

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 JX

Model Different: N/A

FCC ID: R4UARCFLEXJX

Report No.: ER/2015/80067A-01

Issue Date: Sep. 22, 2015

Rule Part: §15.231

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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 JX

Model Different: N/A

FCC ID: R4UARCFLEXJX

File Number: ER/2015/80067A-01

Date of test: Aug. 18, 2015 ~ Sep. 22, 2015

Date of EUT Received: Aug. 18, 2015

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 of FCC Rules Part 15.231.

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

Test By:

Marcus Tseng

Date:

Sep. 22, 2015

Marcus Tseng / Engineer

Prepared By:

Allen Tsai

Date:

Sep. 22, 2015

Allen Tsai / Engineer

Approved By:

Jim Chang

Date:

Sep. 22, 2015

Jim Chang / Asst. Manager

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Version

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1. GENERAL INFORMATION

1.1 Product Description

Product Name:	Industrial radio remote control systems	
Brand Name:	ARC	
Model No.	FLEX JX	
Model Different:	N/A	
Hardware Version:	N/A	
Software Version:	N/A	
Power Supply:	6Vdc from Rechargeable Li-Ion battery	
	Battery:	Model:BAT-03, Supplier: N/A

433 MHz:

Operating Frequency	433.00MHz ~ 434.525MHz
Transmit Power	≤ 71.72 dBuV/m Max.
Modulation Technique	GFSK
Number of Channels	62 Channel
Channel Spacing	25 kHz
Antenna Type	PCB Antenna

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1.2 Related Submittal(s) / Grant (s)

The equipment under Test (Hereafter Called: EUT) is Industrial radio remote control systems supporting, 433MHz features, and below is details of information.

Product Feature	
Product Name:	Industrial radio remote control systems
Brand Name:	ARC
Type No.:	FLEX JX
Model Difference:	N/A
FCC ID	R4UARCFLEXJX
Modulation:	GFSK

Note: The above EUT information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

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1.3 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.

1.4 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: 990257 (Wugu)

Canada Registration Number: 4620A-5

1.5 Special Accessories

There are no special accessories used while test was conducted.

1.6 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 (Not apply in the report)

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. 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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2.4 Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

Note:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Following shows an offset computation example with cable loss 0.5 dB and 10 dB attenuator.

Offset = RF cable loss (dB)+ attenuation factor(dB) =0.5+10=10.5(dB)

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= $20 \log (\mu\text{V/m})$
 : 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, $\mu\text{V/m}$ at 3meters = $56.81818(F) - 6136.3636$; For the band 260-470MHz $\mu\text{V/m}$ at 3meters = $41.6667(F) - 7083.3333$; Where F is the frequency in MHz.
 6. 433.00 MHz limit = $41.6667 * 433.00 - 7083.3333 = 10958.3478 \mu\text{V/m}$
 = 80.80 dBuV/m
 433.75 MHz limit = $41.6667 * 433.75 - 7083.3333 = 10989.597825 \mu\text{V/m}$
 = 80.82 dBuV/m
 434.525 MHz limit = $41.6667 * 434.525 - 7083.3333 = 11021.88952 \mu\text{V/m}$
 = 80.85 dBuV/m

2.5 Configuration of Tested System

Fig. 2-1 Configuration of Tested System

EUT(TX)

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 433.00 ~ 434.525 MHz Band

62 channels are provided.

CH	FREQUENCY	CH	FREQUENCY	CH	FREQUENCY	CH	FREQUENCY
01	433.000MHZ	18	433.425MHZ	35	433.850MHZ	52	434.275MHZ
02	433.025MHZ	19	433.450MHZ	36	433.875MHZ	53	434.300MHZ
03	433.050MHZ	20	433.475MHZ	37	433.900MHZ	54	434.325MHZ
04	433.075MHZ	21	433.500MHZ	38	433.925MHZ	55	434.350MHZ
05	433.100MHZ	22	433.525MHZ	39	433.950MHZ	56	434.375MHZ
06	433.125MHZ	23	433.550MHZ	40	433.975MHZ	57	434.400MHZ
07	433.150MHZ	24	433.575MHZ	41	434.000MHZ	58	434.425MHZ
08	433.175MHZ	25	433.600MHZ	42	434.025MHZ	59	434.450MHZ
09	433.200MHZ	26	433.625MHZ	43	434.050MHZ	60	434.475MHZ
10	433.225MHZ	27	433.650MHZ	44	434.075MHZ	61	434.500MHZ
11	433.250MHZ	28	433.675MHZ	45	434.100MHZ	62	434.525MHZ
12	433.275MHZ	29	433.700MHZ	46	434.125MHZ		
13	433.300MHZ	30	433.725MHZ	47	434.150MHZ		
14	433.325MHZ	31	433.750MHZ	48	434.175MHZ		
15	433.350MHZ	32	433.775MHZ	49	434.200MHZ		
16	433.375MHZ	33	433.800MHZ	50	434.225MHZ		
17	433.400MHZ	34	433.825MHZ	51	434.250MHZ		

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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	1 to 62	1,31,62	GFSK	1	MAIN
RADIATED EMISSION TEST (ABOVE 1 GHz)					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
433 MHz	1 to 62	1,31,62	GFSK	1	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	1 to 62	1,31,62	GFSK	1	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 : Vertical)	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 : Horizontal)	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					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESC17	100760	05/04/2015	05/03/2016
LISN	SCHWARZ BECK	NSLK 8127	8127-649	05/15/2015	05/14/2016
LISN	FCC	FCC-LISN-50/250- 25-2-01	04034	03/13/2015	03/12/2016
Coaxial Cables	N/A	WK CE Cable	N/A	11/26/2014	11/25/2015

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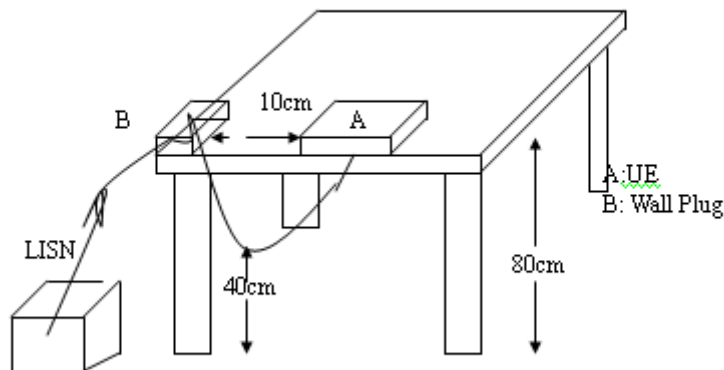
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6.3 EUT Setup

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.

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 10th harmonic of the fundamental frequency, and data containing the worst result over 30MHz are shown on the test report.

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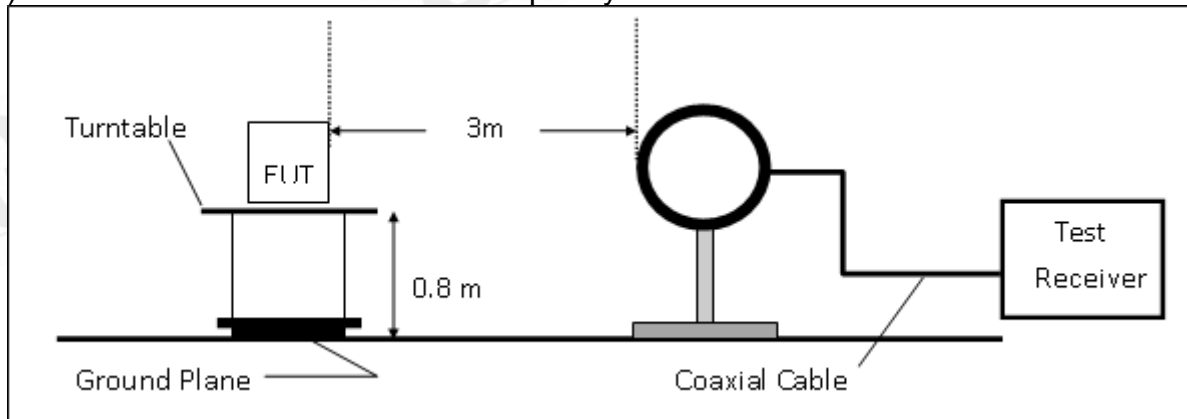
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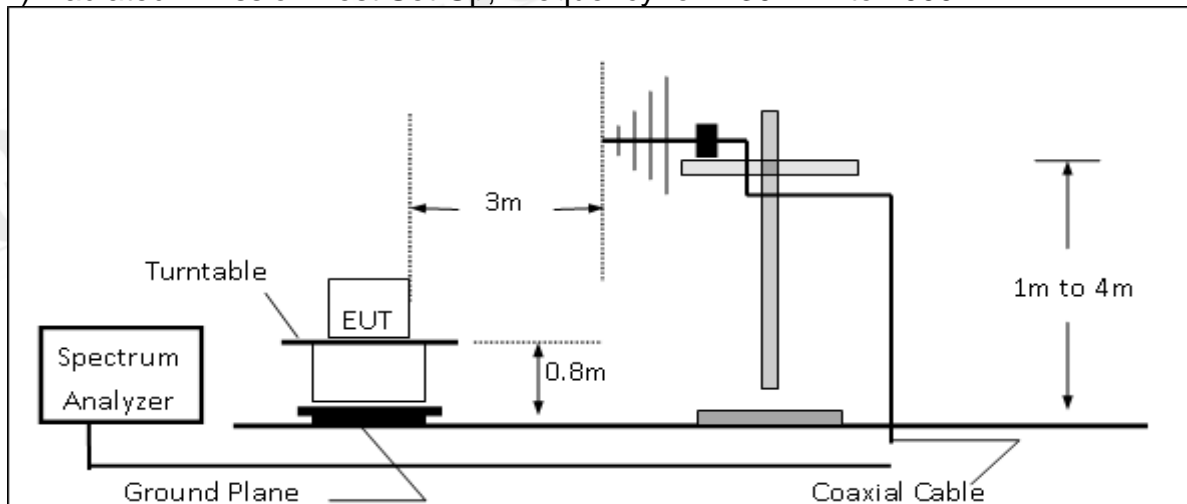
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7.2 Test SET-UP (Block Diagram of Configuration).

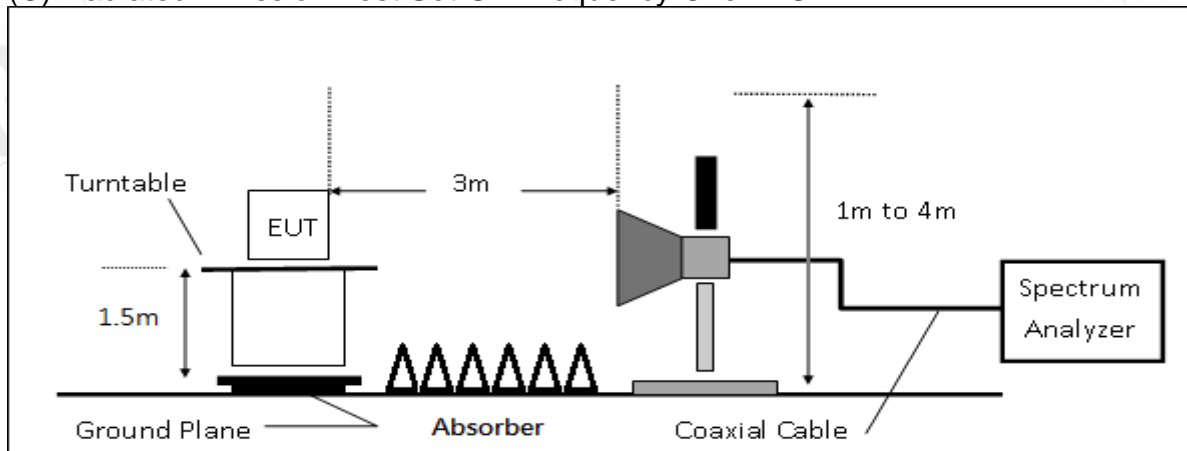
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



(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:

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100760	05/04/2015	05/03/2016
Spectrum Analyzer	Agilent	E4446A	MY51100003	01/29/2015	01/28/2016
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	12/22/2014	12/21/2015
Spectrum Analyzer	R&S	FSV-30	101398	10/07/2014	10/06/2015
Loop Antenna	ETS.LINDGREN	6502	00143303	12/9/2014	12/08/2015
Bilog Antenna	SCHWAZBECK	VULB9168	378	12/23/2014	12/22/2015
Horn antenna	ETS.LINDGREN	3117	123995	05/05/2015	05/04/2016
Horn Antenna	Schwarzbeck	BBHA9170	184	12/25/2014	12/24/2015
Pre-Amplifier	Agilent	8447D	2944A07676	01/02/2015	01/01/2016
Pre-Amplifier	Agilent	8449B	3008A00578	01/02/2015	01/01/2016
Pre-Amplifier	EMC Instruments Corp.	EMC184045	980135	01/02/2015	01/01/2016
Filter 2400-2483.5 MHz	EWT	EWT-14-0166	M2	01/02/2015	01/01/2016
Attenuator	Mini-Circuit	BW-S10W2+	004	01/02/2015	01/01/2016
Turn Table	HD	DT420	N/A	N.C.R	N.C.R
Antenna Tower	ChamPro	AM-BS-4500-B	060776-ABS	N.C.R	N.C.R
Controller	ChamPro	EM1000	060776	N.C.R	N.C.R
Low Loss Cable	Huber Suhner	966_Rx	9	01/02/2015	01/01/2016
3m Site NSA	SGS	966 chamber	N/A	07/01/2015	06/30/2016

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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 $20 \cdot \log(\mu V/m)$

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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7.7. Measurement Result

Operation Band	: Main Low	Test Date	:2015-08-31
Fundamental Frequency	:433.00 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX MAIN	Engineer	:Burly
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB

433.00	F	Average	---	---	61.52	80.80	-19.28
433.00	F	Peak	77.54	-5.82	71.72	100.80	-29.08

Operation Band	: Main Low	Test Date	:2015-08-31
Fundamental Frequency	:433.00 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX MAIN	Engineer	:Burly
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB

433.00	F	Average	---	---	55.32	80.80	-25.48
433.00	F	Peak	71.34	-5.82	65.52	100.80	-35.28

Note: Average Actual = Peak Actual + Average Factor (-10.2)

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Operation Band	: Main Mid	Test Date	:2015-08-31
Fundamental Frequency	:433.75 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX MAIN	Engineer	:Burly
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
433.75	F	Average	---	---	61.24	80.82	-19.58
433.75	F	Peak	77.27	-5.83	71.44	100.82	-29.38

Operation Band	: Main Mid	Test Date	:2015-08-31
Fundamental Frequency	:433.75 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX MAIN	Engineer	:Burly
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
433.75	F	Average	---	---	55.46	80.82	-25.36
433.75	F	Peak	71.49	-5.83	65.66	100.82	-35.16

Note: Average Actual = Peak Actual + Average Factor (-10.2)

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Operation Band	: Main High	Test Date	:2015-08-31
Fundamental Frequency	:434.525 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX MAIN	Engineer	:Burly
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
433.525	F	Average	---	---	61.03	80.85	-19.82
434.525	F	Peak	77.07	-5.84	71.23	100.85	-29.62

Operation Band	: Main High	Test Date	:2015-08-31
Fundamental Frequency	:434.525 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX MAIN	Engineer	:Burly
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
433.525	F	Average	---	---	55.27	80.85	-25.58
434.525	F	Peak	71.31	-5.84	65.47	100.85	-35.38

Note: Average Actual = Peak Actual + Average Factor (-10.2)

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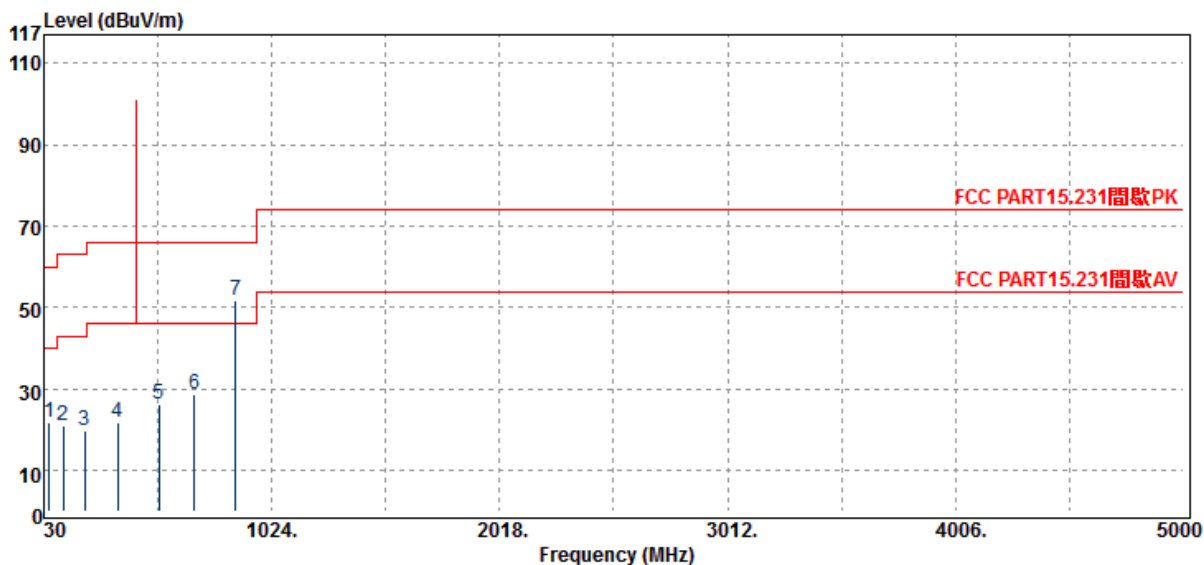
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Operation Band	:433 MHz	Test Date	:2015-08-31
Fundamental Frequency	:433.00 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX LOW	Engineer	:Burly
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
54.25	S	Peak	31.69	-9.73	21.96	60.00	-38.04
114.39	S	Peak	32.69	-11.80	20.89	63.00	-42.11
207.51	S	Peak	31.13	-11.32	19.81	63.00	-43.19
353.01	S	Peak	28.92	-7.11	21.81	66.00	-44.19
532.46	S	Peak	30.52	-4.03	26.49	66.00	-39.51
684.75	S	Peak	29.84	-0.95	28.89	66.00	-37.11
866.00	H	Peak	49.33	2.45	51.78	66.00	-14.22
866.00	H	Average	---	---	41.58	46.00	-4.42

Note: Average Actual = Peak Actual + Average Factor (-10.2)

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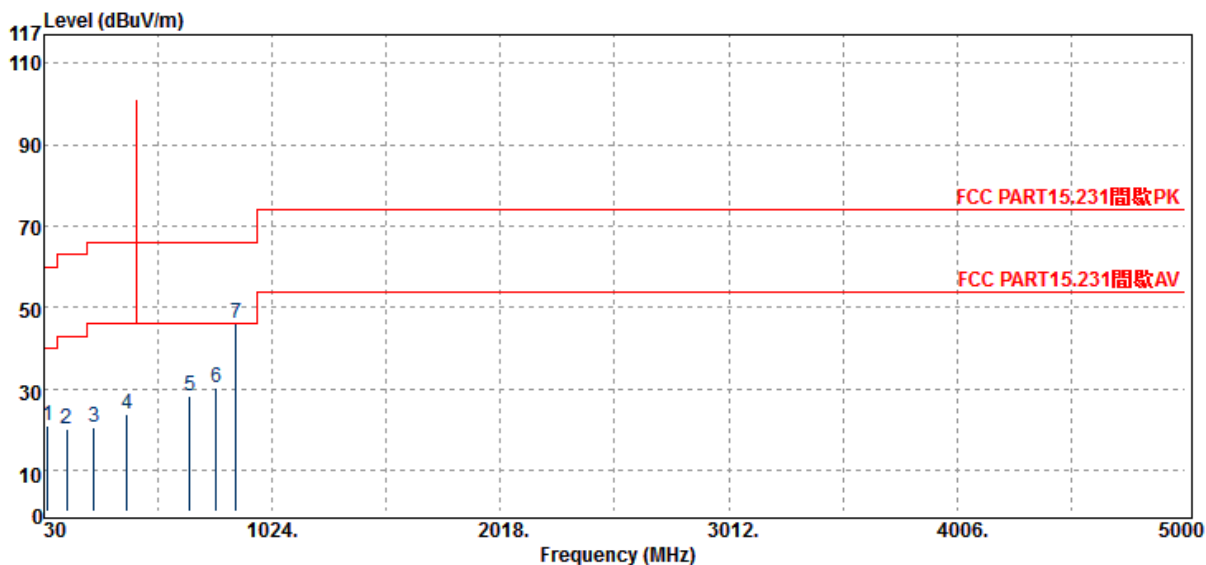
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Operation Band	:433 MHz	Test Date	:2015-08-31
Fundamental Frequency	:433.00 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX LOW	Engineer	:Burly
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
46.49	S	Peak	30.31	-9.35	20.96	60.00	-39.04
128.94	S	Peak	30.91	-10.59	20.32	63.00	-42.68
248.25	S	Peak	30.66	-9.90	20.76	66.00	-45.24
391.81	S	Peak	30.06	-6.12	23.94	66.00	-42.06
665.35	S	Peak	29.52	-1.18	28.34	66.00	-37.66
778.84	S	Peak	30.01	0.45	30.46	66.00	-35.54
866.00	H	Peak	43.85	2.45	46.30	66.00	-19.70
866.00	H	Average	---	---	36.10	46.00	-9.90

Note: Average Actual = Peak Actual + Average Factor (-10.2)

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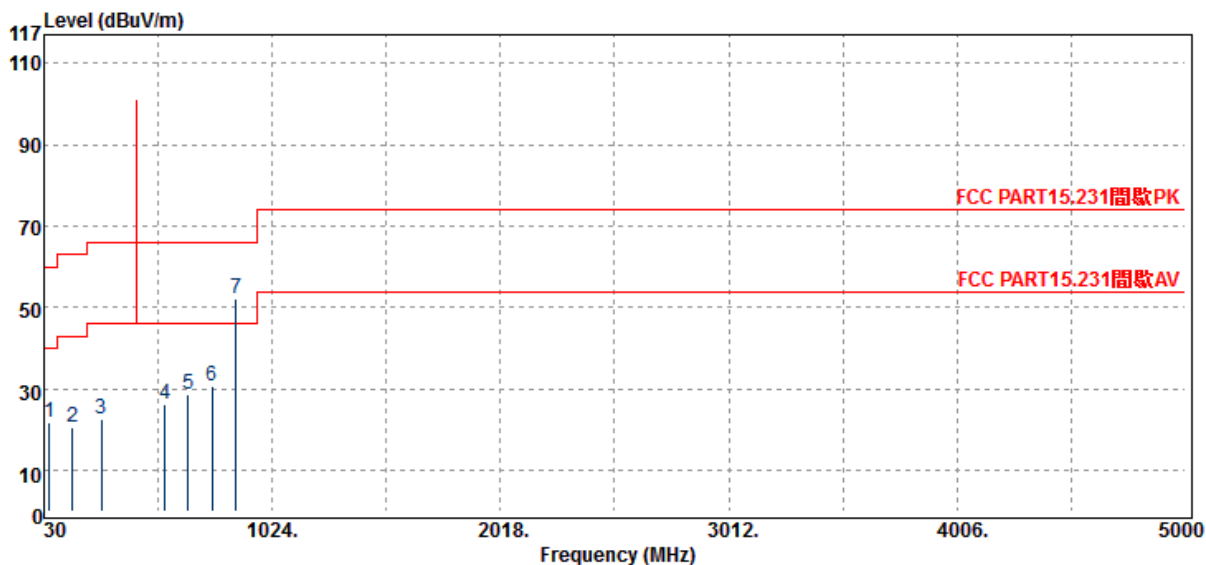
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Operation Band	:433 MHz	Test Date	:2015-08-31
Fundamental Frequency	:433.75 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX MID	Engineer	:Burly
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dB μ V		dB μ V/m	dB μ V/m	
54.25	S	Peak	31.77	-9.73	22.04	60.00	-37.96
153.19	S	Peak	29.77	-9.13	20.64	63.00	-42.36
280.26	S	Peak	31.10	-8.38	22.72	66.00	-43.28
555.74	S	Peak	30.45	-3.95	26.50	66.00	-39.50
657.59	S	Peak	29.71	-1.13	28.58	66.00	-37.42
762.35	S	Peak	29.51	1.14	30.65	66.00	-35.35
867.50	H	Peak	49.71	2.49	52.20	66.00	-13.80
867.50	H	Average	---	---	42.00	46.00	-4.00

Note: Average Actual = Peak Actual + Average Factor (-10.2)

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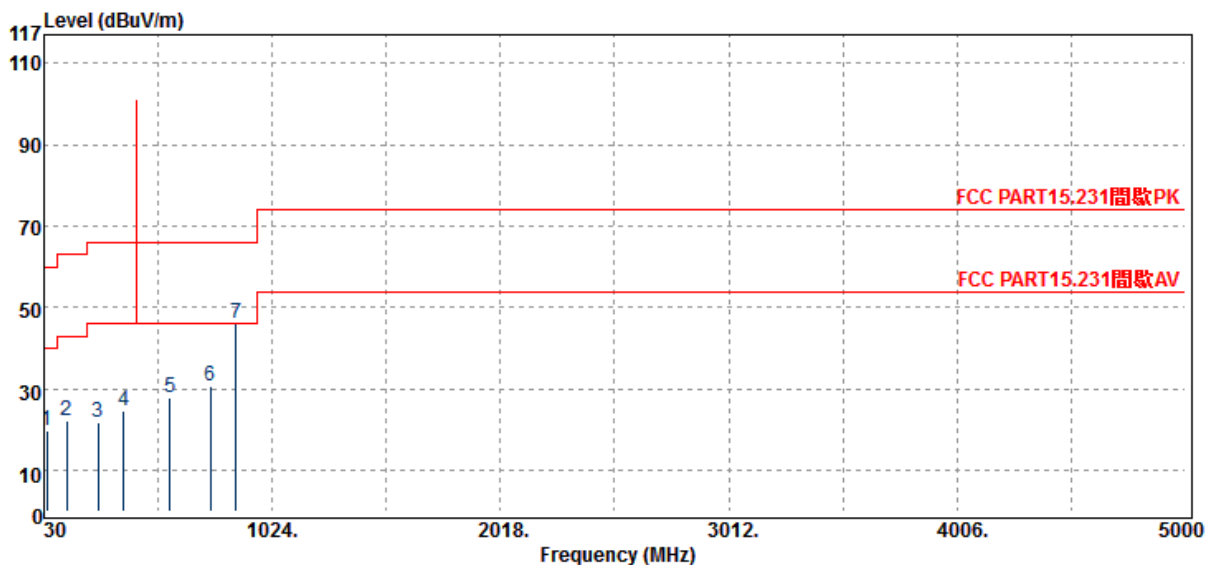
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Operation Band	:433 MHz	Test Date	:2015-08-31
Fundamental Frequency	:433.75 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX MID	Engineer	:Burly
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
42.61	S	Peak	29.38	-9.55	19.83	60.00	-40.17
128.94	S	Peak	32.83	-10.59	22.24	63.00	-40.76
264.74	S	Peak	31.35	-9.30	22.05	66.00	-43.95
376.29	S	Peak	31.16	-6.58	24.58	66.00	-41.42
579.99	S	Peak	30.01	-2.12	27.89	66.00	-38.11
755.56	S	Peak	30.12	0.80	30.92	66.00	-35.08
867.50	H	Peak	43.47	2.49	45.96	66.00	-20.04
867.50	H	Average	---	---	35.76	46.00	-10.24

Note: Average Actual = Peak Actual + Average Factor (-10.2)

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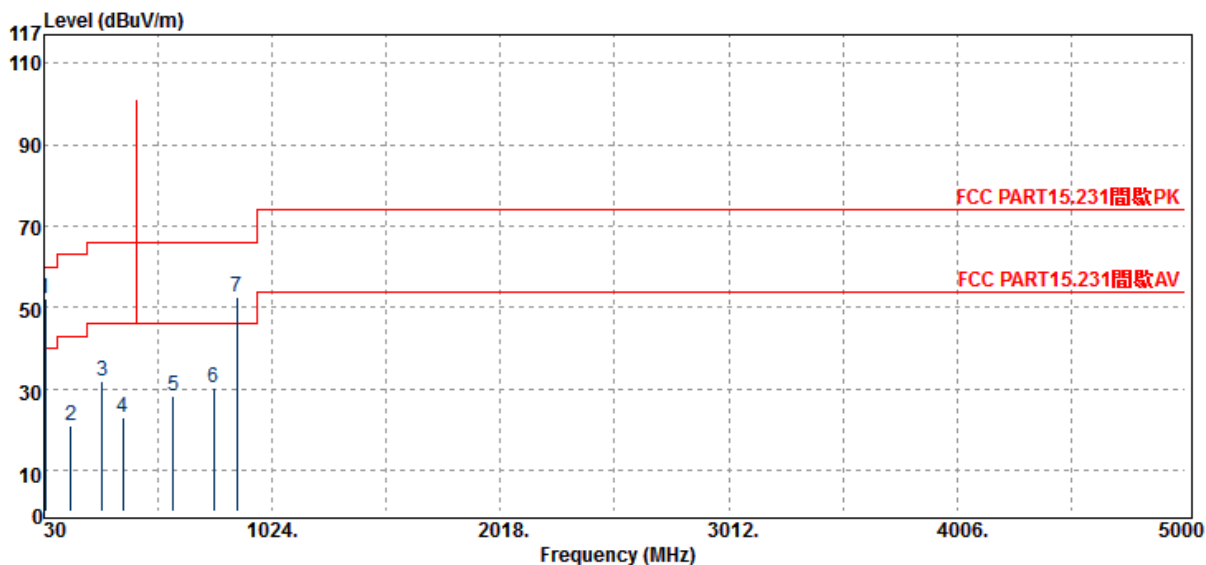
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Operation Band	:433 MHz	Test Date	:2015-08-31
Fundamental Frequency	:434.525 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX High	Engineer	:Burly
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
34.85	S	Peak	62.21	-10.17	52.04	60.00	-7.96
146.40	S	Peak	30.45	-9.57	20.88	63.00	-42.12
282.20	S	Peak	40.27	-8.34	31.93	66.00	-34.07
372.41	S	Peak	29.76	-6.73	23.03	66.00	-42.97
592.60	S	Peak	29.86	-1.55	28.31	66.00	-37.69
770.11	S	Peak	29.48	0.94	30.42	66.00	-35.58
869.05	H	Peak	50.20	2.53	52.73	66.00	-13.27
869.05	H	Average	---	---	42.53	46.00	-3.47

Note: Average Actual = Peak Actual + Average Factor (-10.2)

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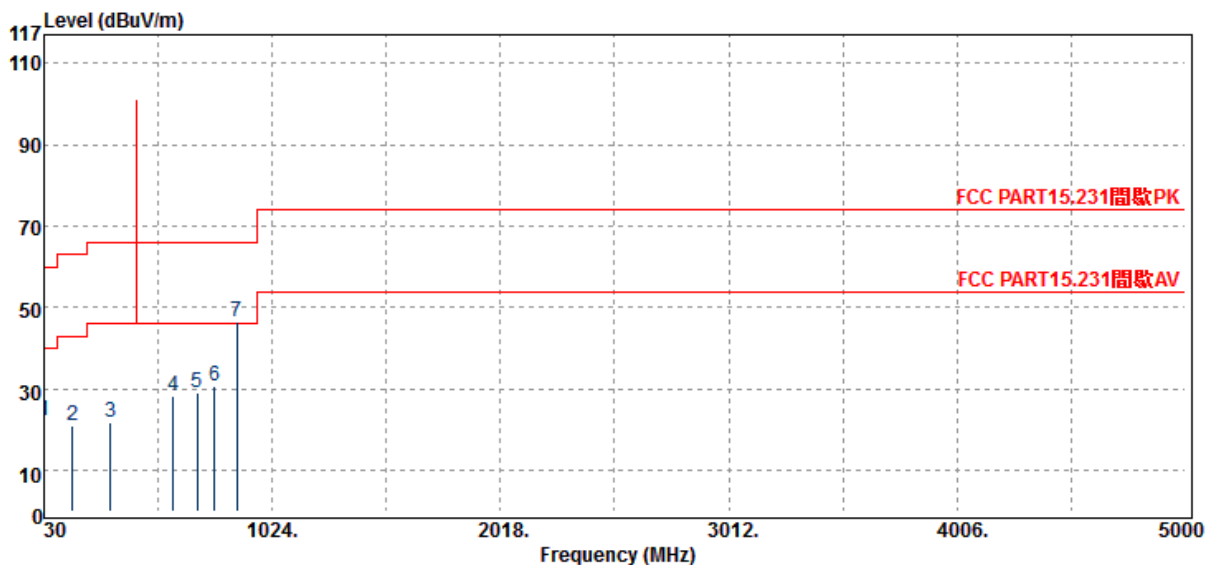
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Operation Band	:433 MHz	Test Date	:2015-08-31
Fundamental Frequency	:434.525 MHz	Temp./Humi.	:24.5 deg_C / 57RH
Operation Mode	:TX High	Engineer	:Burly
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
31.94	S	Peak	32.36	-10.22	22.14	60.00	-37.86
154.16	S	Peak	30.20	-9.07	21.13	63.00	-41.87
319.06	S	Peak	29.43	-7.57	21.86	66.00	-44.14
592.60	S	Peak	29.87	-1.55	28.32	66.00	-37.68
696.39	S	Peak	30.10	-0.91	29.19	66.00	-36.81
772.05	S	Peak	29.92	0.86	30.78	66.00	-35.22
869.05	H	Peak	44.14	2.53	46.67	66.00	-19.33
866.00	H	Average	---	---	36.47	46.00	-9.53

Note: Average Actual = Peak Actual + Average Factor (-10.2)

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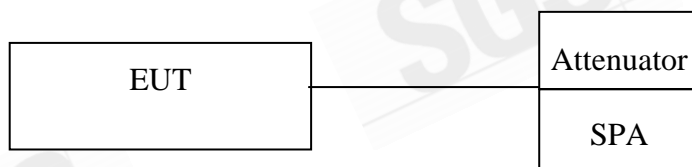
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8. 20dB OCCUPIED BANDWIDTH

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, VBW= 10KHz, Span =100KHz.
4. Set SPA -20dB Occupied bandwidth.

8.2 Test SET-UP (Block Diagram of Configuration)



8.3 Measurement Equipment Used:

SGS Conducted Emission Test Site No.A					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Power Meter	Anritsu	ML2495A	1005007	12/20/2014	12/19/2015
Power Sensor	Anritsu	MA2411B	917032	12/20/2014	12/19/2015
Spectrum Analyzer	Agilent	E4446A	MY51100003	01/29/2015	01/28/2016
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/02/2015	01/01/2016
Spectrum Analyzer	Agilent	E4440A	MY45304525	05/05/2015	05/04/2016
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2015	01/01/2016
Attenuator	Mini-Circuit	BW-S10W2+	002	01/02/2015	01/01/2016

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8.4 Measurement Results

Refer to attached data chart.

The center frequency f_c is **433.75MHz**, according to the Rules, section 15.231(C), the Bandwidth of Center Frequency at-20dB should be calculated as following:

$$433.75 \times 0.0025 = 1.0843 \text{ (MHz)}$$

Measurement Result:

CH	20dB Bandwidth (kHz)
Low	41.79
Mid	38.57
High	41.04
Limit=1084.3 kHz	

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20dB Band Width Test Data (CH Low)



20dB Band Width Test Data (CH Mid)



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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)

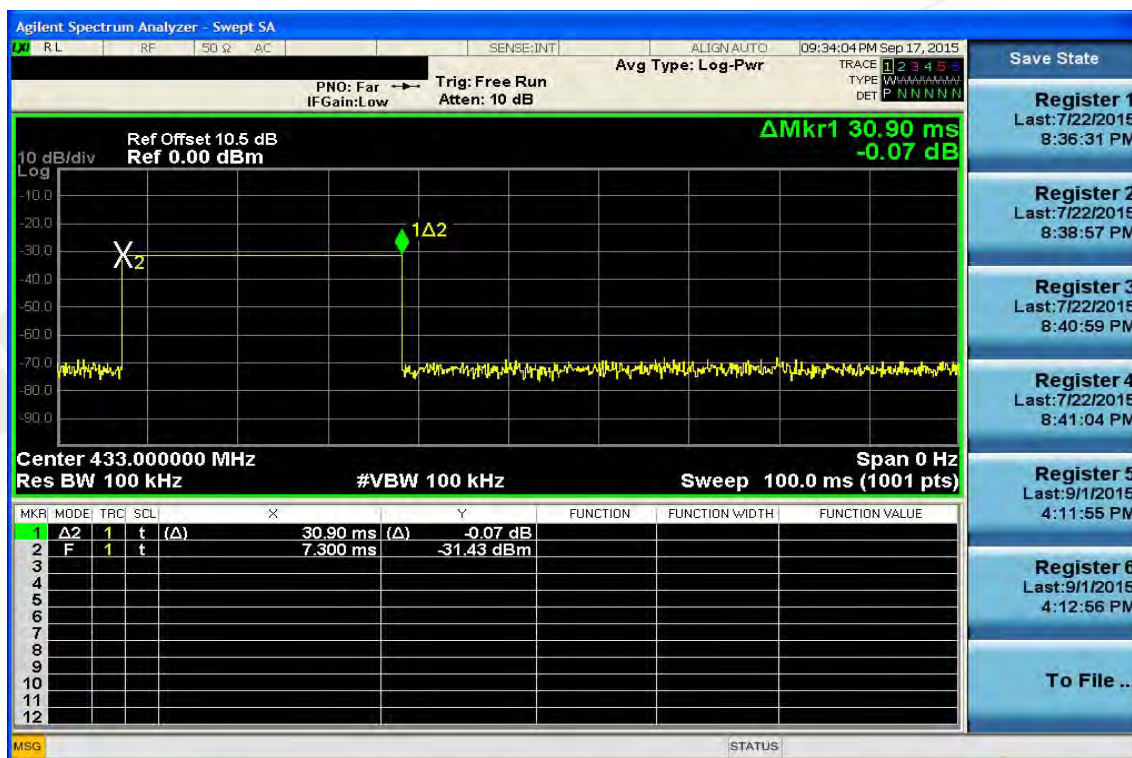
Same as 8.3 Radiated Emission Measurement.

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)
30.9	100	-10.2



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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)

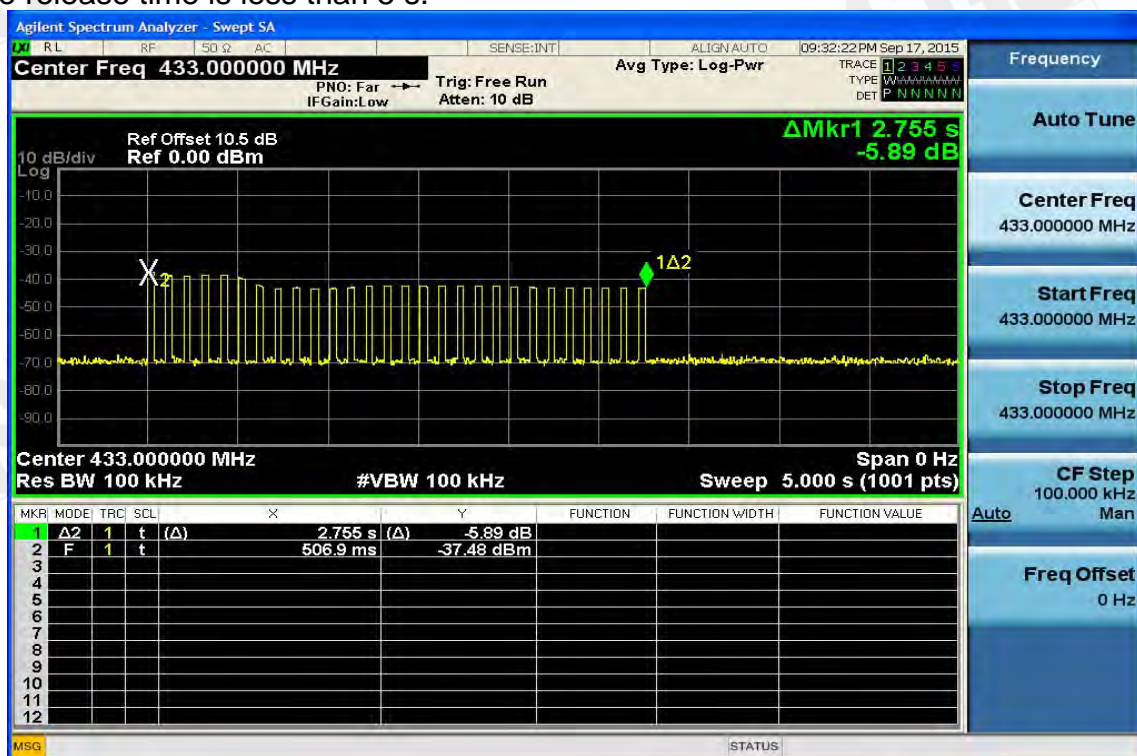
Same as 8.3 Radiated Emission Measurement.

10.3 Measurement Equipment Used:

Same as 8.3 Radiated Emission Measurement.

10.4 Measurement Results

The release time is less than 5 s.



Note: X = release time

~ End of Report ~

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