

# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

## INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT OF

**Product Name:** Industrial radio remote control systems

**Brand Name:** ARC

**Model No.:** FLEX ECO 6X(MRX), FLEX ECO 6S(MRX)

**Model Difference:** 6X: 6 Push button, Two step  
6S: 6 Push button, One step

**FCC ID:** R4UARCFLEXECO6

**Report No.:** ER/2017/80052

**Issue Date:** Nov. 10, 2017

**FCC Rule Part:** §15.231

**Prepared for:** Advanced Radiotech Corporation  
1F. 288-1, Hsin Ya Road, Chien Chen Dist.,  
Kaohsiung City, Taiwan

**Prepared by:** SGS Taiwan Ltd.  
Electronics & Communication Laboratory  
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City, Taiwan 24803



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## VERIFICATION OF COMPLIANCE

**Applicant:** Advanced Radiotech Corporation  
1F. 288-1, Hsin Ya Road, Chien Chen Dist., Kaohsiung City, Taiwan

**Product Name:** Industrial radio remote control systems

**Brand Name:** ARC

**Model No.:** FLEX ECO 6X(MRX), FLEX ECO 6S(MRX)

**Model Difference:** 6X: 6 Push button, Two step  
6S: 6 Push button, One step

**FCC ID:** R4UARCFLEXECO6

**Report Number:** ER/2017/80052

**Date of test:** Aug. 04, 2017 ~ Nov. 03, 2017

**Date of EUT Received:** Aug. 04, 2017

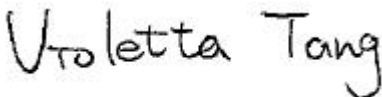
### We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits.

The test results of this report relate only to the tested sample identified in this report.

**Test By:**  **Date:** Nov. 10, 2017

**Marcus Tseng / Sr. Engineer**

**Prepared By:**  **Date:** Nov. 10, 2017

**Violetta Tang / Clerk**

**Approved By:**  **Date:** Nov. 10, 2017

**Jim Chang / Asst. Manager**

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## Revision History

Report Number	Revision	Description	Issue Date
ER/2017/80052	Rev.00	Initial creation of document	Nov. 10, 2017

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## 1. GENERAL INFORMATION

### 1.1 Product Description

#### General:

Product Name:	Industrial radio remote control systems
Brand Name:	ARC
Model No.	FLEX ECO 6X(MRX), FLEX ECO 6S(MRX)
Model Difference:	6X: 6 Push button, Two step 6S: 6 Push button, One step
Hardware Version:	N/A
Software Version:	N/A
Power Supply:	3Vdc from AA Battery

#### 433 MHz:

Operating Frequency	433.05MHz ~ 434.575MHz
Transmit Power	≤88.26dBuV/m Max.
Modulation Technique	GFSK
Number of Channels	62 Channels
Channel Spacing	50 kHz
Antenna Type	Meander Line Antenna

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## 1.2 Test Methodology

FCC Part 15, Subpart C §15.231

ANSI C63.10:2013

Note:

1. All test items have been performed and record as per the above standards.
2. The composite system is compliance with FCC Subpart B is authorized under the certification procedure.

## 1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan. (TAF code 0513)

FCC Registration Numbers are: 509634 / TW0001

## 1.4 Special Accessories

There are no special accessories used while test was conducted.

## 1.5 Equipment Modifications

There was no modification incorporated into the EUT.

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## 2. SYSTEM TEST CONFIGURATION

### 2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

### 2.2 EUT Exercise

The Transmitter was operated in the normal operating mode. the Tx frequency was fixed which was for the purpose of the measurements.

### 2.3 Test Procedure

#### 2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz,. The CISPR Quasi-Peak and Average detector mode is employed according to §15.107. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

#### 2.3.2 Radiated Emissions

The EUT is a placed on as turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m above the reference ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

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## 2.5 Limitation

### (1) Conducted Emission

According to section 15.207(a) Conducted Emission Limits is as following.

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 – 0.5	66 - 56	56 - 46
0.5 – 5	56	46
5 - 30	60	50

### (2) Radiated Emission

According to 15.231(b), the field strength of emissions from Intentional Radiators operated under this section shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental		Field Strength of Spurious	
	(dBuV/m)	(uV/m)	(dBuV/m)	(uV/m)
40.66 - 40.70	67.04	2,250	47	225
70 - 130	61.94	1,250	41.9	125
130 - 174	* 61.94 - 71.48	* 1,250 - 3,750	* 41.9 – 51.48	* 125 to 375
174 - 260	71.48	3,750	51.48	375
260 - 470	* 71.48 - 81.94	* 3,750 - 12,500	* 51.48 - 54	* 375 to 1250
above 470	81.94	12,500	74	1250

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- Remark 1. Emission level in dBuV/m=20 log (uV/m)  
:
2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
  3. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of § 15.205
  4. Emission spurious frequency which appearing within the Restricted Bands specified in provision of §15.205, then the general radiated emission limits in § 15.209 apply.
  5. For the band 130-174MHz, uV/m at 3meters = 56.81818(F) – 6136.3636;  
For the band 260-470MHz uV/m at 3meters = 41.6667(F) – 7083.3333;  
Where F is the frequency in MHz.

<b>Operation</b>	<b>433.05 MHz</b>
<b>Freq.</b>	
41.6667 X 433.05 - 7083.3333=	10960.431 uV/m
20log(10960.43)= 80.8	dBuV/m (AV Limit)
80.8+20= 100.8	dBuV/m (Peak Limit)
<b>Operation</b>	<b>433.8 MHz</b>
<b>Freq.</b>	
41.6667 X 433.8 - 7083.3333=	10991.681 uV/m
20log(10991.68)= 80.82	dBuV/m (AV Limit)
80.82+20= 100.82	dBuV/m (Peak Limit)
<b>Operation</b>	<b>434.575 MHz</b>
<b>Freq.</b>	
41.6667 X 434.575 - 7083.3333=	11023.973 uV/m
20log(11023.97)= 80.85	dBuV/m (AV Limit)
80.85+20= 100.85	dBuV/m (Peak Limit)

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## 2.6 Configuration of Tested System

Fig. 2-1 Configuration of Tested System



Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	N/A					

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### 3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207	Conducted Emission	N/A
§15.231	Radiated Emission	Compliant
§15.231(c)	20dB Bandwidth	Compliant
§15.35 (c)	Duty Cycle Test (Pulse Modulation)	Compliant
§15.231(a)(1)	Release Time Measurement	Compliant

### 4. DESCRIPTION OF TEST MODES

#### 4.1 Operated in 433.05 ~ 434.575 MHz Band

62 channels are provided.

CH	FREQUENCY	CH	FREQUENCY	CH	FREQUENCY	CH	FREQUENCY
01	433.050MHZ	17	433.450MHZ	33	433.850MHZ	49	434.250MHZ
02	433.075MHZ	18	433.475MHZ	34	433.875MHZ	50	434.275MHZ
03	433.100MHZ	19	433.500MHZ	35	433.900MHZ	51	434.300MHZ
04	433.125MHZ	20	433.525MHZ	36	433.925MHZ	52	434.325MHZ
05	433.150MHZ	21	433.550MHZ	37	433.950MHZ	53	434.350MHZ
06	433.175MHZ	22	433.575MHZ	38	433.975MHZ	54	434.375MHZ
07	433.200MHZ	23	433.600MHZ	39	434.000MHZ	55	434.400MHZ
08	433.225MHZ	24	433.625MHZ	40	434.025MHZ	56	434.425MHZ
09	433.250MHZ	25	433.650MHZ	41	434.050MHZ	57	434.450MHZ
10	433.275MHZ	26	433.675MHZ	42	434.075MHZ	58	434.475MHZ
11	433.300MHZ	27	433.700MHZ	43	434.100MHZ	59	434.500MHZ
12	433.325MHZ	28	433.725MHZ	44	434.125MHZ	60	434.525MHZ
13	433.350MHZ	29	433.750MHZ	45	434.150MHZ	61	434.550MHZ
14	433.375MHZ	30	433.775MHZ	46	434.175MHZ	62	434.575MHZ
15	433.400MHZ	31	433.800MHZ	47	434.200MHZ		
16	433.425MHZ	32	433.825MHZ	48	434.225MHZ		

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**4.2 The Worst Test Modes and Channel Details**  
**RADIATED EMISSION TEST:**

RADIATED EMISSION TEST (BELOW 1 GHz)					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
433 MHz	62	1,31,62	GFSK	9.6	MAIN
RADIATED EMISSION TEST (ABOVE 1 GHz)					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
433 MHz	62	1,31,62	GFSK	9.6	MAIN

**Note:**

The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for 433MHz Transmitter for channel Low, Mid and High, the worst case H position was reported.

**ANTENNA PORT CONDUCTED MEASUREMENT:**

CONDUCTED TEST					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
433 MHz	62	1,31,62	GFSK	9.6	MAIN

**Note:**

Per 15.31 (e) - For battery operated equipment, the equipment tests shall be performed using a new battery. All test items for this report are performed with a new battery.

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## 5. MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Peak Output Power	+/- 1.55 dB
20dB Bandwidth	+/- 123.36 Hz
100 KHz Bandwidth Of Frequency Band Edges	+/- 0.84 dB
Frequency Separation	+/- 123.36 Hz
Number of hopping frequency	+/- 123.36 Hz
Time of Occupancy	+/- 123.36 Hz
Temperature	+/- 0.65 °C
Humidity	+/- 4.6 %
DC / AC Power Source	DC= +/- 0.13%, AC= +/- 0.2%

### Radiated Spurious Emission:

Measurement uncertainty (Polarization : <b>Vertical</b> )	9kHz~30MHz: +2.3dB
	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

Measurement uncertainty (Polarization : <b>Horizontal</b> )	9kHz~30MHz: +2.3dB
	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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## 6. CONDUCTED EMISSIONS TEST (NOT APPLY IN THE REPORT)

### 6.1 Standard Applicable

According to §15.207 and frequency within 150 kHz to 30MHz shall not exceed the limit table as below.

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Note

- 1.The lower limit shall apply at the transition frequencies
- 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

### 6.2 Measurement Equipment Used:

Conducted Emission Test Site					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EMI Test Receiver	R&S	ESCI 7	100950	12/12/2016	12/11/2017
Coaxial Cables	N/A	N30N30-1042-1 50cm	N/A	08/30/2017	08/29/2018
LISN	Schwarzbeck	NSLK 8127	8127-648	06/18/2017	06/17/2018
Test Software	Farad	EZ-EMC	Ver. SGS-03A2	N.C.R.	N.C.R.

### 6.3 EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

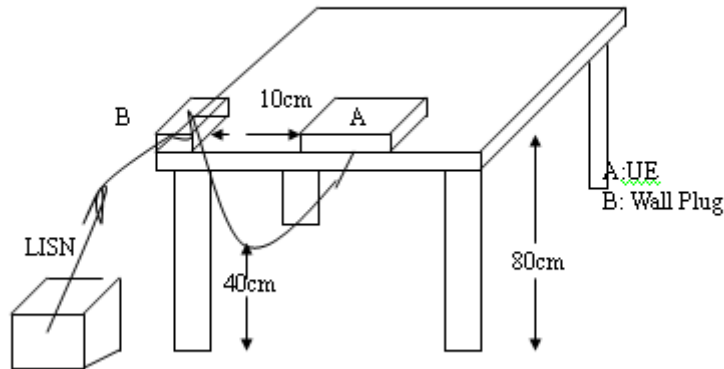
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## 6.4 Test SET-UP (Block Diagram of Configuration)



## 6.5 Measurement Procedure

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

## 6.6 Measurement Result

N/A; powered from battery.

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## 7. RADIATED EMISSION TEST

### 7.1 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
4. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. Repeat above procedures until all frequency of the interest measured were complete.

Auxiliary Procedure (Setting on Spectrum to capture the reading of emission level):

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for  $f \geq 1$  GHz, 100 kHz for  $f < 1$  GHz

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Test was measured starting from 9kHz to 10<sup>th</sup> harmonic of the fundamental frequency, and data containing the worst result over 30MHz are shown on the test report.

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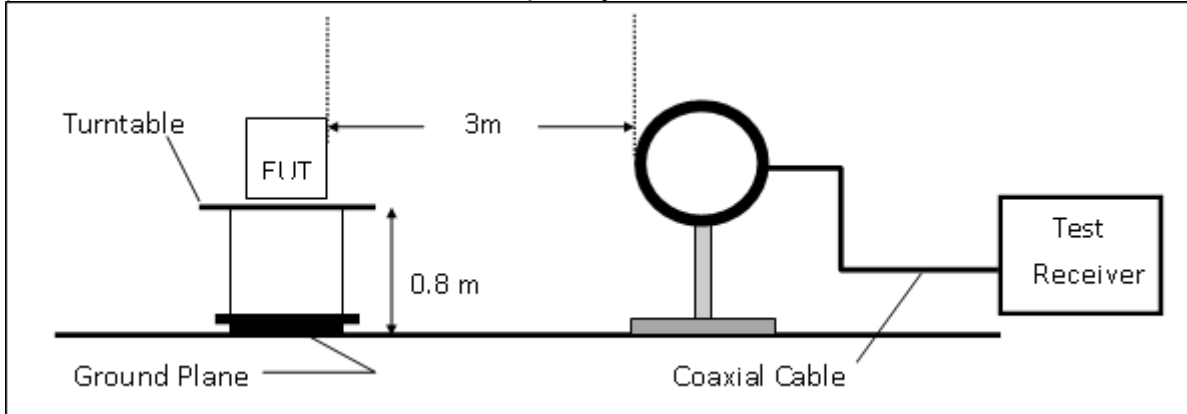
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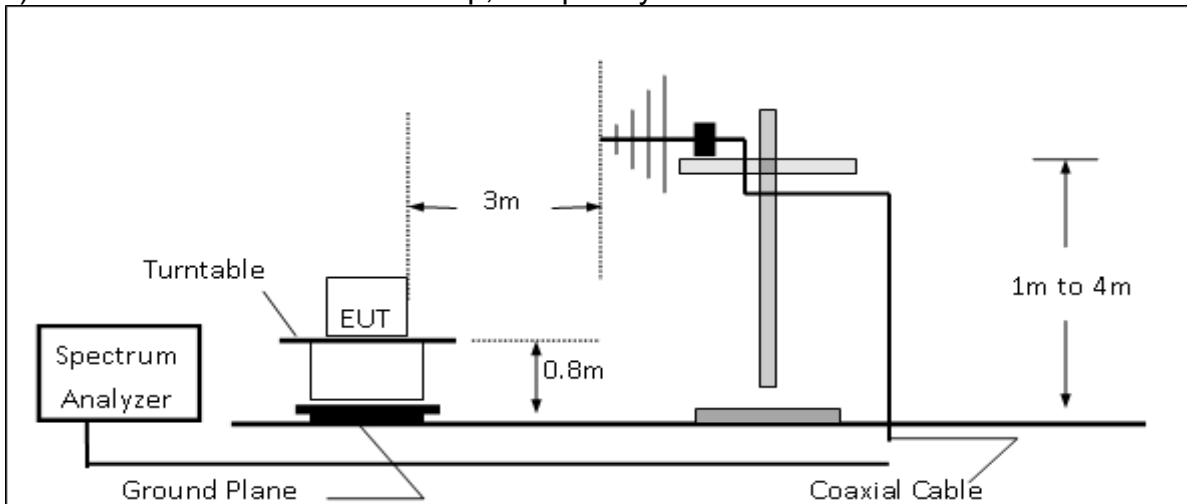


## 7.2 Test SET-UP (Block Diagram of Configuration).

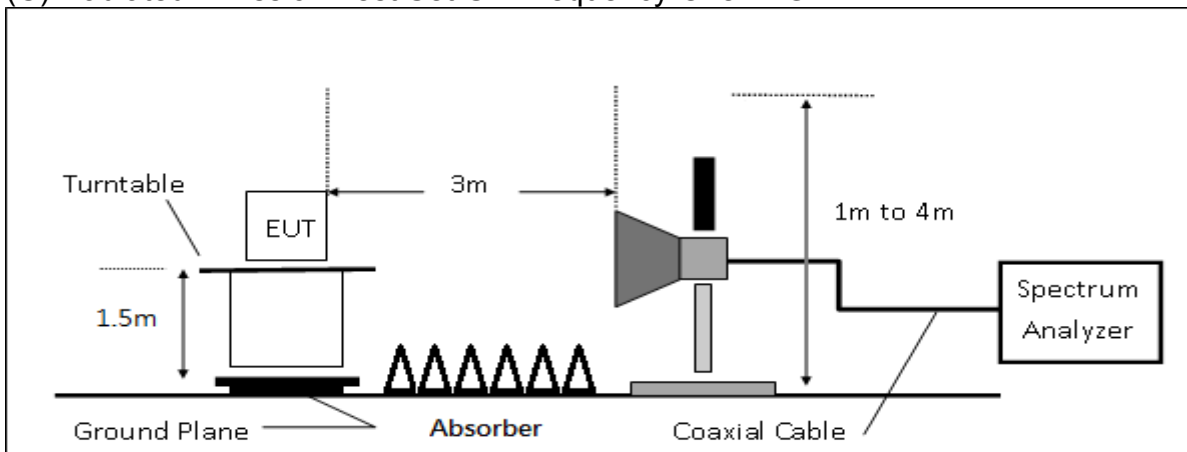
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



(B) Radiated Emission Test Set-UP, Frequency form 30MHz to 1000MHz



(C) Radiated Emission Test Set-UP Frequency Over 1 GHz



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### 7.3 Measurement Equipment Used:

SGS 966 Chamber No.C					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EMI Test Receiver	R&S	ESU 40	100363	04/18/2017	04/17/2018
Loop Antenna	ETS-Lindgren	6502	00143303	12/23/2016	12/22/2017
Broadband Antenna	TESEQ	CBL 6112D	35240	11/03/2016	11/02/2017
Horn Antenna	ETS-Lindgren	3117	00143272	12/15/2016	12/16/2017
Horn Antenna	Schwarzbeck	BBHA9170	185	08/01/2017	07/31/2018
Pre Amplifier	EMC Instruments	EMC330	980096	12/12/2016	12/11/2017
Pre Amplifier	EMC Instruments	EMC0011830	980199	12/12/2016	12/11/2017
Pre Amplifier	R&S	SCU-18	10204	12/12/2016	12/11/2017
Pre Amplifier	R&S	SCU-26	100780	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	RG 214/U	966Rx 9K-30M	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	RG 214/U SUCOFLEX 104	966Rx 30M-3G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Rx 1G-18G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	mini 141-12 SUCOFLEX 104	966Rx 18G-40G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	966Tx 30M-18G	12/12/2016	12/11/2017
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	966Tx 18G-40G	12/12/2016	12/11/2017
Attenuator	WOKEN	218FS-10	RF27	12/12/2016	12/11/2017
Site NSA	SGS	966 Chamber C	SAC-C	03/02/2017	03/01/2018
Site VSWR	SGS	966 Chamber C	SAC-C	03/02/2017	03/01/2018
DC Power Supply	HOLA	DP-3003	D7070035	05/04/2017	05/03/2018
Controller	MF	MF-7802	N/A	N.C.R.	N.C.R.
Antenna Master	MF	N/A	N/A	N.C.R.	N.C.R.
Turn Table	MF	N/A	N/A	N.C.R.	N.C.R.
Test Software	World-Pallas	Dr. E	V 3.0 Lite	N.C.R.	N.C.R.

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## 7.4 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	

Remark:

The limit of the emission level is expressed in dBuV/m, which converts  $20 \cdot \log(uV/m)$

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre\_Amplifier Gain(dB)

**Note :**

“F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

## 7.5 Test Results of Radiated Spurious Emissions form 9 kHz to 30 MHz

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit per 15.31(o) was not reported.

## 7.6 Measurement Result:

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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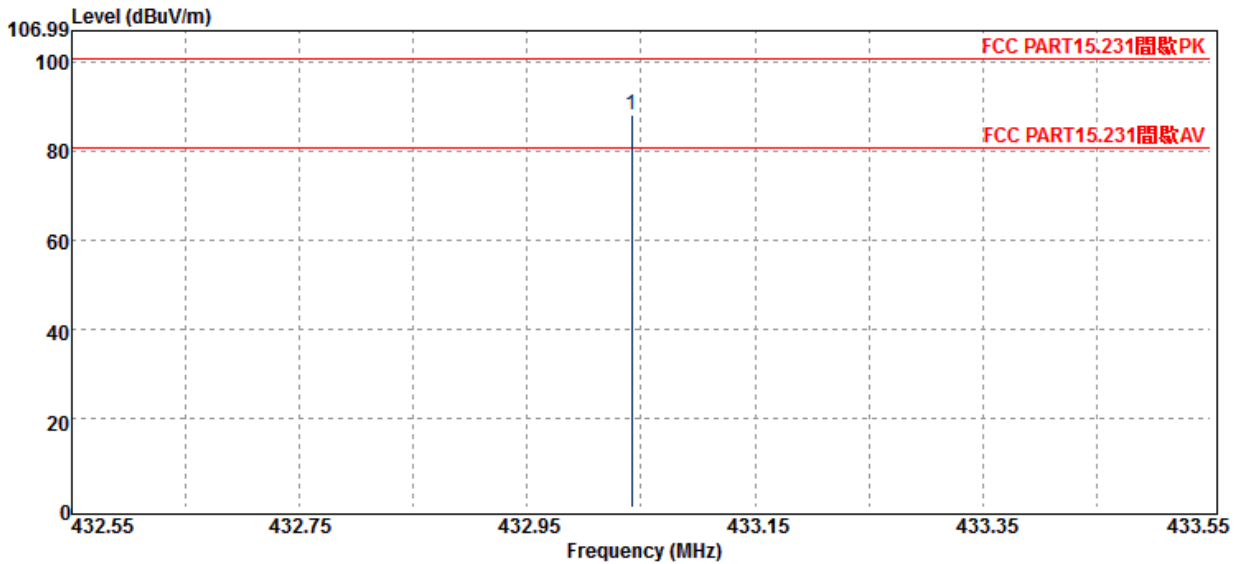
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### 7.7 Measurement Result:

Operation Band	:433 MHz	Test Date	:2017-09-18
Fundamental Frequency	:433.05 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:MAIN	Engineer	:Kane
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Safe Margin dB
433.04	F	Average	---	-11.63	76.63	80.80	-4.17
433.04	F	Peak	91.73	-3.47	88.26	100.80	-21.91

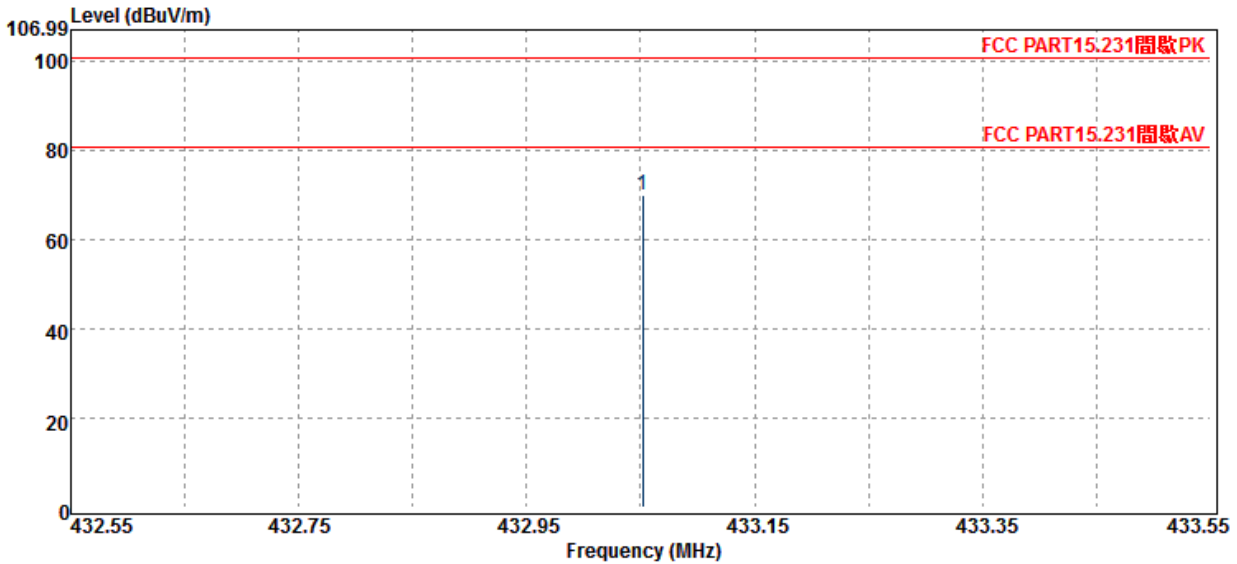
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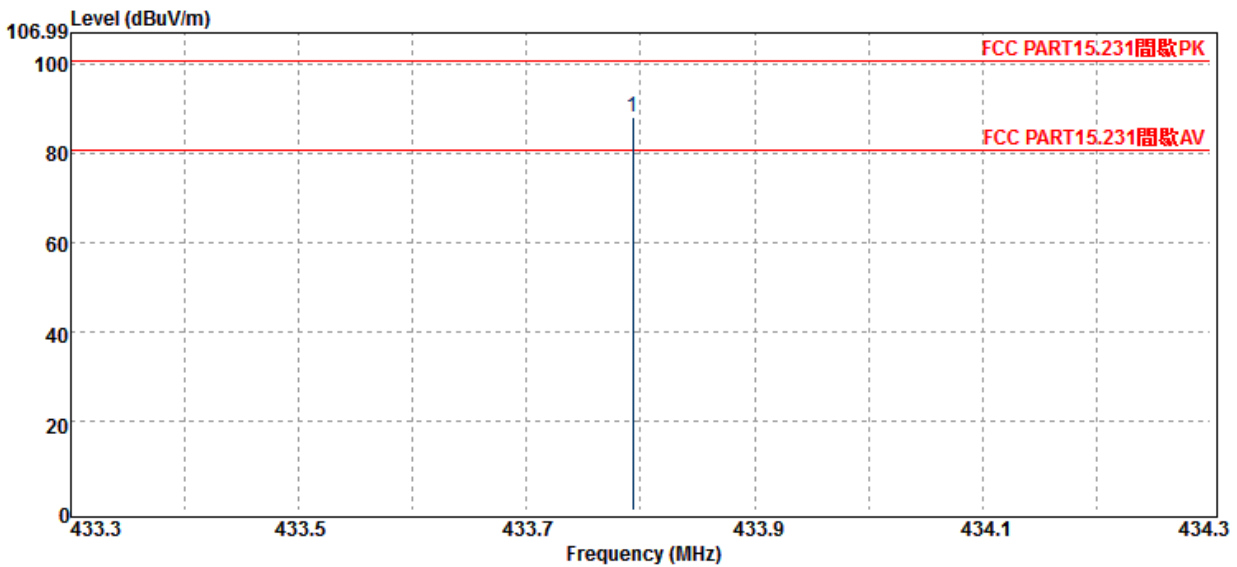
Operation Band	:433 MHz	Test Date	:2017-09-18
Fundamental Frequency	:433.05 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:MAIN	Engineer	:Kane
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
433.05	F	Average	---	-11.63	58.15	80.80	-22.65
433.05	F	Peak	73.25	-3.47	69.78	100.80	-21.91

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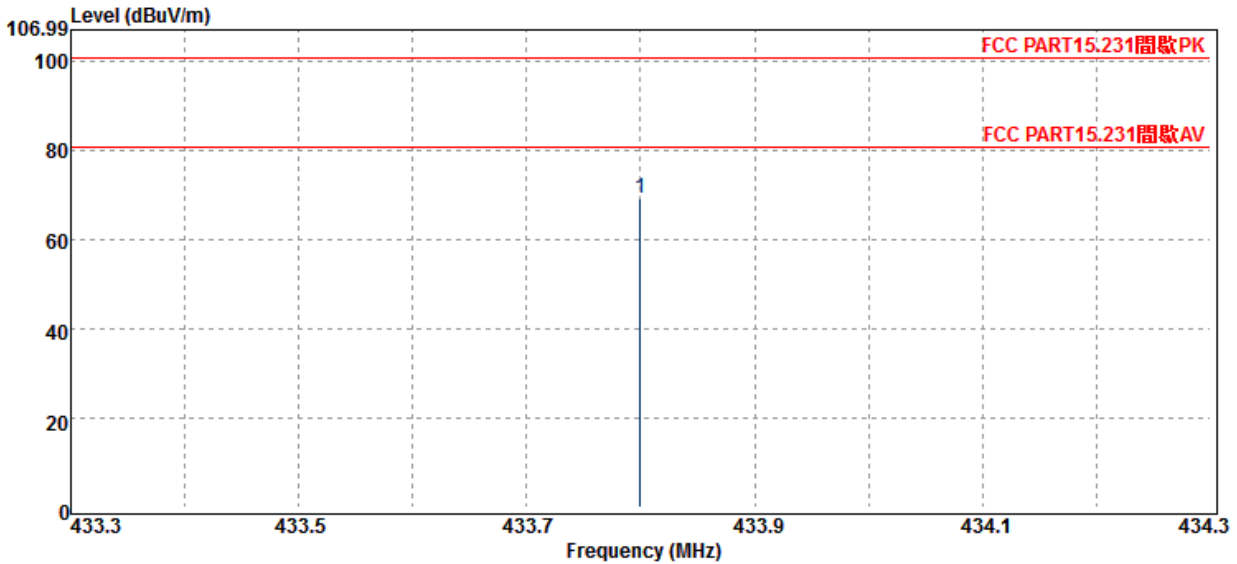
Operation Band	:433 MHz	Test Date	:2017-09-18
Fundamental Frequency	:433.8 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:MAIN	Engineer	:Kane
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
433.79	F	Average	---	-11.63	76.52	80.82	-4.30
433.79	F	Peak	91.67	-3.52	88.15	100.82	-21.91

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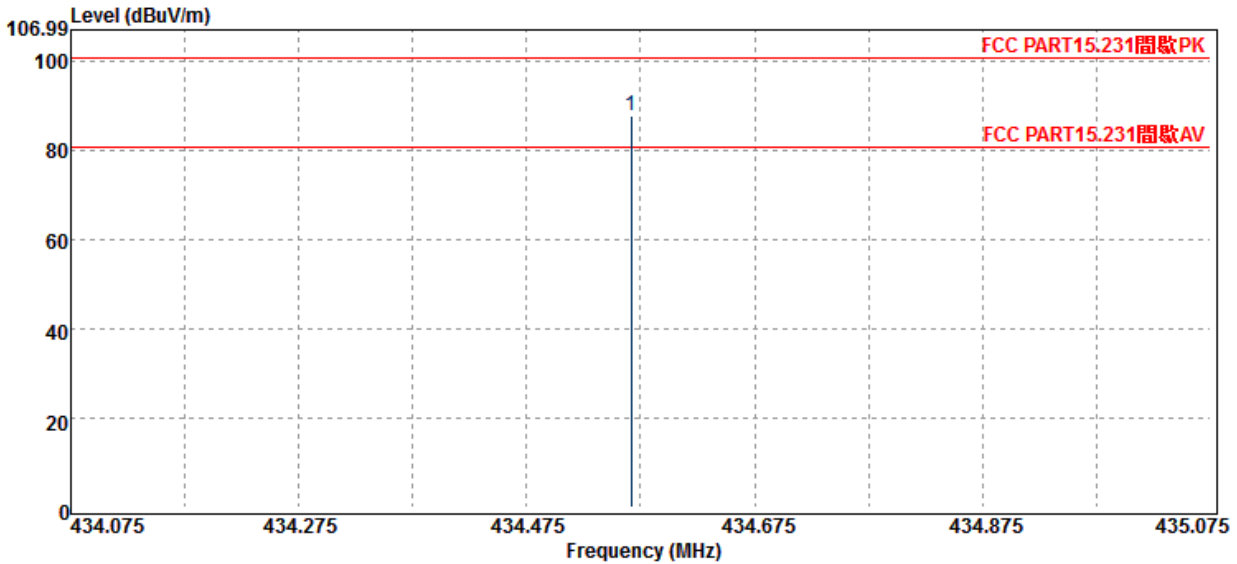
Operation Band	:433 MHz	Test Date	:2017-09-18
Fundamental Frequency	:433.8 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:MAIN	Engineer	:Kane
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
433.80	F	Average	---	-11.63	57.62	80.82	-23.20
433.80	F	Peak	72.77	-3.52	69.25	100.82	-21.91

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Operation Band	:433 MHz	Test Date	:2017-09-18
Fundamental Frequency	:434.575 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:MAIN	Engineer	:Kane
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL

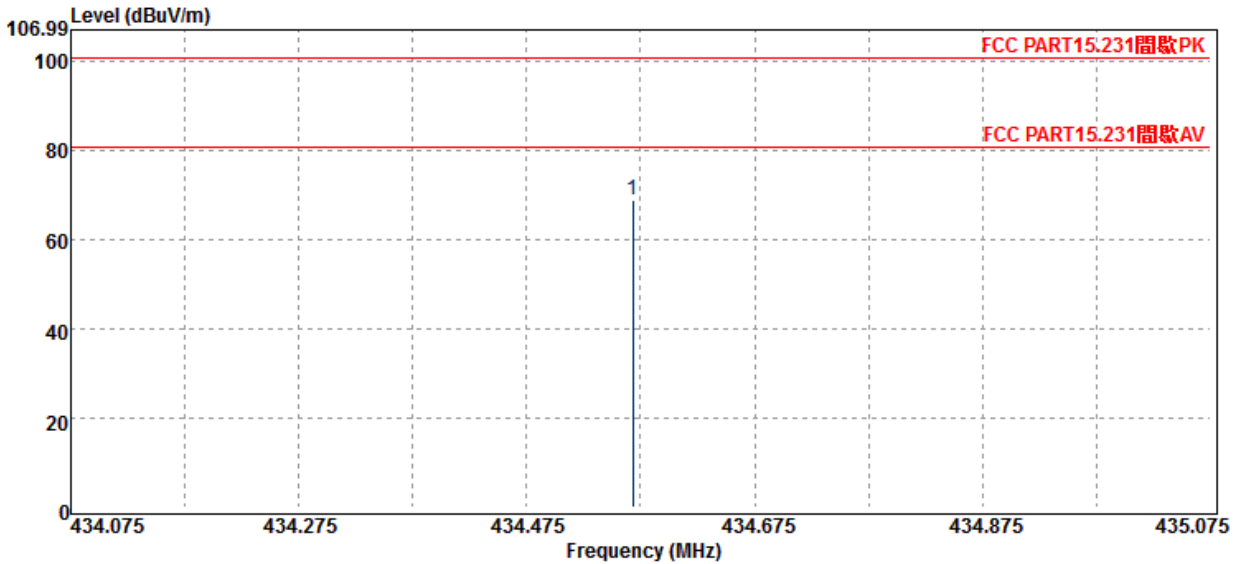


Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
434.57	F	Average	---	-11.63	76.25	80.85	-4.60
434.57	F	Peak	91.46	-3.58	87.88	100.85	-21.91

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Operation Band	:433 MHz	Test Date	:2017-09-18
Fundamental Frequency	:434.575 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:MAIN	Engineer	:Kane
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



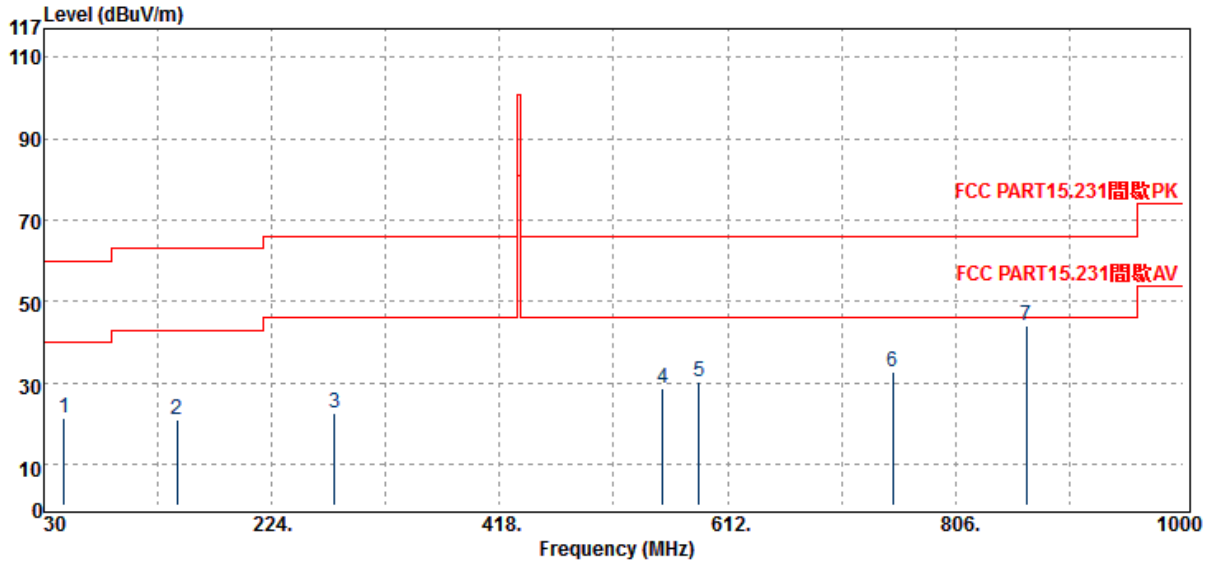
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
434.57	F	Average	---	-11.63	57.24	80.85	-23.61
434.57	F	Peak	72.45	-3.58	68.87	100.85	-21.91

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**Below 1GHz Worst-Case Data:**

Operation Band :433 MHz  
Fundamental Frequency :433.05 MHz  
Operation Mode :TX CH LOW  
EUT Pol. :H Plane

Test Date :2017-09-18  
Temp./Humi. :24.5 deg\_C / 57RH  
Engineer :Kane  
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Safe Margin dB
47.46	S	Peak	29.36	-7.85	21.51	60.00	-38.49
143.49	S	Peak	29.32	-8.09	21.23	63.00	-41.77
277.35	S	Peak	29.23	-6.55	22.68	66.00	-43.32
556.71	S	Peak	30.16	-1.34	28.82	66.00	-37.18
587.75	S	Peak	30.28	-0.05	30.23	66.00	-35.77
752.65	S	Peak	30.26	2.67	32.93	66.00	-33.07
866.10	H	Average	---	-11.63	32.46	46.00	-13.54
866.10	H	Peak	39.19	4.90	44.09	66.00	-21.91

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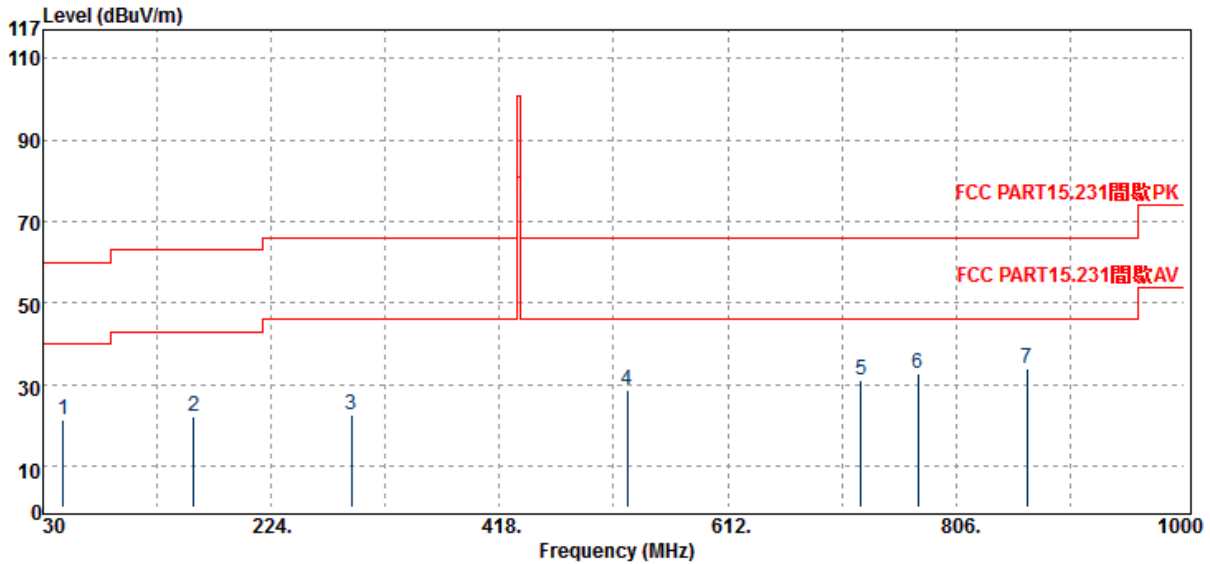
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Operation Band	:433 MHz	Test Date	:2017-09-18
Fundamental Frequency	:433.05 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX CH LOW	Engineer	:Kane
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Safe Margin dB
47.46	S	Peak	29.13	-7.85	21.28	60.00	-38.72
158.04	S	Peak	29.52	-7.45	22.07	63.00	-40.93
291.90	S	Peak	28.83	-6.08	22.75	66.00	-43.25
526.64	S	Peak	30.17	-1.44	28.73	66.00	-37.27
725.49	S	Peak	29.59	1.74	31.33	66.00	-34.67
773.99	S	Peak	29.88	2.78	32.66	66.00	-33.34
866.10	H	Average	---	-11.63	22.44	46.00	-23.56
866.10	H	Peak	29.17	4.90	34.07	66.00	-21.91

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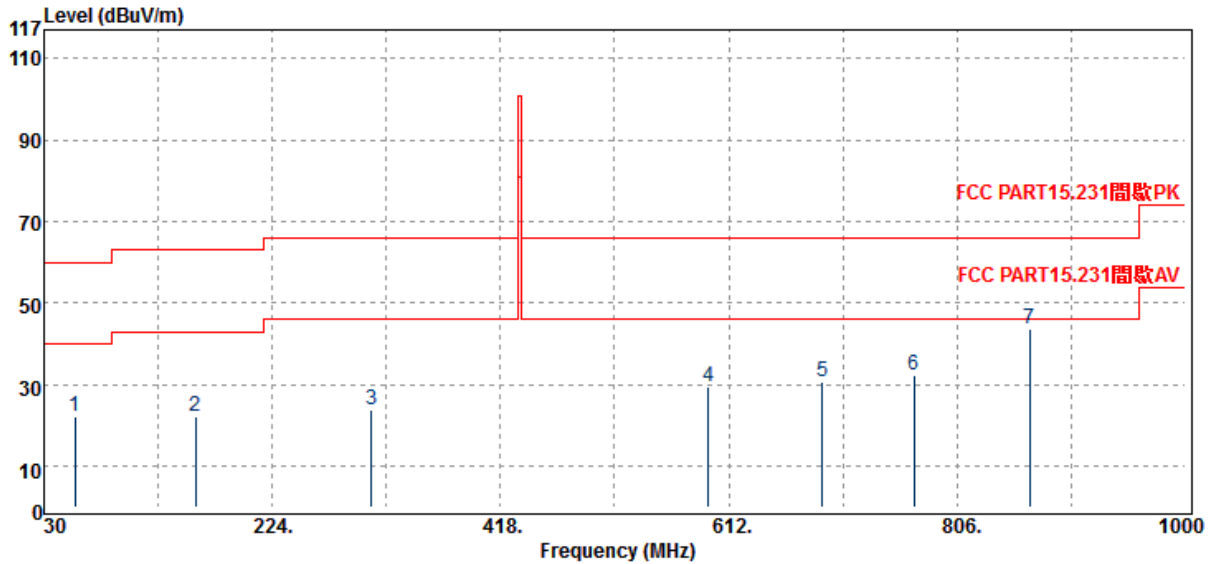
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Operation Band	:433 MHz	Test Date	:2017-09-18
Fundamental Frequency	:433.8 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX CH MID	Engineer	:Kane
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Safe Margin dB
56.19	S	Peak	30.24	-7.91	22.33	60.00	-37.67
159.01	S	Peak	29.61	-7.38	22.23	63.00	-40.77
308.39	S	Peak	29.58	-5.57	24.01	66.00	-41.99
594.54	S	Peak	29.46	0.08	29.54	66.00	-36.46
691.54	S	Peak	29.38	1.47	30.85	66.00	-35.15
769.14	S	Peak	29.70	2.77	32.47	66.00	-33.53
867.60	H	Average	---	-11.63	32.01	46.00	-13.99
867.60	H	Peak	38.87	4.77	43.64	66.00	-21.91

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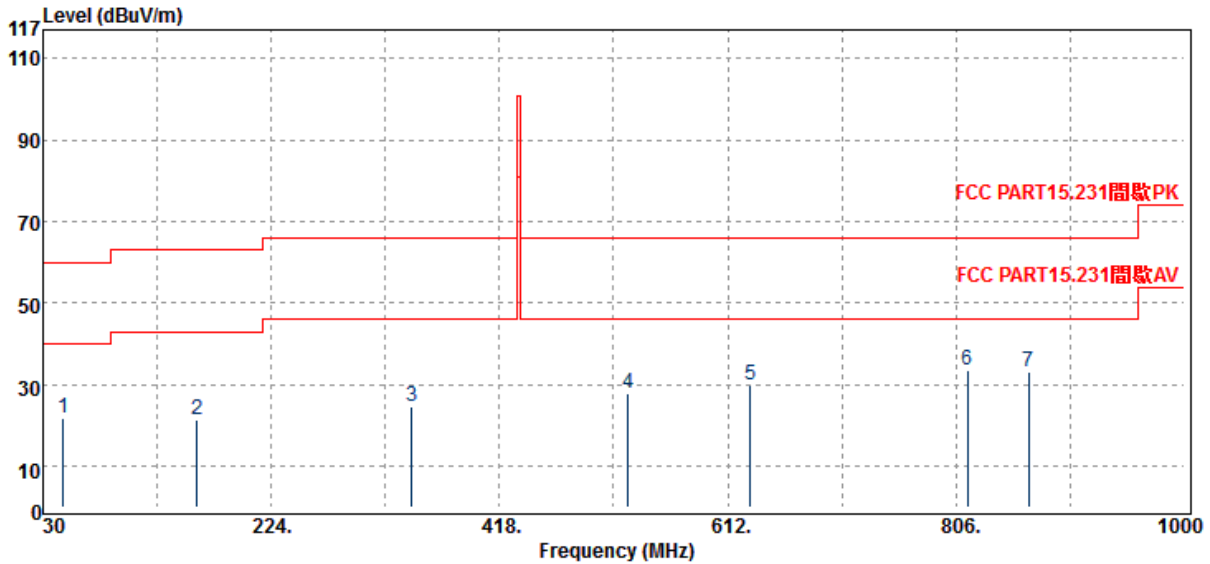
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Operation Band	:433 MHz	Test Date	:2017-09-18
Fundamental Frequency	:433.8 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX CH MID	Engineer	:Kane
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Safe Margin dB
47.46	S	Peak	29.51	-7.85	21.66	60.00	-38.34
160.95	S	Peak	28.71	-7.43	21.28	63.00	-41.72
343.31	S	Peak	29.69	-5.13	24.56	66.00	-41.44
527.61	S	Peak	29.45	-1.32	28.13	66.00	-37.87
631.40	S	Peak	29.65	0.16	29.81	66.00	-36.19
815.70	S	Peak	30.24	3.35	33.59	66.00	-32.41
867.60	H	Average	---	-11.63	21.56	46.00	-24.44
867.60	H	Peak	28.42	4.77	33.19	66.00	-21.91

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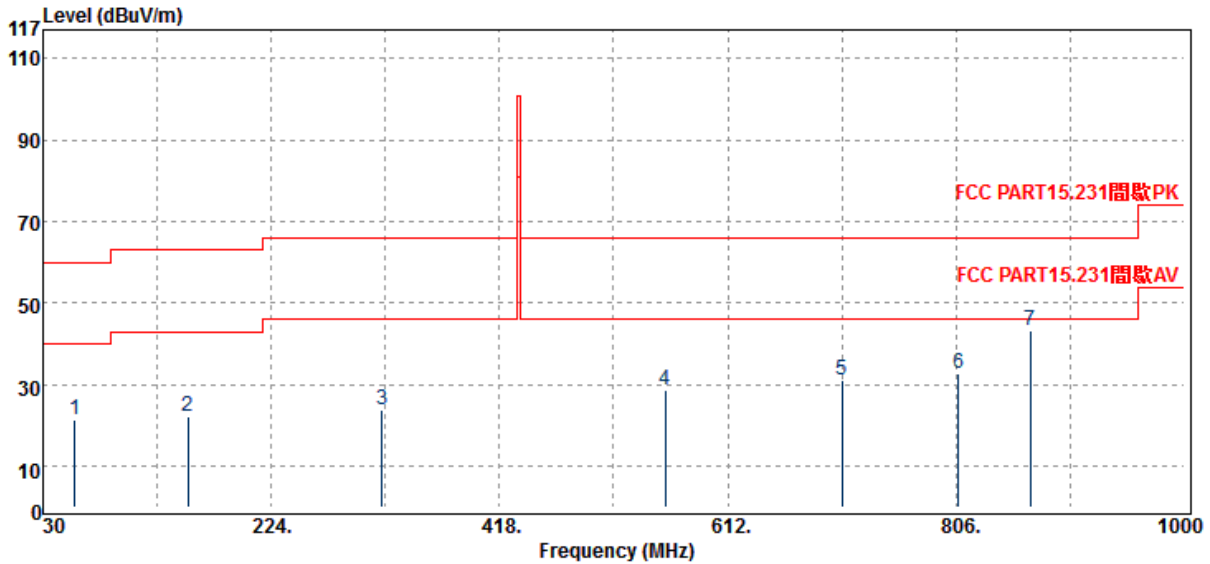
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Operation Band	:433 MHz	Test Date	:2017-09-18
Fundamental Frequency	:434.575 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX CH HIGH	Engineer	:Kane
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Safe Margin dB
57.16	S	Peak	29.52	-7.98	21.54	60.00	-38.46
153.19	S	Peak	30.16	-7.71	22.45	63.00	-40.55
318.09	S	Peak	29.17	-5.38	23.79	66.00	-42.21
558.65	S	Peak	30.14	-1.46	28.68	66.00	-37.32
709.00	S	Peak	29.56	1.42	30.98	66.00	-35.02
807.94	S	Peak	29.48	3.21	32.69	66.00	-33.31
869.15	H	Average	---	-11.63	31.5	46.00	-14.5
869.15	H	Peak	38.33	4.80	43.13	66.00	-21.91

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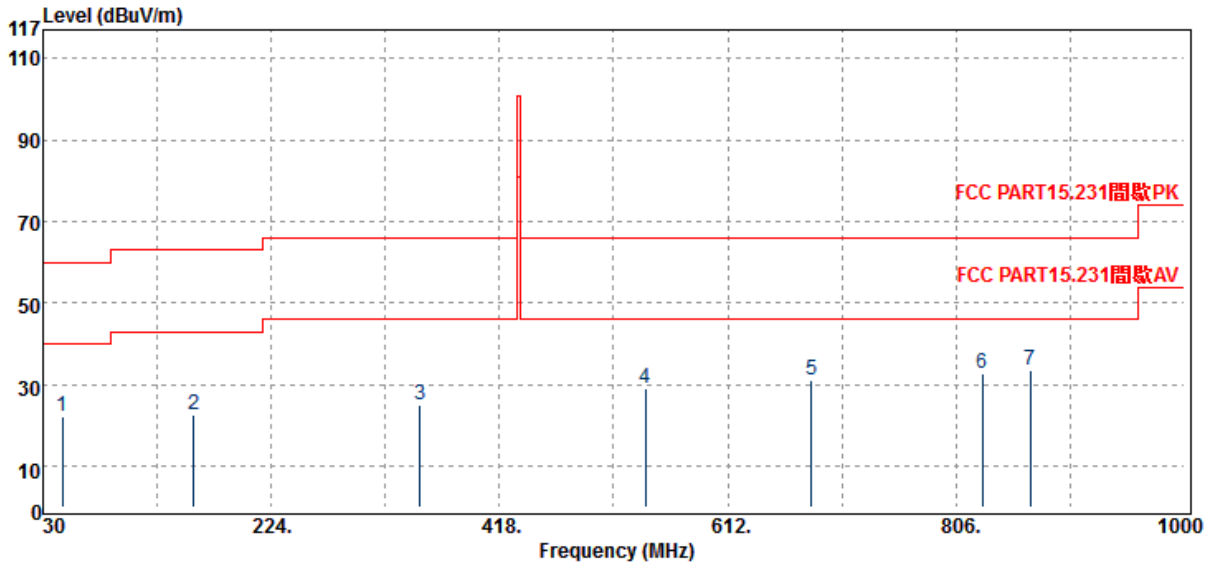
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Operation Band	:433 MHz	Test Date	:2017-09-18
Fundamental Frequency	:434.575 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX CH HIGH	Engineer	:Kane
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Safe Margin dB
46.49	S	Peak	30.23	-7.91	22.32	60.00	-37.68
158.04	S	Peak	30.10	-7.45	22.65	63.00	-40.35
350.10	S	Peak	30.02	-4.97	25.05	66.00	-40.95
542.16	S	Peak	31.03	-1.75	29.28	66.00	-36.72
682.81	S	Peak	29.94	1.10	31.04	66.00	-34.96
828.31	S	Peak	29.36	3.35	32.71	66.00	-33.29
869.15	H	Average	---	-11.63	22.13	46.00	-23.87
869.15	H	Peak	28.96	4.80	33.76	66.00	-21.91

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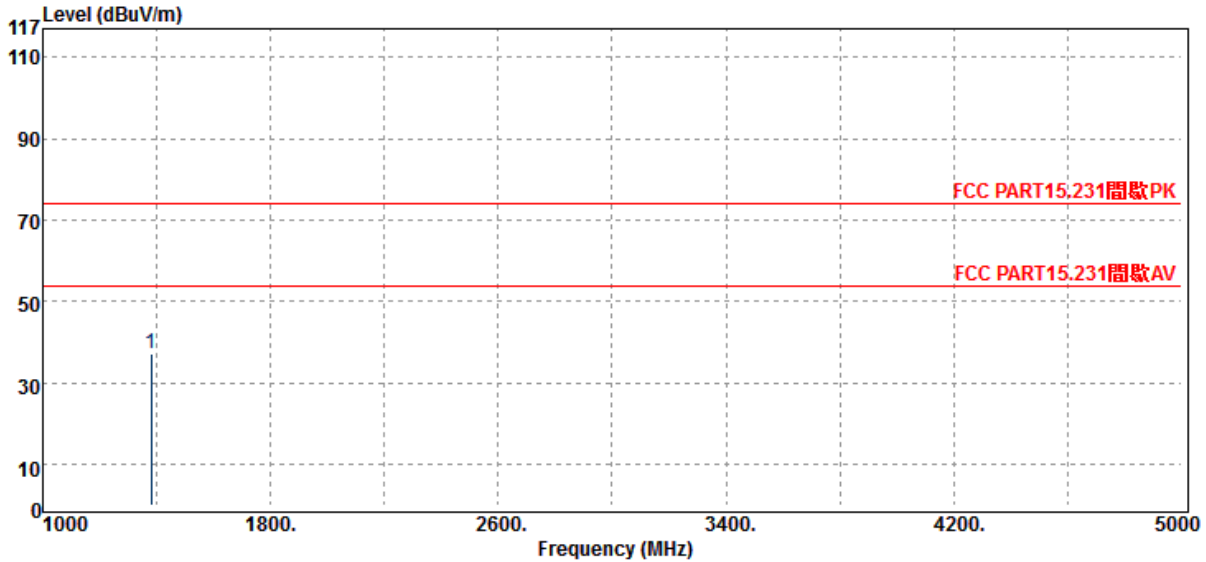
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**Above 1GHz Worst-Case Data:**

Operation Band	:433 MHz	Test Date	:2017-09-15
Fundamental Frequency	:433.05 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX CH LOW	Engineer	:Kane
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL

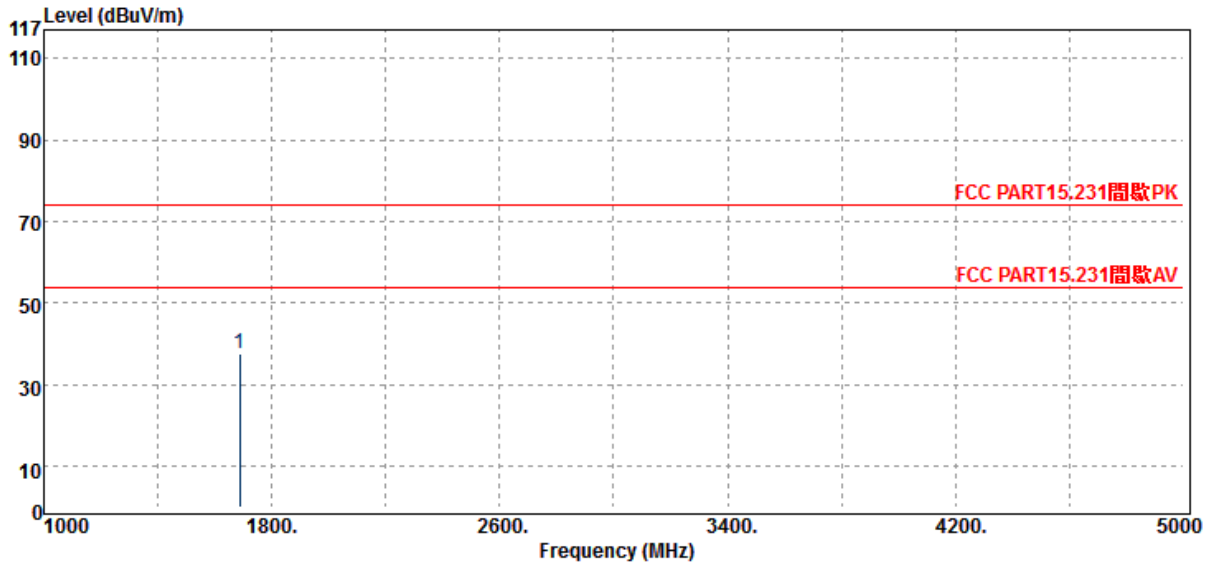


Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dBuV	dB	dBuV/m	dBuV/m	dB
1380.00	S	Average	---	-11.63	25.57	54.00	-28.43
1380.00	S	Peak	42.78	-5.58	37.20	74.00	-36.80

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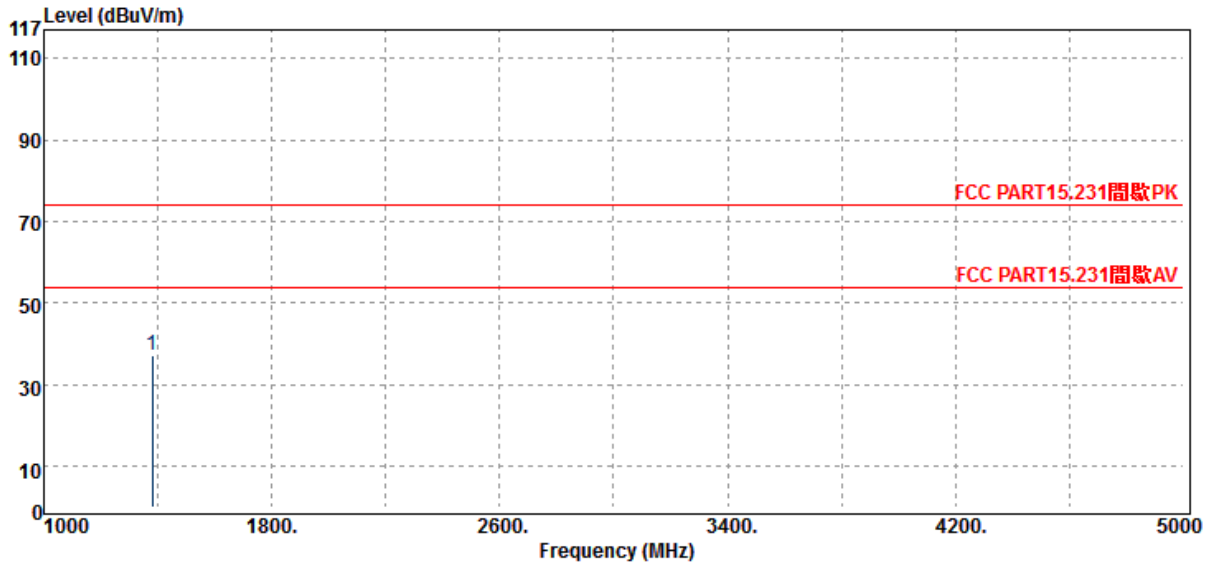
Operation Band	:433 MHz	Test Date	:2017-09-15
Fundamental Frequency	:433.05 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX CH LOW	Engineer	:Kane
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Safe Margin dB
1688.00	S	Average	---	-11.63	25.99	54.00	-28.01
1688.00	S	Peak	42.87	-5.25	37.62	74.00	-36.38

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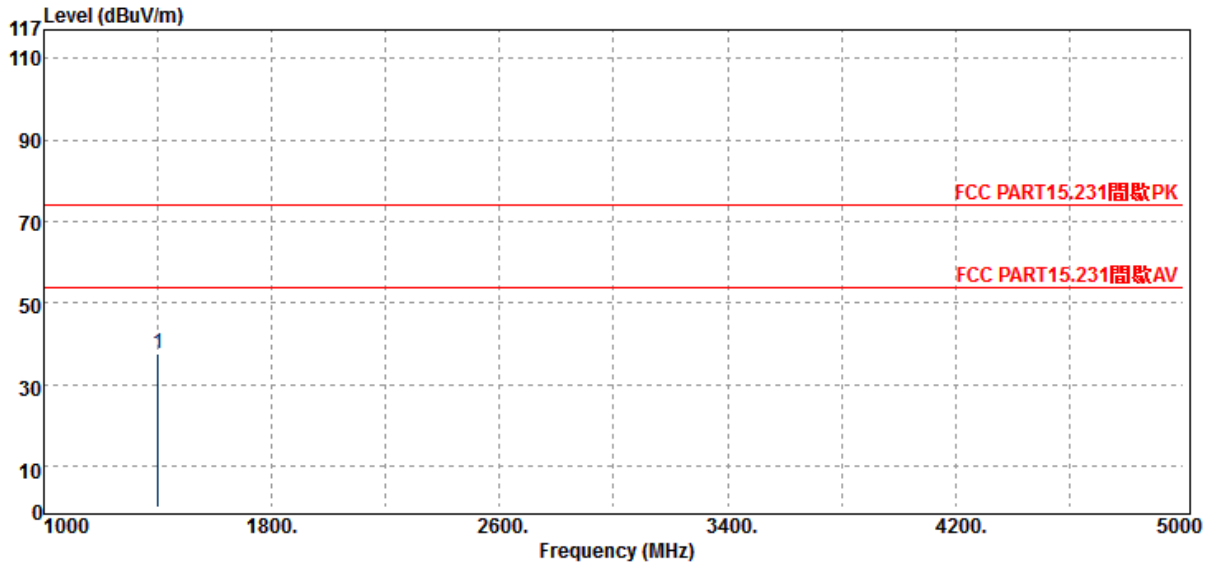
Operation Band	:433 MHz	Test Date	:2017-09-18
Fundamental Frequency	:433.8 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX CH MID	Engineer	:Kane
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
1380.00	S	Average	---	-11.63	25.52	54.00	-28.48
1380.00	S	Peak	42.73	-5.58	37.15	74.00	-21.91

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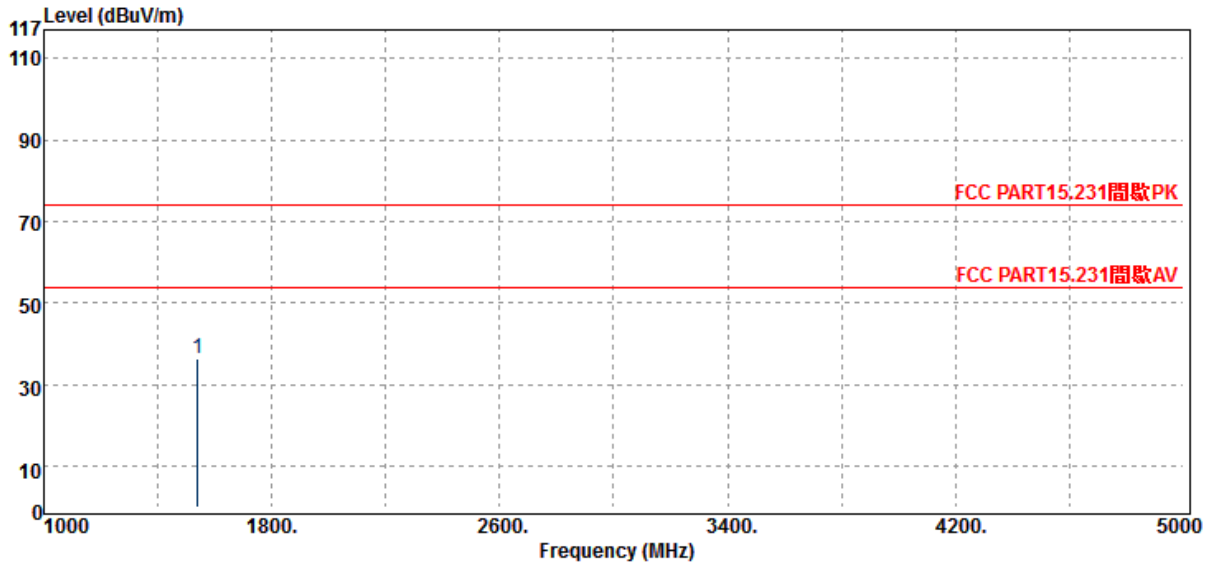
Operation Band	:433 MHz	Test Date	:2017-09-18
Fundamental Frequency	:433.8 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX CH MID	Engineer	:Kane
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
1400.00	S	Average	---	-11.63	26.17	54.00	-27.83
1400.00	S	Peak	43.33	-5.53	37.80	74.00	-21.91

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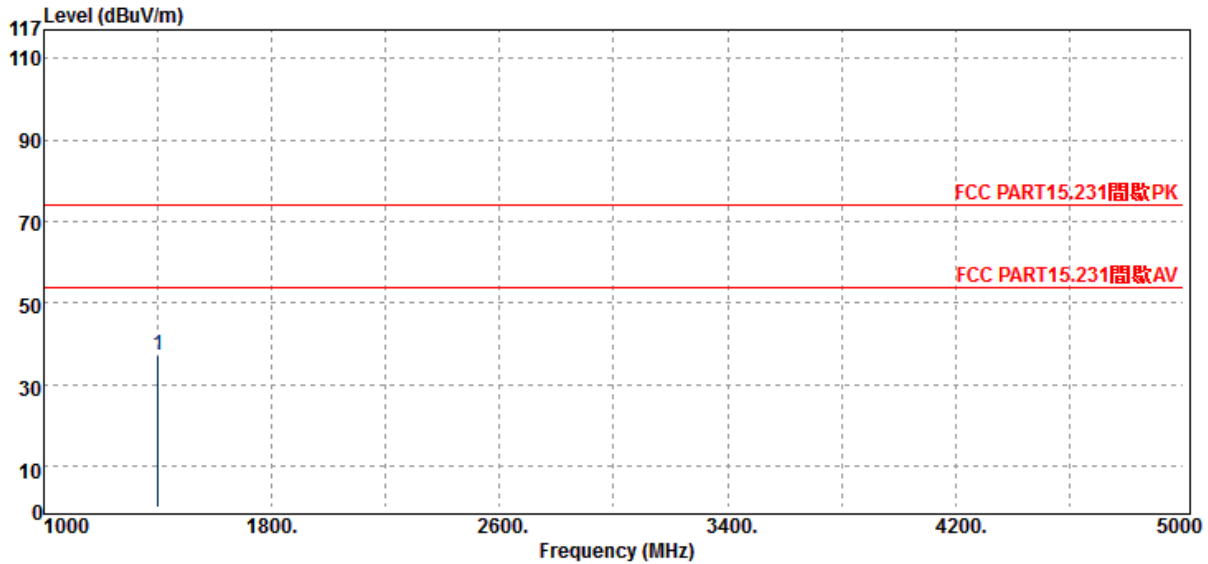
Operation Band	:433 MHz	Test Date	:2017-09-18
Fundamental Frequency	:434.575 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX CH HIGH	Engineer	:Kane
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	Margin
		PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
1540.00	S	Average	---	-11.63	24.97	54.00	-29.03
1540.00	S	Peak	42.02	-5.42	36.60	74.00	-21.91

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Operation Band	:433 MHz	Test Date	:2017-09-18
Fundamental Frequency	:434.575 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX CH HIGH	Engineer	:Kane
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
1400.00	S	Average	---	-11.63	25.79	54.00	-28.21
1400.00	S	Peak	42.95	-5.53	37.42	74.00	-21.91

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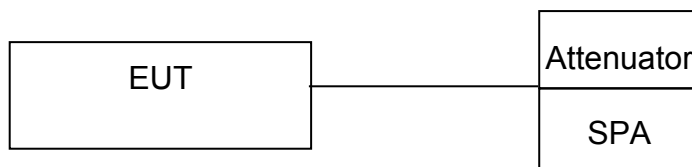
## 8. 20 dB OCCUPIED BANDWIDTH

§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.

### 8.1 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation
3. Set SPA Center Frequency = fundamental frequency, RBW=3kHz, VBW= 10KHz, Span =300KHz.
4. Set SPA -20dB occupied bandwidth.

### 8.2 Test SET-UP (Block Diagram of Configuration)



### 8.3 Measurement Equipment Used:

Conducted Emission Test Site					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum Analyzer	KEYSIGHT	N9010A	MY51440113	06/20/2017	06/19/2018
Power Meter	Anritsu	ML2496A	1326001	06/23/2017	06/22/2018
Power Sensor	Anritsu	MA2411B	1315048	06/23/2017	06/22/2018
Power Sensor	Anritsu	MA2411B	1315049	06/23/2017	06/22/2018
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	RF01	12/12/2016	12/11/2017
DC Block	PASTERNAK	PE8210	RF29	12/12/2016	12/11/2017
Splitter	RF-LAMBAD	RFLT2W1G18G	RF35	12/12/2016	12/11/2017
Attenuator	WOKEN	218FS-10	RF23	12/12/2016	12/11/2017
DC Power Supply	Agilent	E3640A	MY53140006	05/02/2017	05/01/2018

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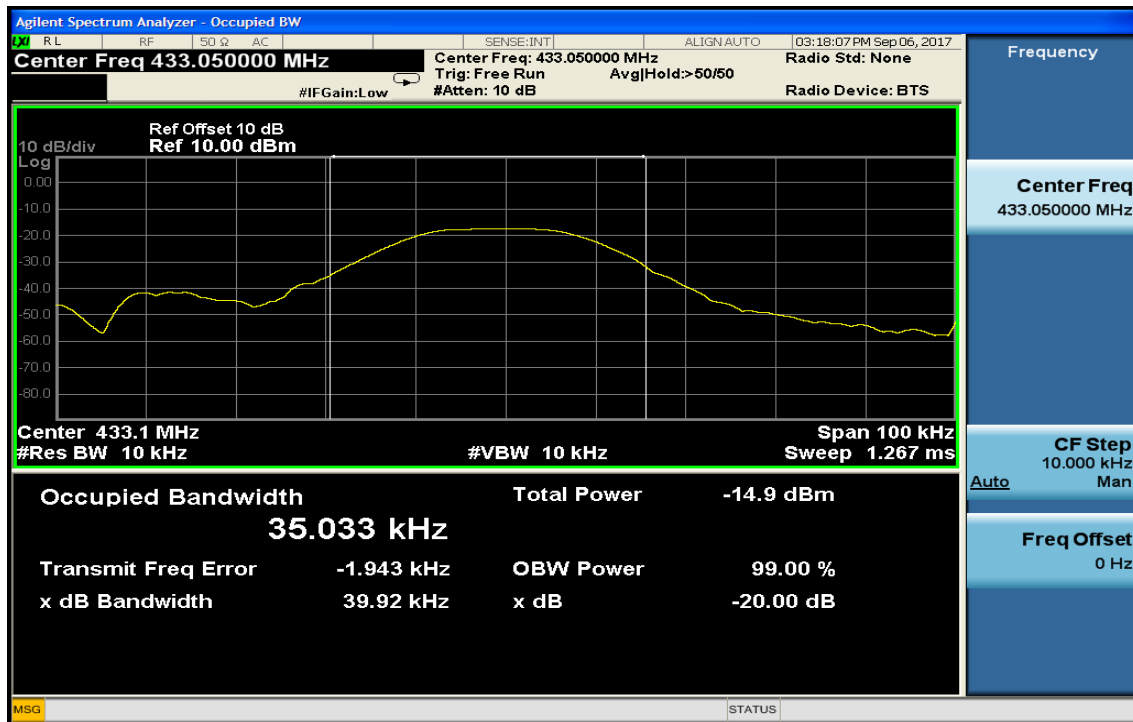
### 8.4 Measurement Results

The center frequency  $f_c$  is **433.92MHz**, according to the Rules, the Bandwidth of Center Frequency at-20dB should be calculated as following:

$$433.05 \times 0.0025 = 1.0826 \text{ (MHz)}$$

CH	20dB Bandwidth (kHz)
Low	39.92
Mid	38.95
High	38.42
<b>Limit=1082.6 kHz</b>	

### 20dB Band Width Test Data (CH Low)



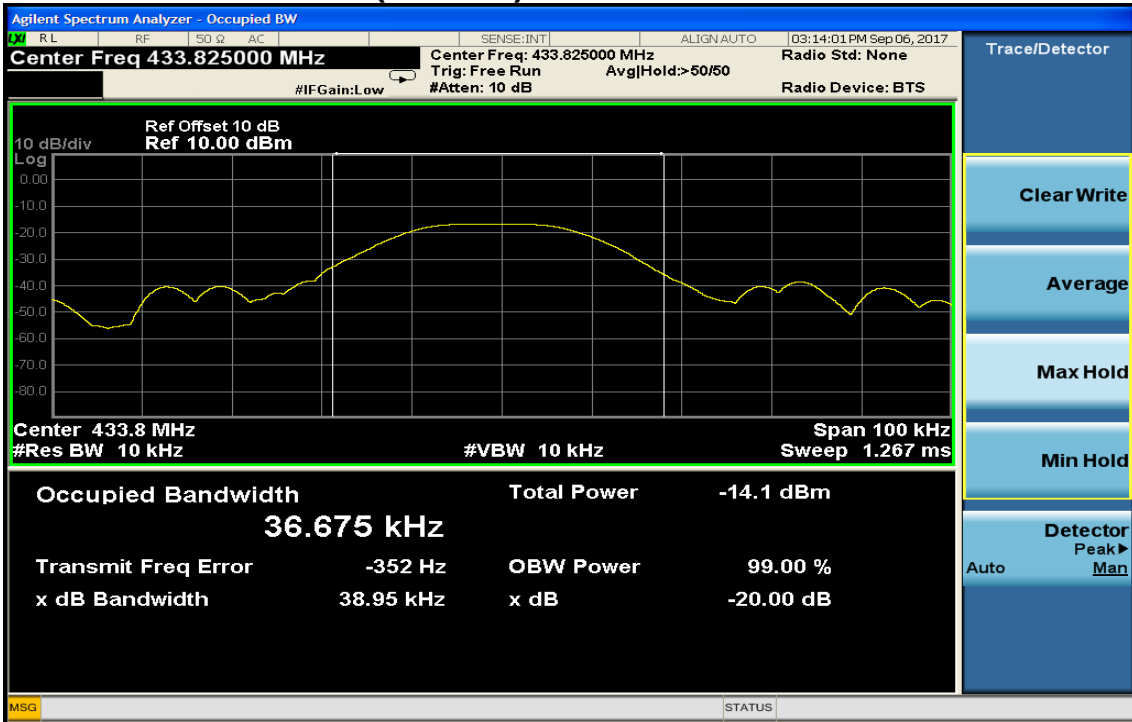
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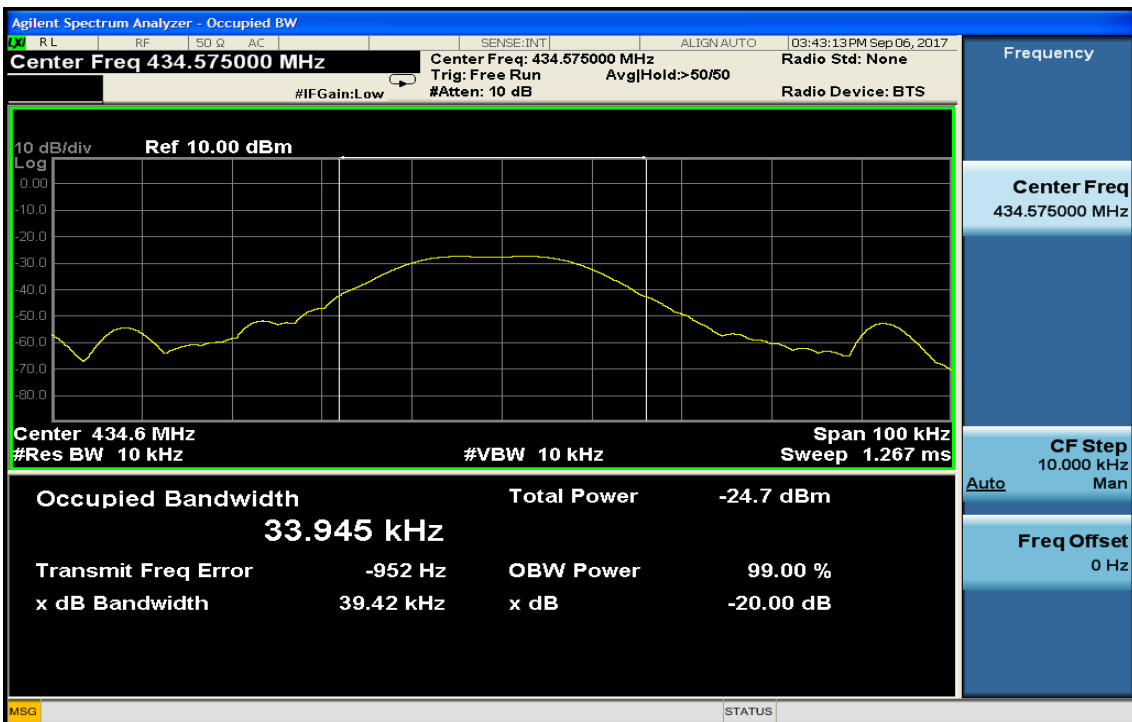
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### 20dB Band Width Test Data (CH Mid)



### 20dB Band Width Test Data (CH High)



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## 9. DUTY CYCLE MEASUREMENT

### 9.1 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set ETU normal operating mode.
3. Set SPA Center Frequency = fundamental frequency, RBW, VBW= 100kHz, Span =0 Hz. Adjacent sweep.
4. Set SPA View. Mark delta.

### 9.2 Test SET-UP (Block Diagram of Configuration)

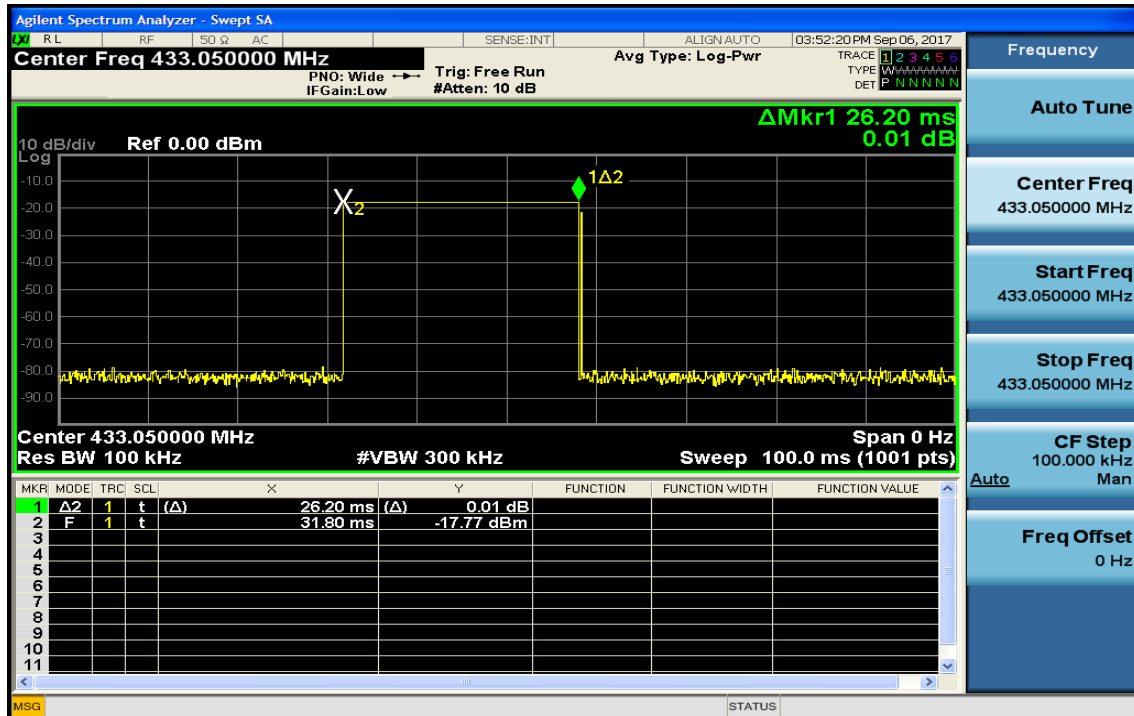
Same as 8.3 Radiated Emission Measurement.

### 9.3 Measurement Equipment Used:

Same as 8.3 Radiated Emission Measurement.

### 9.4 Measurement Results:

Ton (ms)	TP=Ton+Toff (ms)	Avg correction(dB) = 20log(Ton/TP)
26.20	100	-11.63



Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

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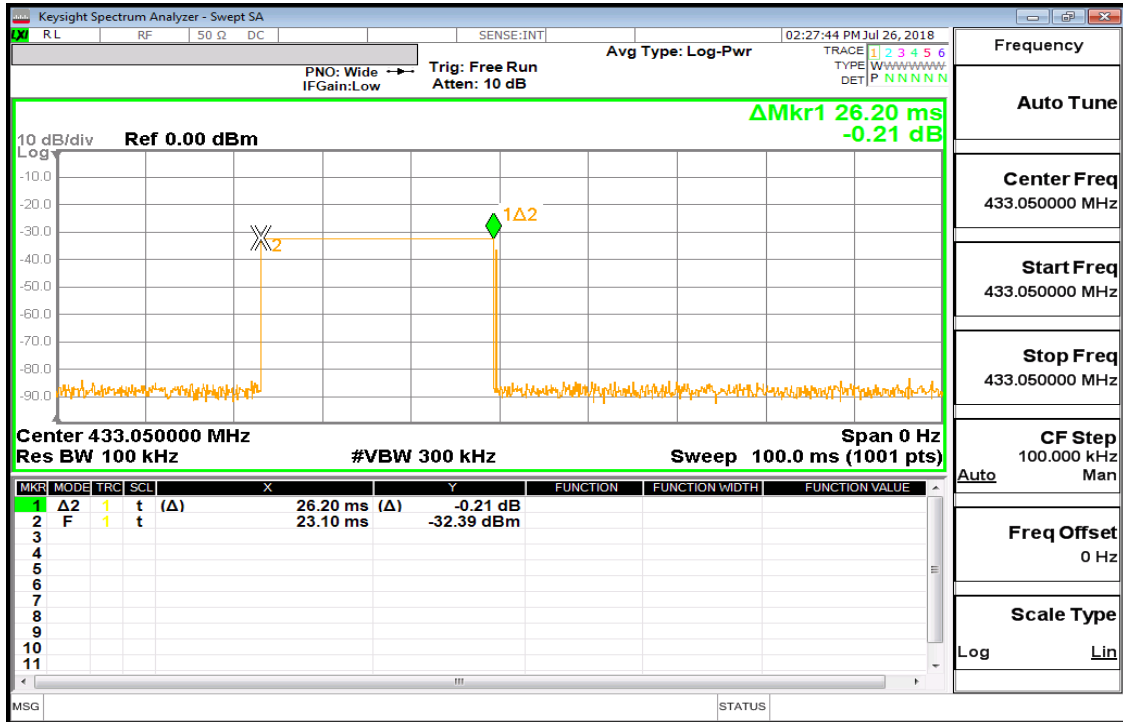
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f (886-2) 2298-0488

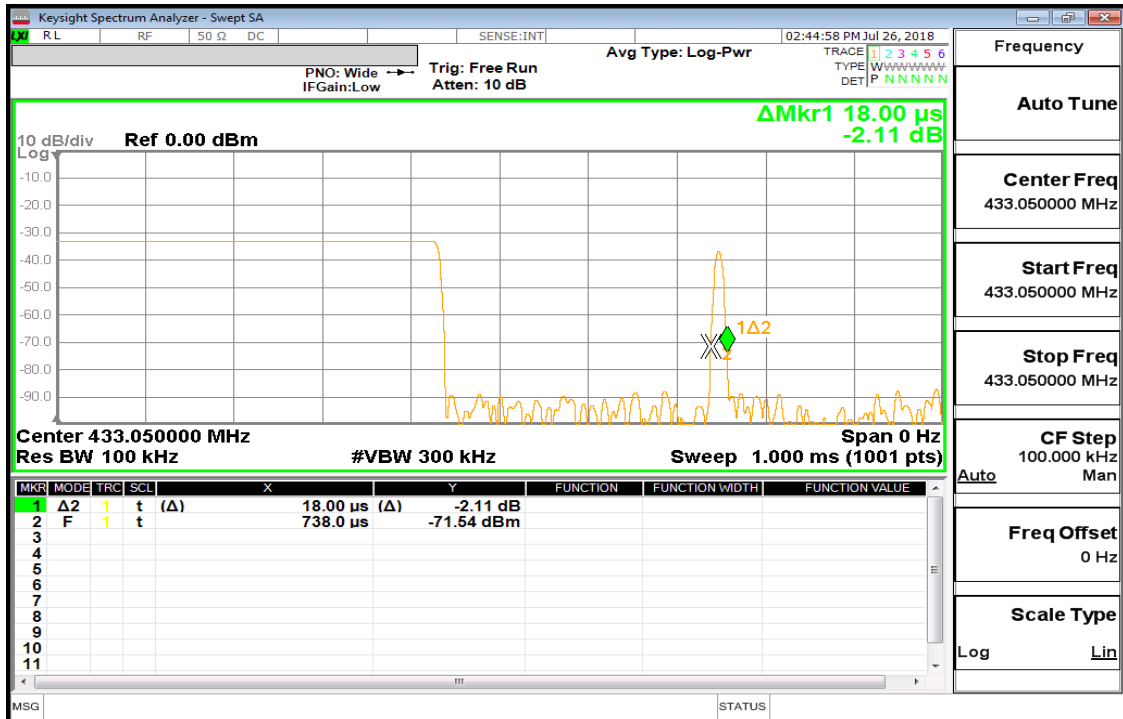
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## Ton\_1



## Ton\_2



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## 10. RELEASE TIME MEASUREMENT:

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

### 10.1 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set SPA Center Frequency = fundamental frequency, RBW=100kHz, VBW= 100kHz, Span =0Hz. Sweep Time= 5s.
3. Set EUT as normal operation and press Transmitter bottom for 2 s approximately,
4. Set SPA Max hold. Delta Mark.

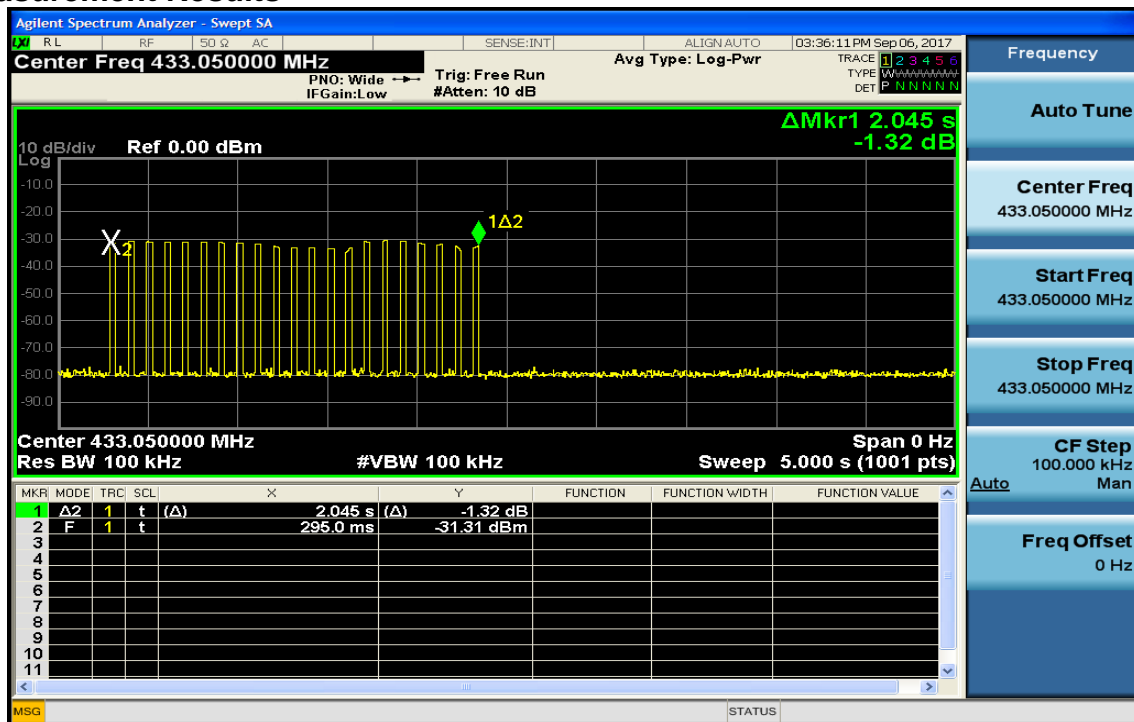
### 10.2 Test SET-UP (Block Diagram of Configuration)

Same as 8.3 Radiated Emission Measurement.

### 10.3 Measurement Equipment Used:

Same as 8.3 Radiated Emission Measurement.

### 10.4 Measurement Results



~ End of Report ~

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