvd. S. La Crosse Wisconsin 54601 United States
Manufacturer : La Crosse Technology Ltd.
Address : 2809 Losey Blvd. S. La Crosse Wisconsin 54601 United States
Factory : La Crosse Technology Ltd.
Address : 2809 Losey Blvd. S. La Crosse Wisconsin 54601 United States
Date of Receipt : Jul. 25, 2019
Date of Test : Jul. 26, 2019 ~ Aug. 06, 2019
Issued Date : Aug. 12, 2019
Report Version : R00
Test Sample : Engineering Sample No.: DG1907261
Standard(s) : FCC Part15, Subpart C(15.231)
 ANSI C63.10-2013

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.

Rose. Liu

Prepared by : Rose Liu

Ethan Ma

Approved by : Ethan Ma



Certificate #5123.02

Add: No.3, Jinshagang 1st Road, Shixia, Dalang Town, Dongguan, Guangdong, China.

Tel: +86-769-8318-3000

Web: www.newbtl.com

Declaration

BTL represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with standards traceable to international standard(s) and/or national standard(s).

BTL's reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. **BTL** shall have no liability for any declarations, inferences or generalizations drawn by the client or others from **BTL** issued reports.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, A2LA, or any agency of the U.S. Government.

This report is the confidential property of the client. As a mutual protection to the clients, the public and ourselves, the test report shall not be reproduced, except in full, without our written approval.

BTL's laboratory quality assurance procedures are in compliance with the **ISO/IEC 17025** requirements, and accredited by the conformity assessment authorities listed in this test report.

BTL is not responsible for the sampling stage, so the results only apply to the sample as received.

The information, data and test plan are provided by manufacturer which may affect the validity of results, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements of applied standards and in all the possible configurations as representative of its intended use.

Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

Please note that the measurement uncertainty is provided for informational purpose only and are not use in determining the Pass/Fail results.

Table of Contents	Page
REPORT ISSUED HISTORY	5
1 . SUMMARY OF TEST RESULTS	6
1.1 TEST FACILITY	7
1.2 MEASUREMENT UNCERTAINTY	7
1.3 TEST ENVIRONMENT CONDITIONS	7
2 . GENERAL INFORMATION	8
2.1 GENERAL DESCRIPTION OF EUT	8
2.2 DESCRIPTION OF TEST MODES	9
2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED	10
2.4 DESCRIPTION OF SUPPORT UNITS	10
3 . AC POWER LINE CONDUCTED EMISSIONS TEST	11
3.1 Limit	11
3.2 TEST PROCEDURE	11
3.3 DEVIATION FROM TEST STANDARD	11
3.4 TEST SETUP	12
3.5 EUT OPERATING CONDITIONS	12
3.6 EUT TEST CONDITIONS	12
3.7 TEST RESULTS	12
4 . RADIATED EMISSION TEST	13
4.1 FIELD STRENGTH OF FUNDAMENTAL EMISSIONS MEASUREMENT LIMIT	13
4.2 MEASURING INSTRUMENTS AND SETTING (FIELD STRENGTH OF FUNDAMENTAL EMISSIONS)	13
4.3 RADIATED EMISSIONS MEASUREMENT	14
4.4 DWELL TIME OF PERIODIC OPERATION MEASUREMENT	15
4.5 TEST PROCEDURE	17
4.6 DEVIATION FROM TEST STANDARD	17
4.7 TEST SETUP	17
4.8 TEST RESULTS (9kHz to 30MHz)	19
4.9 TEST RESULTS (30MHz to 1000MHz)	19
4.10 TEST RESULTS (Above 1000MHz)	19
5 . 20dB SPECTRUM BANDWIDTH MEASUREMENT	20
5.1 MEASURING INSTRUMENTS AND SETTING	20

Table of Contents	Page
5.2 TEST PROCEDURES	20
5.3 TEST SETUP LAYOUT	20
5.4 TEST DEVIATION	20
5.5 EUT OPERATION DURING TEST	20
6.6 TEST RESULTS	20
6 . TIMING TESTING	21
6.1 MEASURING INSTRUMENTS AND SETTING	21
6.2 TEST PROCEDURES	21
6.3 TEST SETUP LAYOUT	21
6.4 TEST DEVIATION	21
6.5 EUT OPERATION DURING TEST	21
6.6 TEST RESULTS	21
7 . MEASUREMENT INSTRUMENTS LIST	22
8 . EUT TEST PHOTO	24
APPENDIX A - AC POWER LINE CONDUCTED EMISSIONS	27
APPENDIX B - RADIATED EMISSION - 9 KHz to 30 MHz	28
APPENDIX C - RADIATED EMISSION - 30MHz to 1000MHz	33
APPENDIX D - RADIATED EMISSION - ABOVE 1000MHz	38
APPENDIX E - 20dB SPECTRUM BANDWIDTH	41
APPENDIX F - TIMING TESTING	43

REPORT ISSUED HISTORY

Report Version	Description	Issued Date
R00	Original Issue.	Aug. 12, 2019

1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

FCC Part15, Subpart C (15.231)				
Standard(s) Section	Test Item	Test Result	Judgment	Remark
15.207	AC Power Line Conducted Emissions	Appendix A	N/A	NOTE (1)
15.209& 15.231(e)	Radiated Spurious Emission	Appendix B Appendix C Appendix D	PASS	-----
15.231(c)	20dB Occupied Bandwidth Measurement	Appendix E	PASS	-----
15.231(e)	Timing Testing	Appendix F	PASS	-----

Note:

- (1) "N/A" denotes test is not applicable in this test report
- (2) The EUT's maximum operating frequency is 433.92MHz.

1.1 TEST FACILITY

The test facilities used to collect the test data in this report is at the location of No.3, Jinshagang 1st Road, Shixia, Dalang Town, Dongguan, Guangdong, China.

BTL's test firm number for FCC: 357015

BTL's designation number for FCC: CN1240

1.2 MEASUREMENT UNCERTAINTY

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))

The BTL measurement uncertainty as below table:

A. Radiated Measurement :

Test Site	Method	Measurement Frequency Range	Ant. H / V	U, (dB)
DG-CB03 (3m)	CISPR	9 kHz~30 MHz	V	3.79
		9 kHz~30 MHz	H	3.57
		30 MHz~200 MHz	V	4.88
		30 MHz~200 MHz	H	4.14
		200 MHz~1,000 MHz	V	4.62
		200 MHz~1,000 MHz	H	4.80

Test Site	Method	Measurement Frequency Range	U,(dB)
DG-CB03 (3m)	CISPR	1GHz ~ 6GHz	4.58
		6GHz ~ 18GHz	5.18

Note: Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

1.3 TEST ENVIRONMENT CONDITIONS

Test Item	Temperature	Humidity	Test Voltage	Tested By
Radiated Emissions-9K-30MHz	25°C	60%	DC 3V	Robin Zhuang
Radiated Emissions-30 MHz to 1GHz	24°C	68%	DC 3V	Bert Xu
Radiated Emissions-Above 1000 MHz	24°C	68%	DC 3V	Bert Xu
20dB Occupied Bandwidth Measurement	24.8°C	61.5%	DC 3V	Jonas Chen
Timing Testing	24.8°C	61.5%	DC 3V	Jonas Chen

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	OUTDOOR SENSOR	
Brand Name	LA CROSSE	
Test Model	TX191TH	
Series Model	TX191TH-INT, TX191THvX, TX191THvX-INT, TX191TH-XX, TX191TH-XX-INT	
Model Difference(s)	X can be 0~9, the difference for different version are the product shell color, software, and packaging upgrade version number, when upgrade a version the number progressed to next number.	
Power Source	Supplied from 2*AA battery	
Power Rating	DC 3V	
Product Description	Product Type	Remote Control Device
	Operation Frequency	433.92 MHz
	Modulation Type	ASK
	Number Of Channel	1CH, please see note 2.
	Antenna Designation	Loop antenna
	Field Strength	72.54 dBuV/m (AV Max.)

Note:

- For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
- Channel List:

Channel	Frequency (MHz)
01	433.92

2.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generated from EUT, the test system was pre-scanning tested based 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.

Test Mode	Description
Mode 1	TX CH 433.92MHz

Note:

- (1) EUT uses a new battery.
- (2) The EUT is considered a portable unit, it was pre-tested on the positioned of each 3 axis. The worst case was found positioned on Y-plane. Therefore only the test data of this Y-plane was used for radiated emission measurement test.

2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



2.4 DESCRIPTION OF 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.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.
-	-	-	-	-

Item	Cable Type	Shielded Type	Ferrite Core	Length
-	-	-	-	-

Note:

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

3. AC POWER LINE CONDUCTED EMISSIONS TEST

3.1 Limit

Frequency of Emission (MHz)	Limit (dB μ V)	
	Quasi-peak	Average
0.15 - 0.50	66 to 56*	56 to 46*
0.50 - 5.0	56	46
5.0 - 30.0	60	50

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.
- (3) The test result calculated as following:
 Measurement Value = Reading Level + Correct Factor
 Correct Factor = Insertion Loss + Cable Loss + Attenuator Factor (if use)
 Margin Level = Measurement Value – Limit Value

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

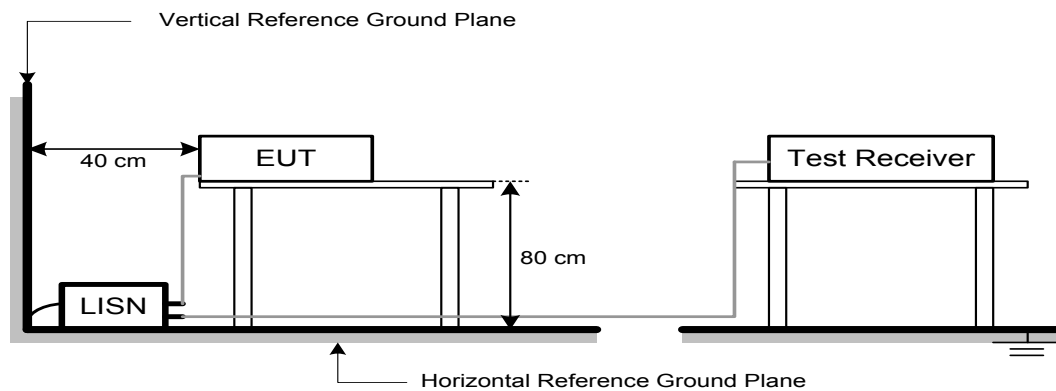
3.2 TEST PROCEDURE

- a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipment powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. 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.
- c. 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.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.3 DEVIATION FROM TEST STANDARD

No deviation

3.4 TEST SETUP



3.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical function (as a customer would normally use it), EUT was programmed to be in continuously transmitting data or hopping on mode.

3.6 EUT TEST CONDITIONS

Temperature: N/A Relative Humidity: N/A Test Voltage: N/A

3.7 TEST RESULTS

Please refer to the APPENDIX A.

Remark:

- (1) All readings are QP Mode value unless otherwise stated AVG in column of 'Note'. If the QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only QP Mode was measured, but AVG Mode didn't perform in this case, a "*" marked in AVG Mode column of Interference Voltage Measured.
- (2) Measuring frequency range from 150 kHz to 30 MHz.

4. RADIATED EMISSION TEST

4.1 FIELD STRENGTH OF FUNDAMENTAL EMISSIONS MEASUREMENT LIMIT

Frequency Band (MHz)	Fundamental EmissionsLimit($\mu\text{V/m}$) at 3m
40.66-40.70	1000
70-130	500
130-174	500-1500(**)
174-260	1500
260-470	1500-5000(**)
Above 470	5000

**1. Linear interpolations, the formulas for calculating the maximum permitted fundamental field strengths are as follows:

- (1) For the band 130 - 174 MHz, $\mu\text{V/m}$ at 3 meters = $22.72727 \times (\text{operating frequency, MHz}) - 2454.545$;
- (2) For the band 260 - 470 MHz, $\mu\text{V/m}$ at 3 meters = $16.6667 \times (\text{operating frequency, MHz}) - 2833.3333$.

So the field strength of emission limits has been calculated in below table.

Carrier Frequency (MHz)	Fundamental EmissionsLimit(dBuV/m) at 3m
433.92 MHz	72.87 (Average)
433.92 MHz	92.87 (Peak)

4.2 MEASURING INSTRUMENTS AND SETTING (FIELD STRENGTH OF FUNDAMENTAL EMISSIONS)

Receiver Parameter	Setting
Attenuation	Auto
Center Frequency	Fundamental Frequency
RBW	120 kHz
Detector	Peak / Average

4.3 RADIATED EMISSIONS MEASUREMENT

Devices complying with 47 CFR FCC part 15 subpart C, section 15.231(e). The field strength of emissions from intentional radiators at 3 meters operated under this Section shall not exceed the following:

Frequency Band (MHz)	Spurious Emissions Limit(μV/m) at 3m
40.66-40.70	100
70-130	50
130-174	50-150(**)
174-260	150
260-470	150-500(**)
Above 470	500

**1. Linear interpolations, the formulas for calculating the maximum permitted fundamental field strengths are as follows:

(1) For the band 130 - 174 MHz, $\mu\text{V/m}$ at 3 meters = $22.72727 \times (\text{operating frequency, MHz}) - 2454.545$;

(2) For the band 260 - 470 MHz, $\mu\text{V/m}$ at 3 meters = $16.6667 \times (\text{operating frequency, MHz}) - 2833.3333$.

(3) The maximum permitted unwanted emissions level is 20 dB below the maximum permitted fundamental level. In addition field strength of any emissions which appear inside of the restriction band shall not exceed the general radiated emissions limits in Section 15.209(a).

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	$2400/F(\text{KHz})$	300
0.490~1.705	$24000/F(\text{KHz})$	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~90kHz for PK/AVG detector
Start ~ Stop Frequency	90kHz~110kHz for QP detector
Start ~ Stop Frequency	110kHz~490kHz for PK/AVG detector
Start ~ Stop Frequency	490kHz~30MHz for QP detector
Start ~ Stop Frequency	30MHz~1000MHz for QP detector

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1MHz / 1MHz for Peak, AV Mode with Dwell time

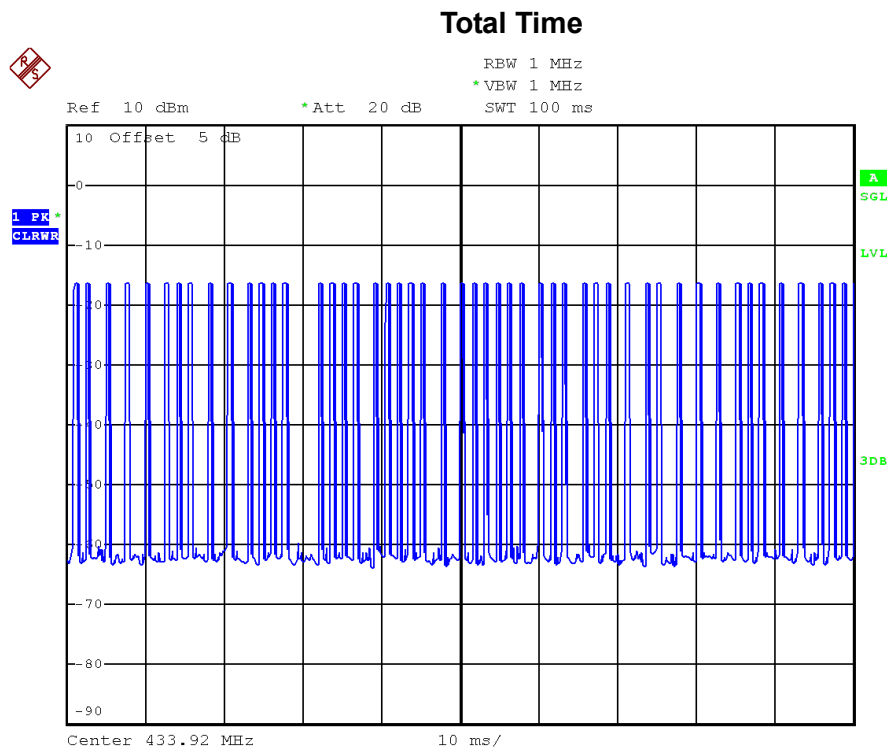
4.4 DWELL TIME OF PERIODIC OPERATION MEASUREMENT

Duty Cycle = $(N1*L1+N2*L2+...+Nn-1*Ln-1+Nn*Ln)/100$ or T

Duty Cycle = $(0.52*13+0.32*38)/100$
 $= 18.92/100$
 $= 18.92\%$

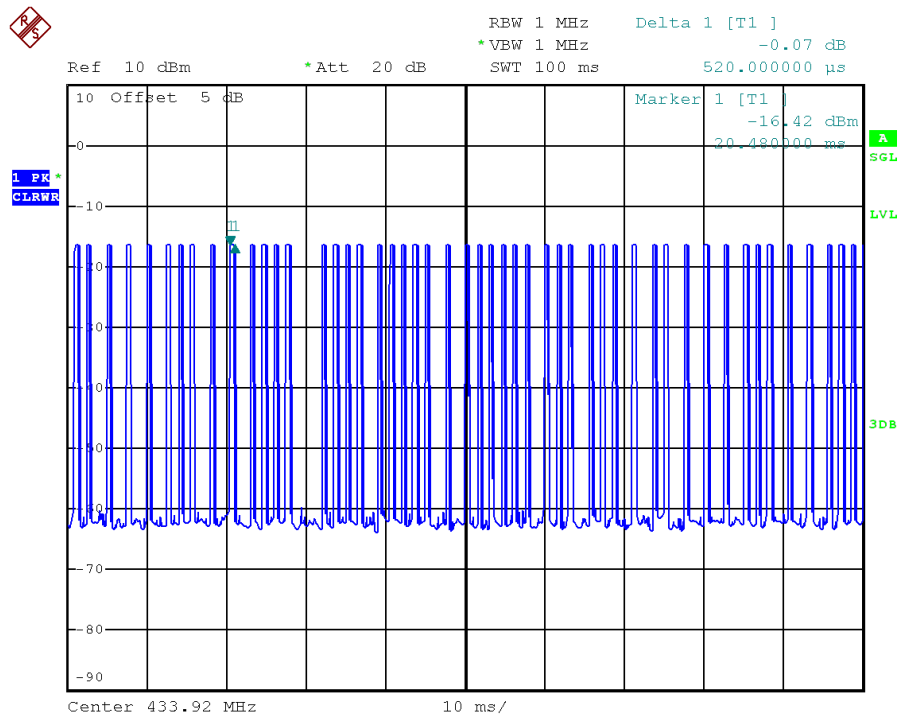
Average Reading = Peak Reading (dBuV/m) + $20\log$ (Duty cycle)

Average Reading = Peak+ $20*\log$ (Duty Cycle) = Peak – 14.462



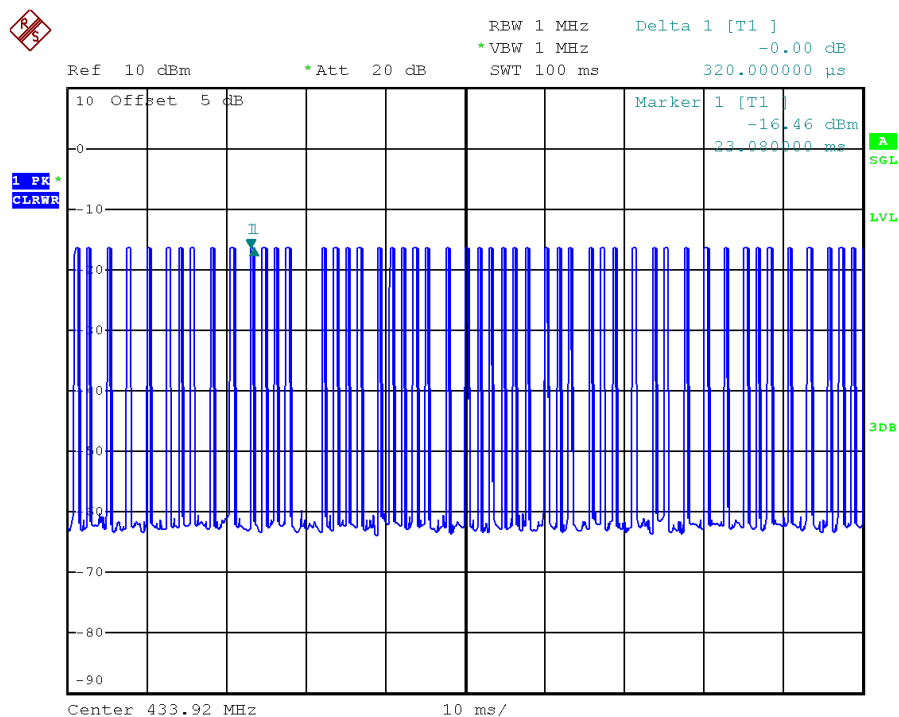
Date: 6.AUG.2019 12:52:59

On Time: 0.52ms*13



Date: 6.AUG.2019 12:50:11

On Time: 0.32ms*38



Date: 6.AUG.2019 12:51:50

4.5 TEST PROCEDURE

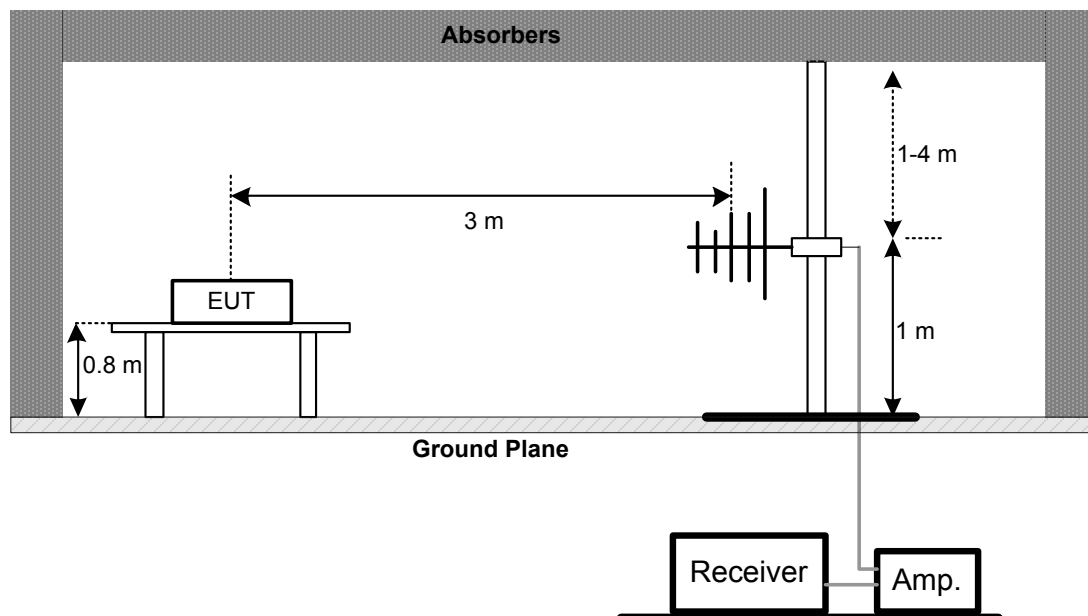
- a. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
- b. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 1.5 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(above 1GHz)
- c. The height of the equipment or of the substitution antenna shall be 0.8 m or 1.5 m, the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights find the maximum reading (used Bore sight function).
- e. The receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1GHz.
- f. The initial step in collecting radiated emission data is a receiver peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- g. All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform. (below 1GHz)
- h. All readings are Peak Mode value unless otherwise stated AVG in column of Note. If the Peak Mode Measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak & AVG Limits and then only Peak Mode was measured, but AVG Mode didn't perform. (above 1GHz)
- i. For the actual test configuration, please refer to the related Item –EUT Test Photos.

4.6 DEVIATION FROM TEST STANDARD

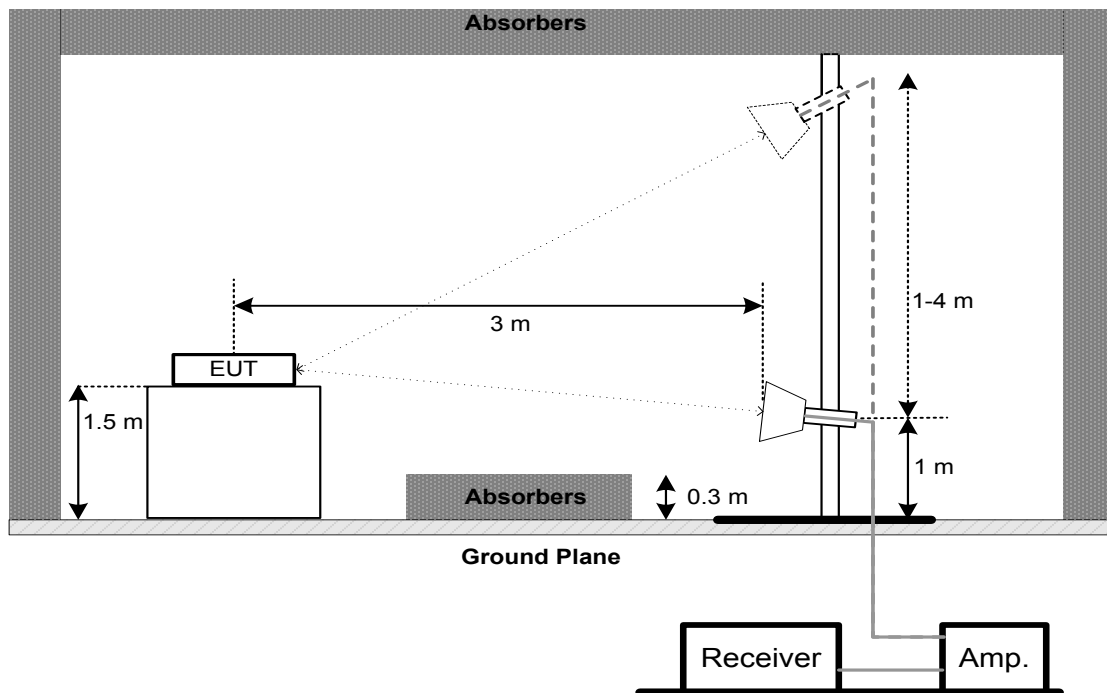
No deviation

4.7 TEST SETUP

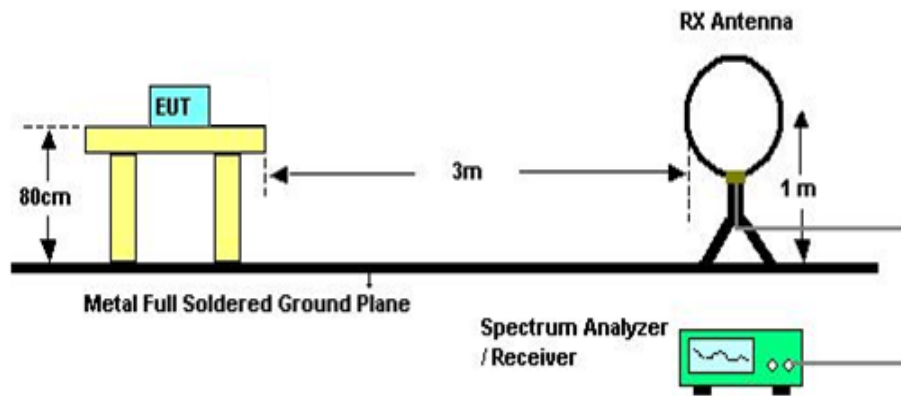
(A) Radiated Emission Test Set-Up Frequency Below 1 GHz



(B) Radiated Emission Test Set-Up Frequency Above 1 GHz



(C) For Radiated Emissions Below 30MHz



4.8 TEST RESULTS (9kHz to 30MHz)

Please refer to the Appendix B.

Remark:

- (1) The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.
- (2) Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB);.
- (3) Limit line = specific limits (dBuV) + distance extrapolation factor..

4.9 TEST RESULTS (30MHz to 1000MHz)

Please refer to the Appendix C.

Remark:

- (1) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission
- (2) A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.
- (3) EUT Orthogonal Axis:
"X" - denotes Laid on Table; "Y" - denotes Vertical Stand; "Z" - denotes Side Stand
- (4) During the measurements above 1 GHz it is taken care of that the EUT is always within the 3 dB cone of radiation BW of the used antenna

4.10 TEST RESULTS (Above 1000MHz)

Please refer to the Appendix D.

Remark:

- (1) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission
- (2) A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.
- (3) EUT Orthogonal Axis:
"X" - denotes Laid on Table; "Y" - denotes Vertical Stand; "Z" - denotes Side Stand
- (4) During the measurements above 1 GHz it is taken care of that the EUT is always within the 3 dB cone of radiation BW of the used antenna.

5. 20dB SPECTRUM BANDWIDTH MEASUREMENT

Limit

The bandwidth of the emissions shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. So the emission bandwidth limits have been calculated in below table.

Fundamental Frequency	20dB Bandwidth Limits (MHz)
433.92 MHz	1.0848

5.1 MEASURING INSTRUMENTS AND SETTING

Please refer to section 5 in this report. The following table is the setting of the Spectrum Analyzer.

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> 20dB Bandwidth
RB	10 kHz
VB	10 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

5.2 TEST PROCEDURES

1. The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.
2. The resolution bandwidth of 10 kHz and the video bandwidth of 10 kHz were used.
3. Measured the spectrum width with power higher than 20dB below carrier.

5.3 TEST SETUP LAYOUT



5.4 TEST DEVIATION

There is no deviation with the original standard.

5.5 EUT OPERATION DURING TEST

The EUT was programmed to be in continuously transmitting mode.

6.6 TESTRESULTS

Please refer to the Appendix E.

6. TIMING TESTING

Limit

In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

6.1 MEASURING INSTRUMENTS AND SETTING

Please refer to section 6 in this report. The following table is the setting of the Spectrum Analyzer.

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	Zero Span
RB	1MHz
VB	1MHz
Detector	Peak
Trace	Max Hold
Sweep Time	100 seconds

6.2 TEST PROCEDURES

1. The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.
2. The resolution bandwidth of 1MHz and the video bandwidth of 1MHz were used.

6.3 TEST SETUP LAYOUT



6.4 TEST DEVIATION

There is no deviation with the original standard.

6.5 EUT OPERATION DURING TEST

The EUT was programmed to be in normal mode.

6.6 TEST RESULTS

Please refer to the Appendix F.

7. MEASUREMENT INSTRUMENTS LIST

Radiated Emissions - 9 kHz to 30 MHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Loop Antenna	EM	EM-6876-1	230	Jan. 15, 2020
2	Cable	N/A	RG 213/U	C-102	May 31, 2020
3	EMI Test Receiver	R&S	ESCI	100895	Mar. 10, 2020
4	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A

Radiated Emission Measurement - Below 1GHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Antenna	Schwarzbeck	VULB9160	9160-3232	Mar. 09, 2020
2	Amplifier	HP	8447D	2944A09673	Aug. 11, 2019
3	Receiver	Agilent	N9038A	MY52130039	Aug. 11, 2019
4	Cable	emci	LMR-400(30MHz-1 GHz)(8m+5m)	N/A	May 24, 2020
5	Controller	CT	SC100	N/A	N/A
6	Controller	MF	MF-7802	MF780208416	N/A
7	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A

Radiated Emission Measurement - Above 1GHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Double Ridged Guide Antenna	ETS	3115	75789	Mar. 09, 2020
2	Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	9170319	Jun. 23, 2020
3	Amplifier	Agilent	8449B	3008A02333	Mar. 10, 2020
4	Microwave Preamplifier With Adaptor	EMC INSTRUMENT	EMC2654045	980039 & HA01	Mar. 10, 2020
5	Receiver	Agilent	N9038A	MY52130039	Aug. 11, 2019
6	Controller	CT	SC100	N/A	N/A
7	Controller	MF	MF-7802	MF780208416	N/A
8	Cable	mitron	B10-01-01-12M	18072744	Jul. 29, 2020
9	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A

20dB Spectrum Bandwidth Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP40	100185	Aug. 11, 2019
2	Attenuator	WOKEN	6SM3502	VAS1214NL	Feb. 12, 2020

Timing Testing					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP40	100185	Aug. 11, 2019
2	Attenuator	WOKEN	6SM3502	VAS1214NL	Feb. 12, 2020

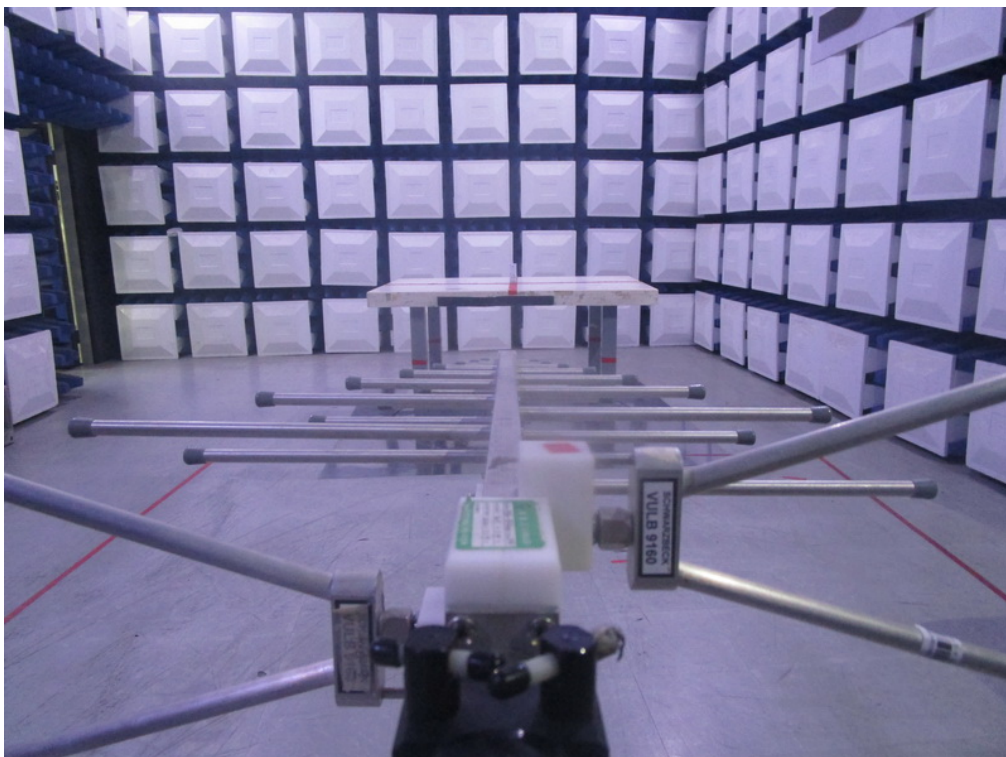
Remark: "N/A" denotes no model name, serial no. or calibration specified.

All calibration period of equipment list is one year.

8. EUT TEST PHOTO**Radiated Measurement Photos****9KHz to 30MHz**

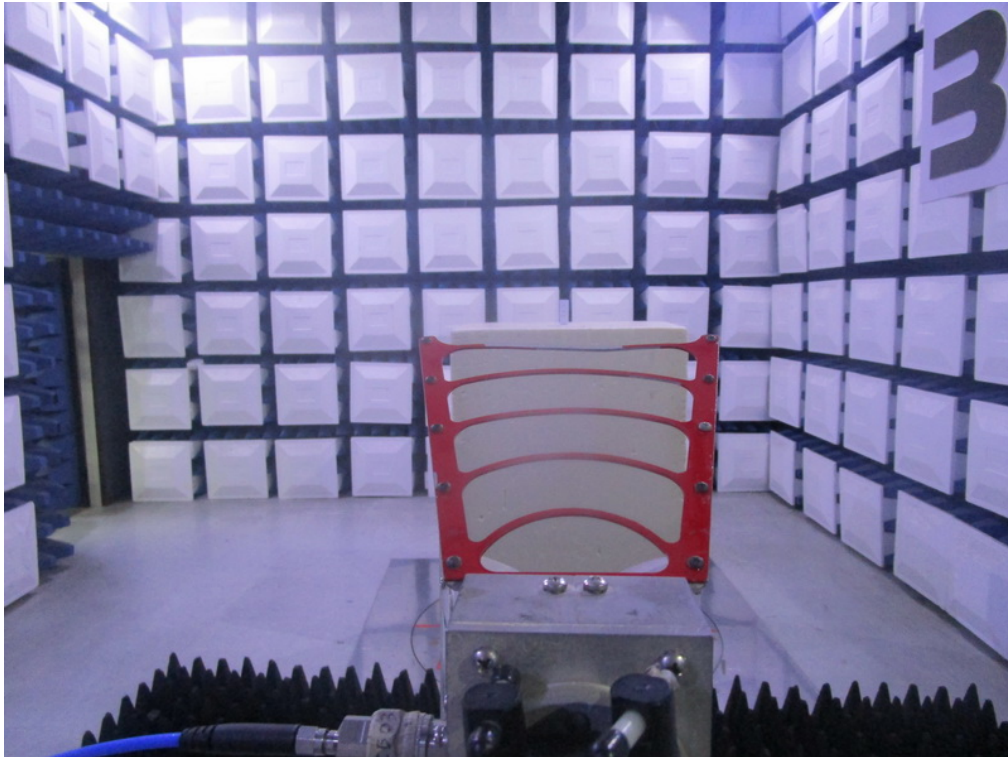
Radiated Measurement Photos

30MHz to 1000MHz



Radiated Measurement Photos

Above 1000MHz



APPENDIX A - AC POWER LINE CONDUCTED EMISSIONS

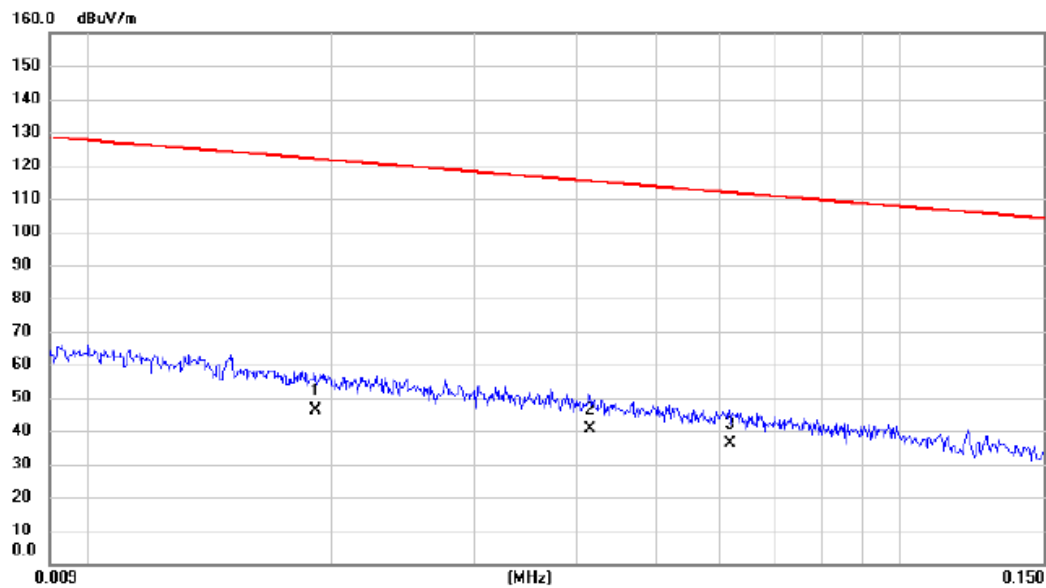
Test Mode: N/A

Note: "N/A" denotes test is not applicable to this device.

APPENDIX B - RADIATED EMISSION - 9 KHz to 30 MHz

Test Mode: TX CH 433.92MHz

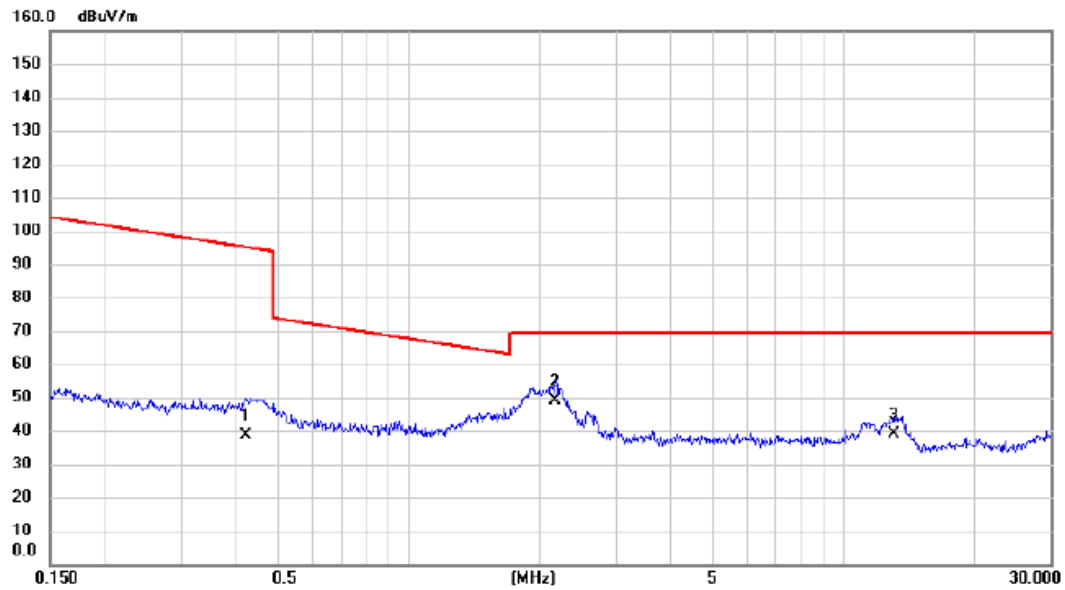
Ant 0°



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Margin		
		MHz	Level	Factor	ment			Detector	Comment
			dBuV	dB	dBuV/m	dBuV/m	dB		
1		0.0191	32.18	14.09	46.27	121.98	-75.71	AVG	
2	*	0.0415	26.59	13.90	40.49	115.24	-74.75	AVG	
3		0.0617	22.56	13.74	36.30	111.80	-75.50	AVG	

Test Mode: TX CH 433.92MHz

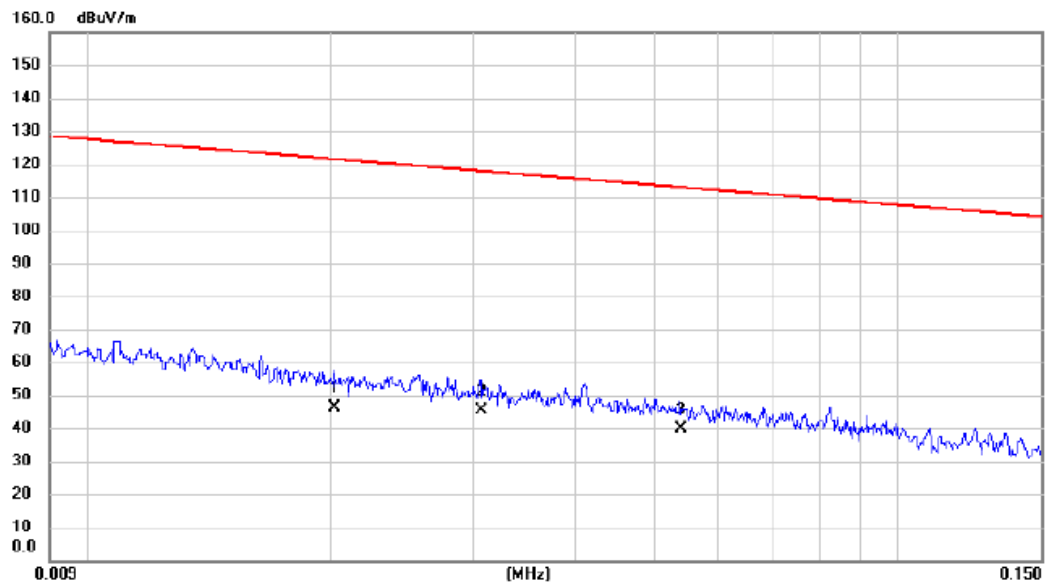
Ant 0°



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1		0.4215	25.45	13.25	38.70	95.11	-56.41	AVG	
2	*	2.1783	37.15	11.71	48.86	69.54	-20.68	QP	
3		13.0575	27.56	11.60	39.16	69.54	-30.38	QP	

Test Mode: TX CH 433.92MHz

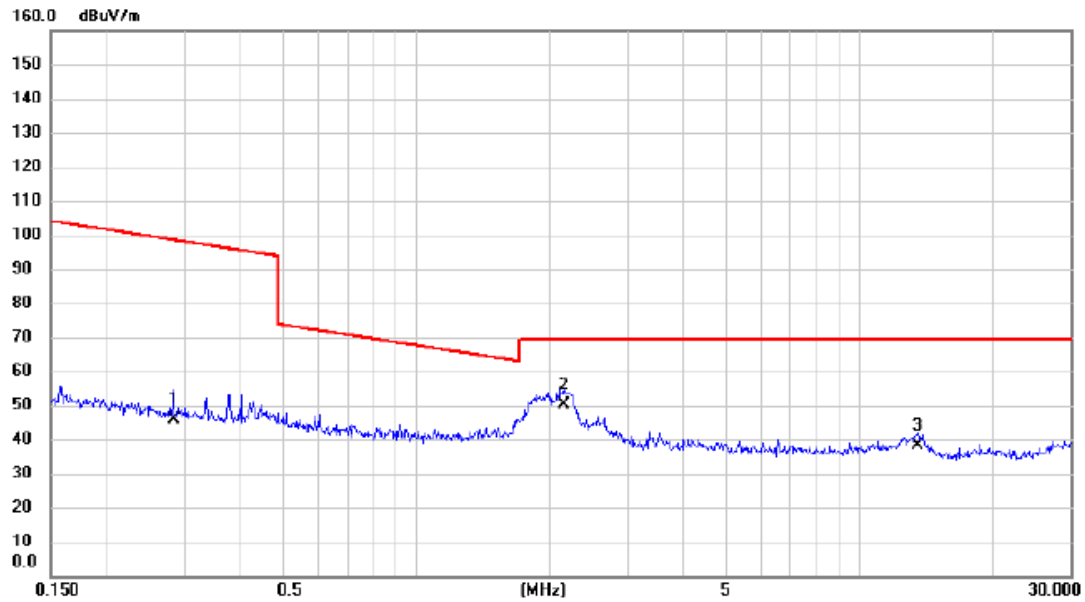
Ant 90°



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1		0.0202	32.49	13.82	46.31	121.50	-75.19	AVG	
2	*	0.0306	31.56	13.86	45.42	117.89	-72.47	AVG	
3		0.0540	25.78	13.87	39.65	112.96	-73.31	AVG	

Test Mode: TX CH 433.92MHz

Ant 90°



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Margin		
		MHz	Level	Factor	ment			Detector	Comment
1		0.2833	32.12	13.58	45.70	98.56	-52.86	AVG	
2	*	2.1552	38.49	11.73	50.22	69.54	-19.32	QP	
3		13.5510	26.54	11.59	38.13	69.54	-31.41	QP	

APPENDIX C - RADIATED EMISSION - 30MHz to 1000MHz

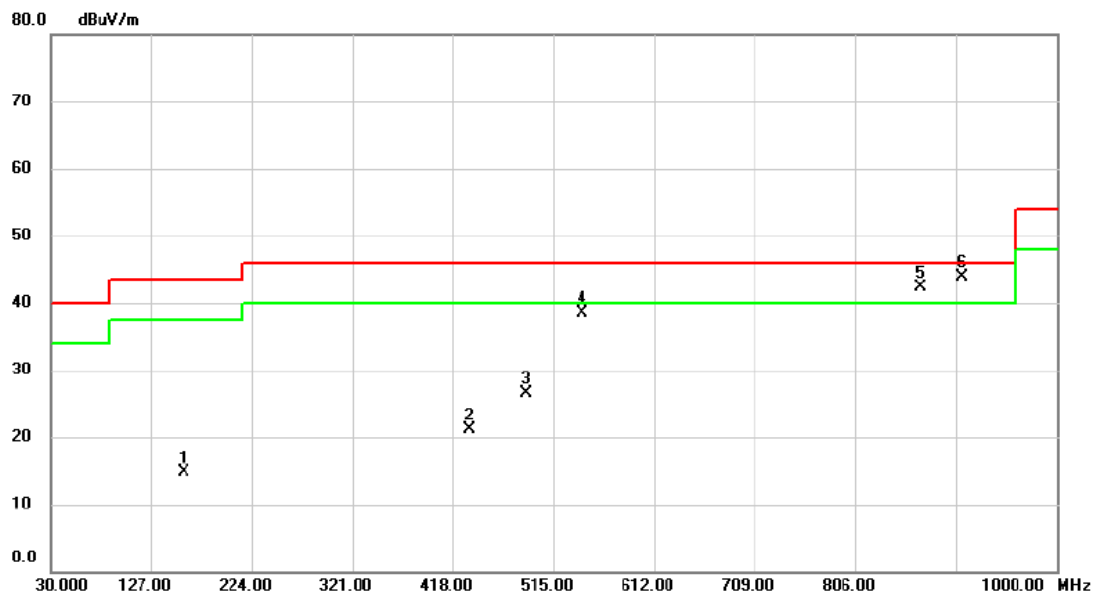
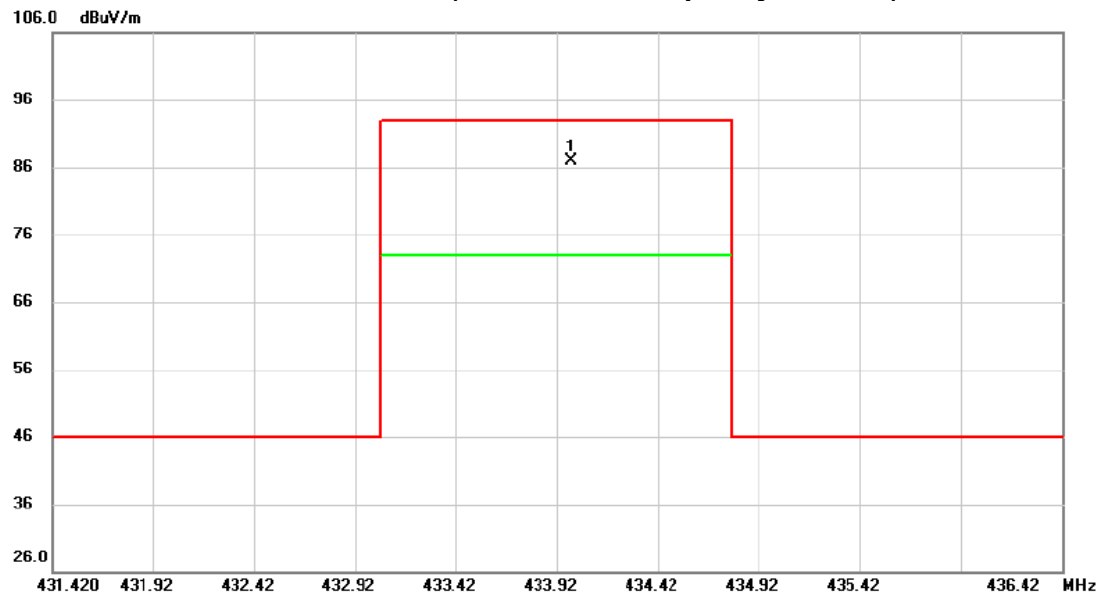
Test Mode :	TX CH 433.92MHz
About the duty cycle correction factor calculated, please refer to the page 16~17	

Freq. (MHz)	Ant.Pol. H/V	Reading		Ant./CF CF(dB)	Act.		Limit		Note
		Peak (dBuV)	AV (dBuV)		Peak (dBuV/m)	AV (dBuV/m)	Peak (dBuV/m)	AV (dBuV/m)	
433.990	V	95.53		-8.53	87.00	72.54	92.87	72.87	Z/F
909.305	V	45.58		-1.70	43.88	29.42	72.87	52.87	Z/H

Remark:

- (1) The average value of fundamental frequency is:
Average = Peak value + 20log(Duty cycle), Final AV=PK – 14.462

Orthogonal Axis: Y TX 433.92 MHz (Fundamental frequency, Vertical)



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1		158.040	25.88	-11.25	14.63	43.50	-28.87	peak	
2		434.005	29.71	-8.53	21.18	46.00	-24.82	peak	
3		488.325	34.34	-7.77	26.57	46.00	-19.43	peak	
4		542.645	45.80	-7.27	38.53	46.00	-7.47	peak	
5	I	868.080	44.55	-2.19	42.36	46.00	-3.64	peak	
6	*	909.305	45.58	-1.70	43.88	46.00	-2.12	peak	

Test Mode :	TX CH 433.92MHz
About the duty cycle correction factor calculated, please refer to the page 16~17	

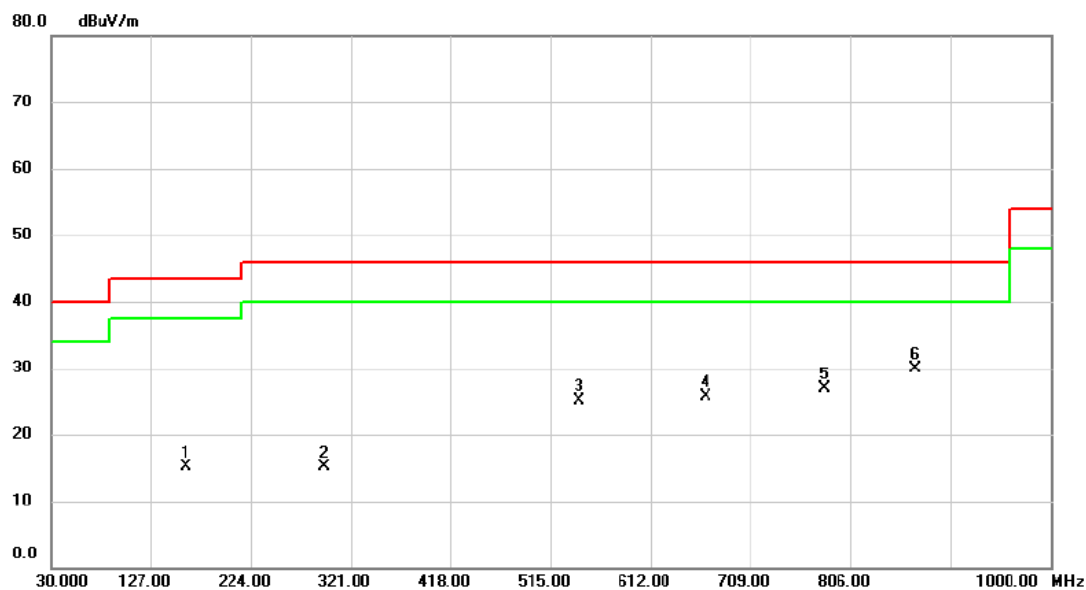
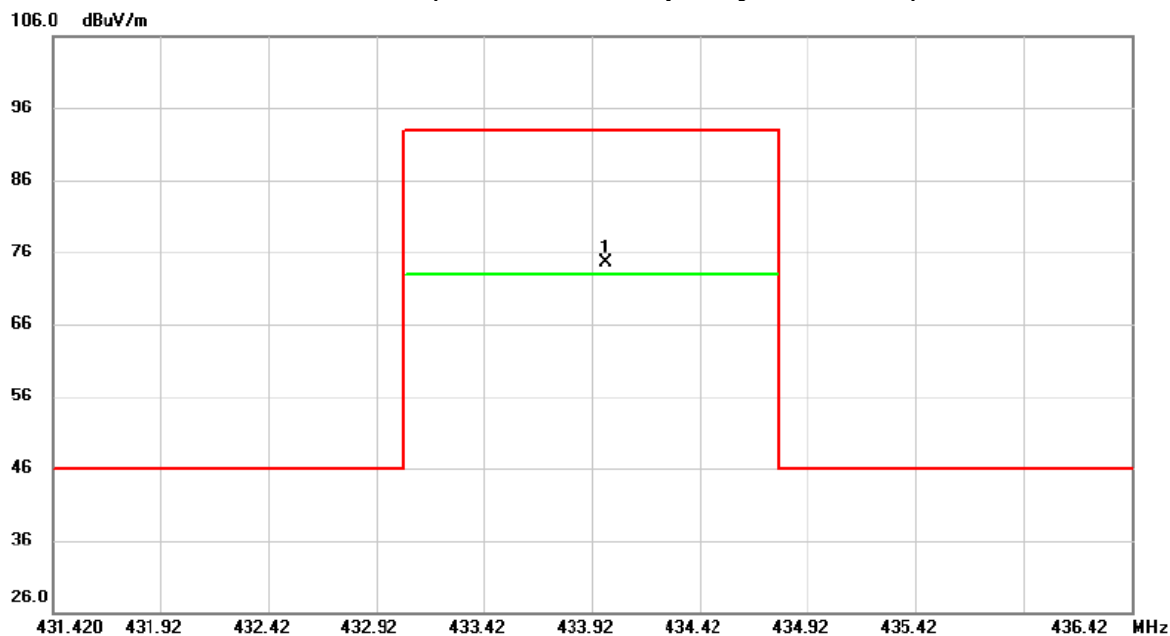
Freq. (MHz)	Ant.Pol. H/V	Reading		Ant./CF CF(dB)	Act.		Limit		Note
		Peak (dBuV)	AV (dBuV)		Peak (dBuV/m)	AV (dBuV/m)	Peak (dBuV/m)	AV (dBuV/m)	
433.985	H	83.12		-8.53	74.59	60.13	92.87	72.87	Z/F
868.080	H	32.15		-2.19	29.96	15.50	72.87	52.87	Z/H

Remark:

(1) The average value of fundamental frequency is:

Average = Peak value + 20log(Duty cycle), Final AV=PK – 14.462

Orthogonal Axis: Y
TX 433.92 MHz (Fundamental frequency, *Horizontal*)



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1		161.435	26.34	-11.21	15.13	43.50	-28.37	peak	
2		295.295	26.83	-11.70	15.13	46.00	-30.87	peak	
3		542.645	32.47	-7.27	25.20	46.00	-20.80	peak	
4		665.350	30.17	-4.47	25.70	46.00	-20.30	peak	
5		780.295	30.23	-3.26	26.97	46.00	-19.03	peak	
6	*	868.080	32.15	-2.19	29.96	46.00	-16.04	peak	

APPENDIX D - RADIATED EMISSION - ABOVE 1000MHz

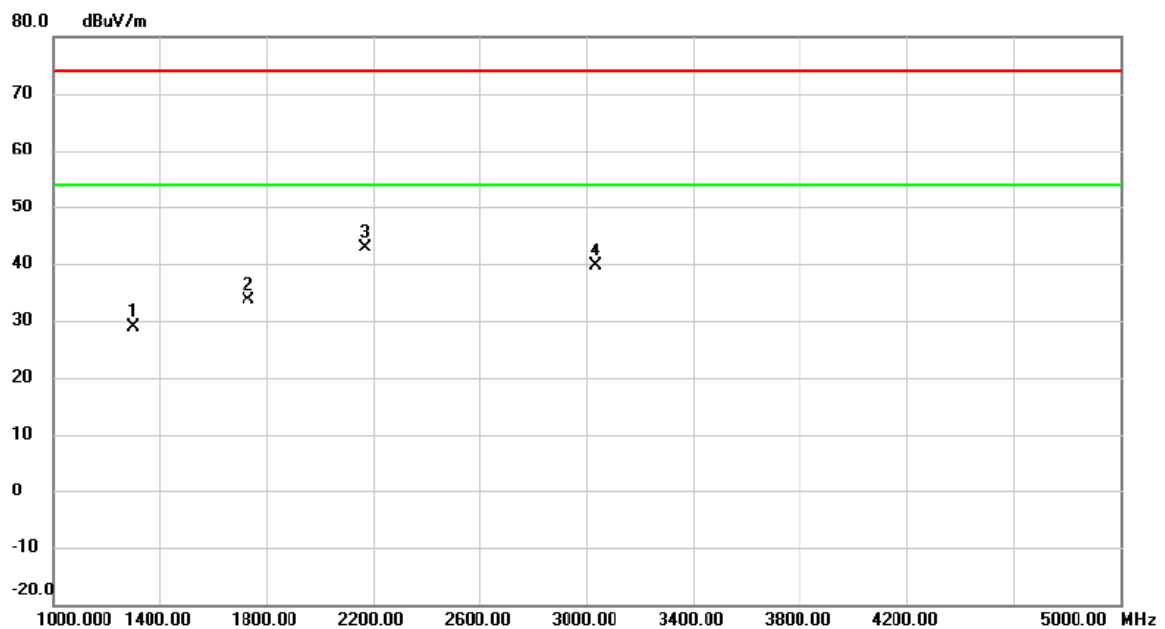
Test Mode : TX CH 433.92MHz

About the duty cycle correction factor calculated, please refer to the page 16~17

Freq. (MHz)	Ant.Pol. H/V	Reading		Ant./CF CF(dB)	Act.		Limit		Margin		Note
		Peak	AV		Peak	AV	Peak	AV	Peak	AV	
		(dBuV)	(dBuV)		(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	
1300.00	V	35.91		-7.10	28.81		74.00		-45.19		Z/E
1734.00	V	38.19		-4.67	33.52		74.00		-40.48		Z/E
2168.00	V	45.99		-3.21	42.78		74.00		-31.22		Z/E
3036.00	V	40.33		-0.79	39.54		74.00		-34.46		Z/E

Remark:

(1) Peak value is much lower than the limit, so AV value isn't shown on this test item.

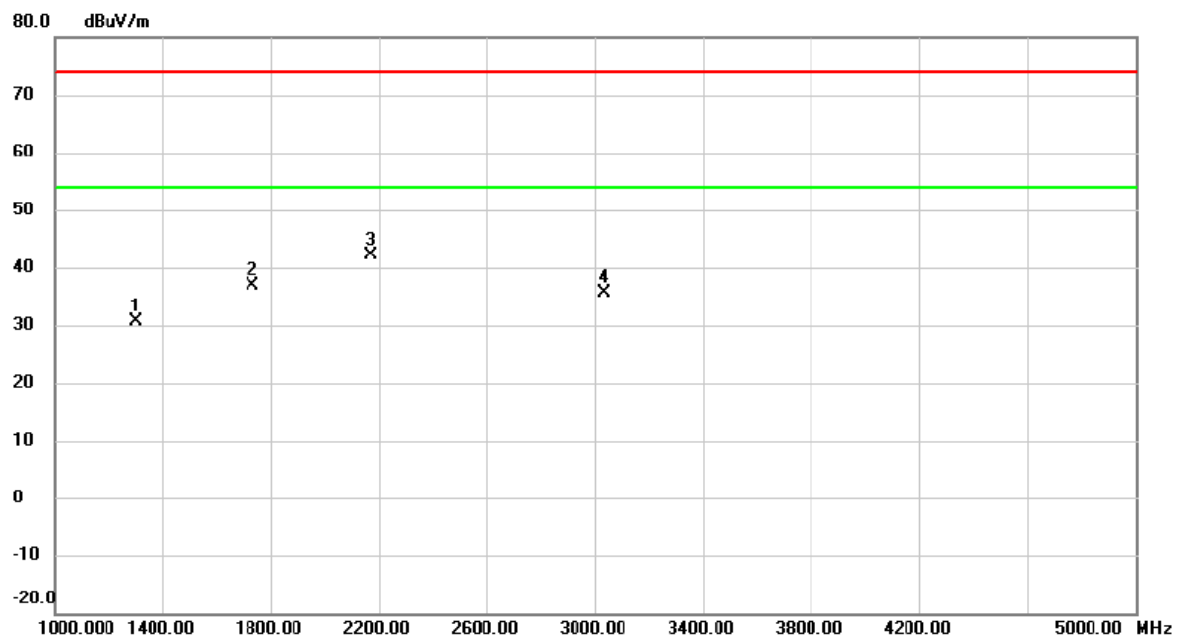


Test Mode :	TX CH 433.92MHz
About the duty cycle correction factor calculated, please refer to the page 16~17	

Freq. (MHz)	Ant.Pol. H/V	Reading		Ant./CF CF(dB)	Act.		Limit		Margin		Note
		Peak	AV		Peak	AV	Peak	AV	Peak	AV	
		(dBuV)	(dBuV)		(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	
1300.00	H	37.72		-7.10	30.62		74.00		-43.38		Z/E
1734.00	H	41.59		-4.67	36.92		74.00		-37.08		Z/E
2168.00	H	45.23		-3.21	42.02		74.00		-31.98		Z/E
3036.00	H	36.49		-0.79	35.70		74.00		-38.30		Z/E

Remark:

(1) Peak value is much lower than the limit, so AV value isn't shown on this test item.

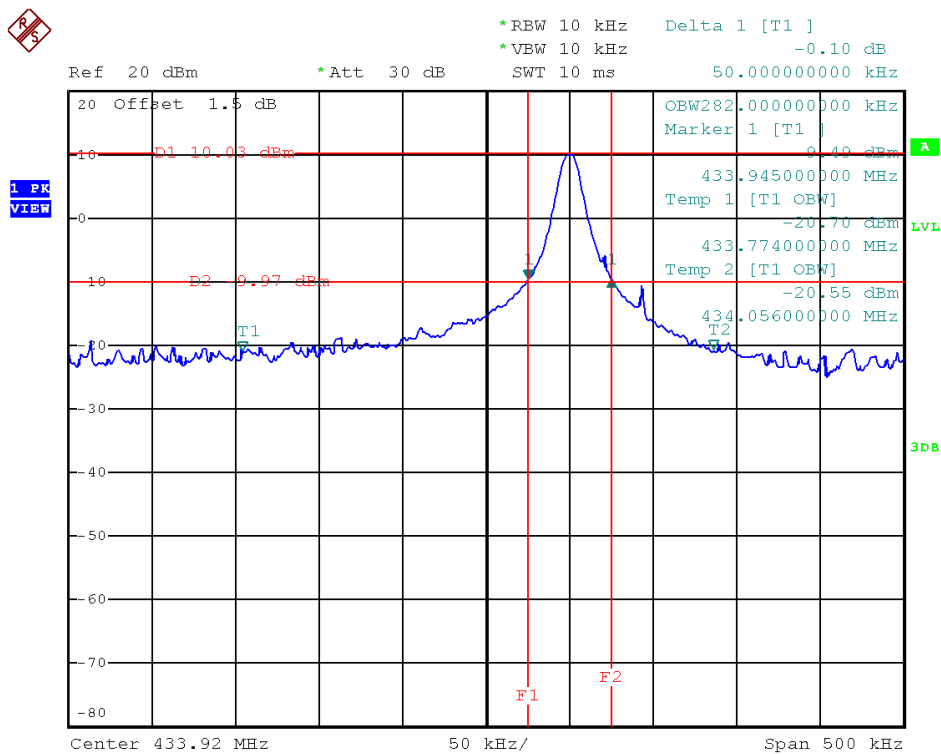


APPENDIX E - 20dB SPECTRUM BANDWIDTH

Test Mode: TX CH 433.92MHz

Frequency (MHz)	20dB Bandwidth (MHz)	99% Occupied BW (MHz)	20 dB BW Limits (MHz)
433.92	0.0500	0.2820	1.0848

TX CH01

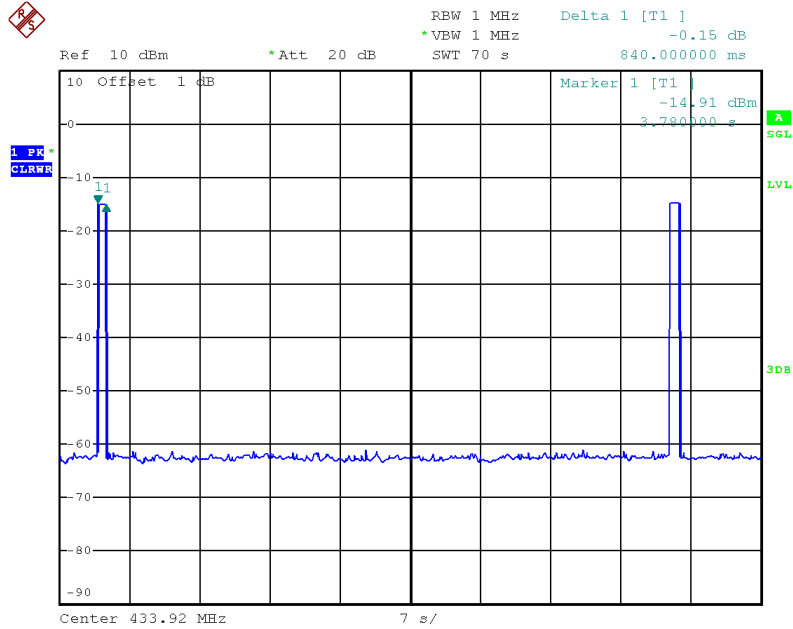


Date: 5.AUG.2019 10:46:55

APPENDIX F - TIMING TESTING

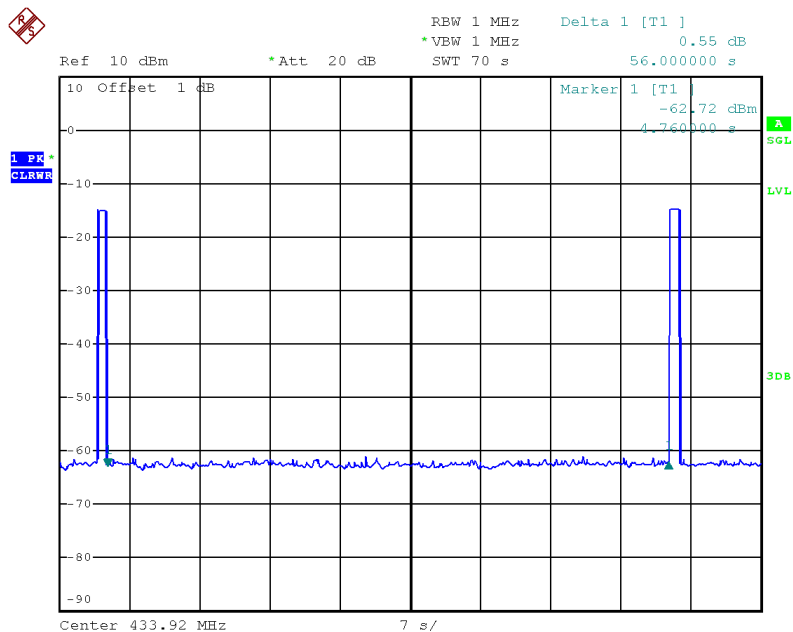
Test Mode: TX CH 433.92MHz

On Time



Date: 6.AUG.2019 12:18:31

Off Time



Date: 6.AUG.2019 12:19:32

End of Test Report