

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 MINI

Model Different: N/A

FCC ID: R4UARCFLEXMINI

Report No.: E2/2014/20020

Issue Date: May. 30, 2014

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

FCC ID: R4UARCFLEXMINI

Model No.: FLEX MINI

Model Difference: N/A

File Number: E2/2014/20020

Date of test: Feb. 24, 2014 ~ May. 30, 2014

Date of EUT Received: Feb. 24, 2014

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 C63.4 2009 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:

Jazz Huang

Date:

May. 30, 2014

Jazz Huang / Engineer

Prepared By:

Tiffany Kao

Date:

May. 30, 2014

Tiffany Kao / Clerk

Approved By:

Jim Chang

Date:

May. 30, 2014

Jim Chang / Supervisor

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Version

Version No.	Date	Description
00	May. 30, 2014	Initial creation of document

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1. GENERAL INFORMATION

1.1 Product Description

Product Name:	Industrial radio remote control systems
Brand Name:	ARC
Model No.	FLEX MINI
Model Difference:	N/A
Hardware Version:	N/A
Software Version:	N/A
Power Supply:	3Vdc from AA batteries*2

433 MHz:

Operating Frequency	433.05MHz -434.60MHz
Transmit Power	<80.79 dBuV/m Max.
Modulation Technique	GFSK
Number of Channels	32 Channel
Channel Spacing	50 kHz

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1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: R4UARCFLEXMINI filing to comply with Section 15.231 of the FCC Part 15, Subpart C Rules.

1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 (2009). Radiated testing was performed at an antenna to EUT distance 3 meters. Tested in accordance with ANSI 63.10: 2009 for testing for un-licensed wireless device.

1.4 Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan Township, Taoyuan County, Taiwan 333 which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2009. FCC Registration Number are: 990257, Canada Registration Number: 4620A-4

The 10 m Open Area Test Sites located on the address of SGS Taiwan Ltd. No. 29, Pau-Tou-Tsuo Valley Chia-Pau Tsuen, Linkou Hsiang, Taipei county, which is constructed and calibrated to meet the CISPR 22/EN 55022 requirements. SGS Site No. 1(3 & 10 meters) and FCC Registration Number: 94644.

1.5 Special Accessories

Not available for this EUT intended for grant.

1.6 Equipment Modifications

Not available for this EUT intended for grant.

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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 0.8 m above ground plane. According to the requirements in Section 7.3.1 of ANSI C63.4-2009. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and Average detector mode.

2.3.2 Radiated Emissions

The EUT is a placed on as turn table which is 0.8 m above 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. according to the requirements in Section 8 and 13 and Subclause 8.3.1.2 of ANSI C63.4-2009.

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2.4 Limitation

(1) Conducted Emission

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.		

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(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

- 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.
 6. 433.05 MHz limit = $41.6667 * 433.05 - 7083.3333 = 10965.431435 uV/m$
= 80.80 dBuV/m
434.60 MHz limit = $41.6667 * 434.60 - 7083.3333 = 11025.01452 uV/m$
= 80.85 dBuV/m

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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					

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
	Duty Cycle Test (Pulse Modulation)	Compliant
§15.231(a)(1)	Release Time Measurement	Compliant

4. DESCRIPTION OF TEST MODES

The EUT has been tested under engineering test mode condition. The Frequency of Channel Low: 433.05MHz and Channel High: 434.60MHz is chosen for testing.

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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	+/- 1.55 dB
Frequency Separation	+/- 123.36 Hz
Number of hopping frequency	+/- 123.36 Hz
Time of Occupancy	+/- 123.36 Hz
Temperature	+/- 0.8 °C
Humidity	+/- 4.7 %
DC / AC Power Source	DC= +/- 1%, 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:

SGS Conducted Emission Test Site No.A					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EMI Test Receiver	R&S	ESCI 3	101311	06/27/2013	06/26/2014
Coaxial Cables	N/A	N30N30-1042-150cm	N/A	02/07/2014	02/06/2015
LISN	Schwarzbeck	NSLK 8127	8127-648	06/17/2013	06/16/2014
LISN	Rolf-Heine	NNB-2/16Z	99012	03/26/2014	03/25/2015
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 C63.4:2009.
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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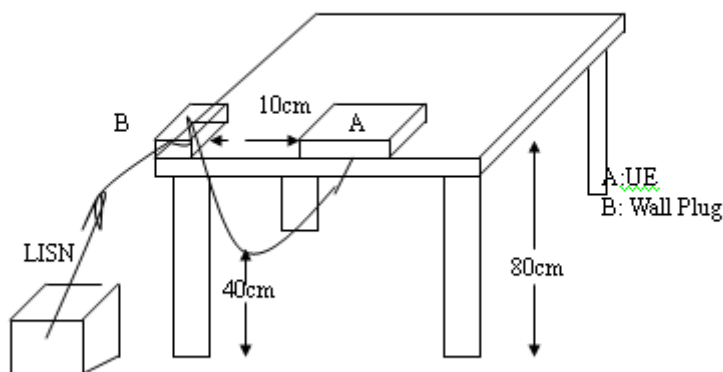
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6.4 Test SET-UP (Block Diagram of Configuration)



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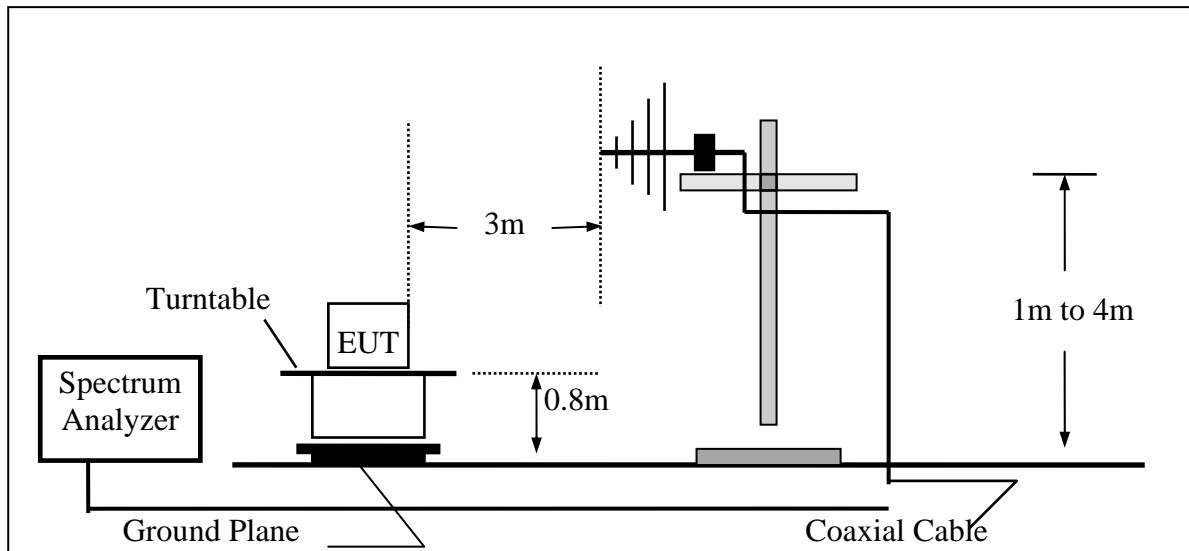
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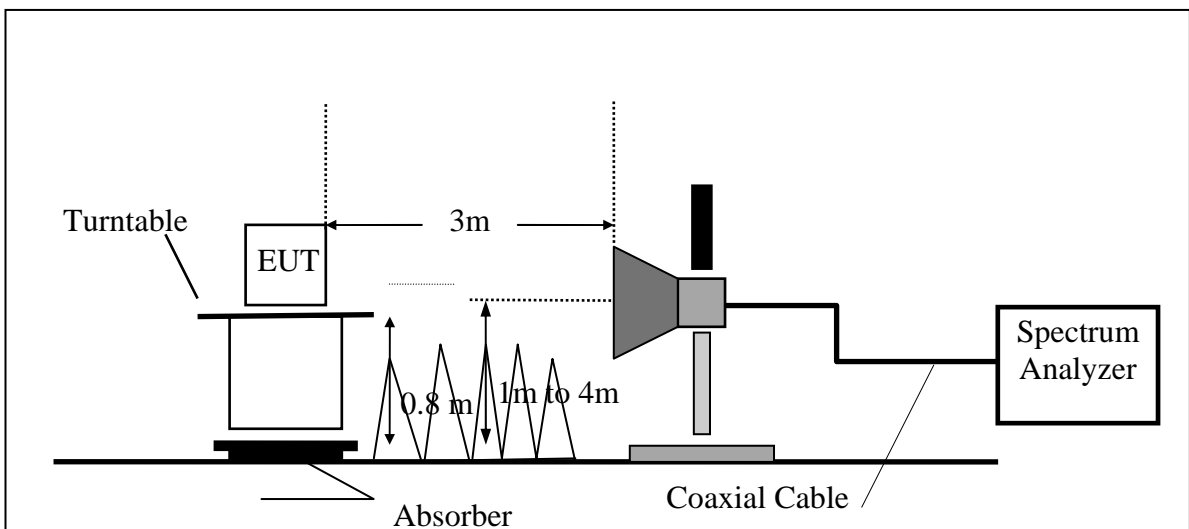
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7.2 Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



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



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7.3 Measurement Equipment Used:

SGS SAC Chamber No.C (FCC)					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EMI Test Receiver	R&S	ESU 40	100363	04/12/2014	04/11/2015
Loop Antenna	ETS-Lindgren	6502	00143303	01/16/2014	01/15/2015
Broadband Antenna	TESEQ	CBL 6112D	35240	01/17/2014	01/16/2015
Horn Antenna	ETS-Lindgren	3117	00143272	01/27/2014	01/26/2015
Horn Antenna	Schwarzbeck	BBHA9170	BBHA9170-184	01/23/2014	01/22/2015
Horn Antenna	ETS-Lindgren	3160-09	00117911	01/22/2014	01/21/2015
Horn Antenna	ETS-Lindgren	3160-10	00117783	01/22/2014	01/21/2015
Pre Amplifier	R&S	SCU-18	10204	03/26/2014	03/25/2015
Pre Amplifier	R&S	SCU-26	100780	03/26/2014	03/25/2015
Pre Amplifier	R&S	SCU-40	100356	03/26/2014	03/25/2015
Pre Amplifier	EMC Instruments	EMC330	980096	03/26/2014	03/25/2015
Pre Amplifier	EMC Instruments	EMC184045	980135	01/24/2014	01/23/2015
Coaxial Cable	Huber+Suhner	RG 214/U	W21.03	03/26/2014	03/25/2015
Coaxial Cable	Huber+Suhner	RG 214/U	W22.03	03/26/2014	03/25/2015
Coaxial Cable	Huber+Suhner	SUCCOFLEX 104	MY17413/4	03/26/2014	03/25/2015
Coaxial Cable	Huber+Suhner	SUCCOFLEX 104	MY17404/4	03/26/2014	03/25/2015
Coaxial Cable	Huber+Suhner	SUCCOFLEX 104	MY17394/4	03/26/2014	03/25/2015
Coaxial Cable	Huber+Suhner	SUCCOFLEX 104	MY17386/4	03/26/2014	03/25/2015
Coaxial Cable	Huber+Suhner	SUCCOFLEX 104	MY17388/4	03/26/2014	03/25/2015
Attenuator	WOKEN	218FS-10	HY-151	01/06/2014	01/05/2015
Communication Tester	R&S	CMW500	131121	01/16/2014	01/15/2015
Communication Tester	Anritsu	MT8820C	6201107337	04/23/2014	04/22/2015
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.
Site NSA	SGS	966 Chamber C	SAC-C	03/05/2014	03/04/2015
Site VSWR	SGS	966 Chamber C	SAC-C	04/10/2014	04/09/2015
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:

1. The limit of the emission level is expressed in dBuV/m, which converts $20 \cdot \log(uV/m)$
2. $\text{Factor(dB)} = \text{Antenna Factor(dB}\mu\text{V/m)} + \text{Cable Loss(dB)} - \text{Pre_Amplifier Gain(dB)}$

7.5. Measurement Result:

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

Note: For the tabular table as presents below, “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency. “E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor

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7.6. Measurement Result

Operation Band	: Main Low	Test Date	:2014-05-12
Fundamental Frequency	:433.05 MHz	Temp./Humi.	:26.6deg_C/53RH
Operation Mode	:TX MAIN	Engineer	:Aken
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:VERTICAL

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.

Freq.	Detector	Note	Spectrum	Factor	Actual	Limit	Margin
	Mode		Reading Level		FS	@3m	
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV/m	dBμV/m	dB
433.05	Peak	F	92.36	-15.23	77.13	100.80	-23.67
433.05	Average	F	-	-2.36	74.77	80.80	-6.03

Operation Band	: Main Low	Test Date	:2014-05-12
Fundamental Frequency	:433.05 MHz	Temp./Humi.	:26.6deg_C/53RH
Operation Mode	:TX MAIN	Engineer	:Aken
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:HORIZONTAL

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.

Freq.	Detector	Note	Spectrum	Factor	Actual	Limit	Margin
	Mode		Reading Level		FS	@3m	
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV/m	dBμV/m	dB
433.05	Peak	F	83.15	-15.23	67.92	100.80	-32.88
433.05	Average	F	-	-2.36	65.56	80.80	-15.24

Note: Average Actual = Peak Actual – Average Factor (-2.36)

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Operation Band	: Main High	Test Date	:2014-05-12
Fundamental Frequency	:434.60 MHz	Temp./Humi.	:26.6deg_C/53RH
Operation Mode	:TX MAIN	Engineer	:Aken
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:VERTICAL

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.

Freq.	Detector	Note	Spectrum	Factor	Actual	Limit	Margin
	Mode		Reading Level		FS	@3m	
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV/m	dBμV/m	dB
434.60	Peak	F	91.79	-15.30	76.49	100.85	-24.36
434.60	Average	F	-	-2.36	74.13	80.85	-6.72

Operation Band	: Main Low	Test Date	:2014-05-12
Fundamental Frequency	:433.05 MHz	Temp./Humi.	:26.6deg_C/53RH
Operation Mode	:TX MAIN	Engineer	:Aken
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:HORIZONTAL

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.

Freq.	Detector	Note	Spectrum	Factor	Actual	Limit	Margin
	Mode		Reading Level		FS	@3m	
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV/m	dBμV/m	dB
434.60	Peak	F	83.63	-15.30	68.33	100.85	-32.52
434.60	Average	F	-	-2.36	65.97	80.85	-14.88

Note: Average Actual = Peak Actual – Average Factor (-2.36)

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Operation Band	:433 MHz	Test Date	:2014-05-12
Fundamental Frequency	:433.05 MHz	Temp./Humi.	:26.6deg_C/53RH
Operation Mode	:TX LOW	Engineer	:Aken
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:VERTICAL

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.

Freq.	Detector	Note	Spectrum	Factor	Actual	Limit	Margin
	Mode		Reading Level		FS	@3m	
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV/m	dBμV/m	dB
34.85	Peak	S	41.30	-18.42	22.88	40.00	-17.12
55.22	Peak	S	45.57	-27.98	17.59	40.00	-22.41
100.81	Peak	S	41.97	-23.05	18.92	43.50	-24.58
136.70	Peak	S	39.41	-21.91	17.50	43.50	-26.00
254.07	Peak	S	38.92	-19.98	18.94	46.00	-27.06
360.77	Peak	S	39.38	-16.74	22.64	46.00	-23.36
866.10	Peak	H	38.00	-9.88	28.12	46.00	-17.88
866.10	Average	H	-	-2.36	25.76	46.00	-20.24
1299.15	Peak	H	-	-	-	-	-
1299.15	Average	H	-	-	-	-	-
1732.00	Peak	H	49.45	-8.15	41.30	80.80	-39.50
1732.00	Average	H	-	-2.36	38.94	60.80	-21.86
2165.25	Peak	H	-	-	-	-	-
2598.30	Peak	H	-	-	-	-	-
3031.35	Peak	H	-	-	-	-	-
3464.40.	Peak	H	-	-	-	-	-
3897.45.	Peak	H	-	-	-	-	-
4330.00	Peak	H	-	-	-	-	-

Note: Average Actual = Peak Actual – Average Factor (-2.36)

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Operation Band	:433 MHz	Test Date	:2014-04-24
Fundamental Frequency	:433.05 MHz	Temp./Humi.	:26.6deg_C/53RH
Operation Mode	:TX LOW	Engineer	:Aken
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:HORIZONTAL

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.

Freq.	Detector	Note	Spectrum	Factor	Actual	Limit	Margin
	Mode		Reading Level		FS	@3m	
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV/m	dBμV/m	dB
37.76	Peak	S	42.45	-19.82	22.64	40.00	-17.36
99.84	Peak	S	43.66	-23.19	20.48	43.50	-23.02
148.34	Peak	S	39.53	-22.61	16.93	43.50	-26.57
249.22	Peak	S	38.69	-20.47	18.22	46.00	-27.78
308.39	Peak	S	38.76	-18.64	20.12	46.00	-25.88
398.60	Peak	S	40.22	-15.71	24.51	46.00	-21.49
866.10	Peak	H	37.90	-9.88	28.02	46.00	-17.98
866.10	Average	H	-	-2.36	25.66	46.00	-20.34
1299.15	Peak	H	-	-	-	-	-
1299.15	Average	H	-	-	-	-	-
1732.00	Peak	H	50.10	-5.15	44.95	80.80	-35.85
1732.00	Average	H	-	-2.36	42.59	60.80	-18.21
2165.25	Peak	H	48.84	-5.84	43.00	80.80	-37.80
2165.25	Average	H	-	-2.36	40.64	60.80	-20.16
2598.30	Peak	H	-	-	-	-	-
3031.35	Peak	H	-	-	-	-	-
3464.40.	Peak	H	-	-	-	-	-
3464.40.	Peak	H	-	-	-	-	-
4330.00	Peak	H	-	-	-	-	-

Note: Average Actual = Peak Actual – Average Factor (-2.36)

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Operation Band	:433 MHz	Test Date	:2014-05-12
Fundamental Frequency	:434.60 MHz	Temp./Humi.	:26.6deg_C/53RH
Operation Mode	:TX High	Engineer	:Aken
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:VERTICAL

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.

Freq.	Detector	Note	Spectrum	Factor	Actual	Limit	Margin
	Mode		Reading Level		FS	@3m	
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV/m	dBμV/m	dB
34.85	Peak	S	41.05	-18.42	22.63	40.00	-17.37
55.22	Peak	S	45.76	-27.98	17.79	40.00	-22.21
111.48	Peak	S	40.58	-22.03	18.55	43.50	-24.95
163.86	Peak	S	40.48	-23.23	17.24	43.50	-26.26
268.62	Peak	S	39.24	-19.69	19.55	46.00	-26.45
343.31	Peak	S	40.31	-17.57	22.74	46.00	-23.26
869.20	Peak	H	38.17	-9.82	28.35	46.00	-17.65
869.20	Average	H	-	-2.36	25.99	46.00	-20.01
1303.80	Peak	H	-	-	-	-	-
1303.80	Average	H	-	-	-	-	-
1738.40	Peak	H	48.63	-8.12	40.51	80.85	-40.34
1738.40	Average	H	-	-2.36	38.15	60.85	-22.70
2173.00	Peak	H	-	-	-	-	-
2607.60	Peak	H	-	-	-	-	-
3042.20	Peak	H	-	-	-	-	-
3476.80	Peak	H	-	-	-	-	-
3911.40	Peak	H	-	-	-	-	-
4346.00	Peak	H	-	-	-	-	-

Note: Average Actual = Peak Actual – Average Factor (-2.36)

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Operation Band	:433 MHz	Test Date	:2014-04-24
Fundamental Frequency	:434.60 MHz	Temp./Humi.	:26.6deg_C/53RH
Operation Mode	:TX High	Engineer	:Aken
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:HORIZONTAL

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.

Freq.	Detector	Note	Spectrum	Factor	Actual	Limit	Margin
	Mode		Reading Level		FS	@3m	
MHz	PK/QP/AV	F/H/E/S	dBμV	dB	dBμV/m	dBμV/m	dB
100.81	Peak	S	43.06	-23.05	20.01	43.50	-23.49
136.70	Peak	S	39.44	-21.91	17.53	43.50	-25.97
242.43	Peak	S	38.47	-21.28	17.19	46.00	-28.81
274.44	Peak	S	39.64	-19.69	19.95	46.00	-26.05
364.65	Peak	S	38.69	-16.79	21.89	46.00	-24.11
414.12	Peak	S	38.69	-14.92	23.76	46.00	-17.97
869.20	Peak	H	37.85	-9.82	28.03	46.00	-17.98
869.20	Average	H	-	-2.36	25.67	46.00	-20.33
1303.80	Peak	H	-	-	-	-	-
1303.80	Average	H	-	-	-	-	-
1738.40	Peak	H	49.20	-5.12	44.08	80.85	-36.77
1738.40	Average	H	-	-2.36	41.72	60.85	-19.13
2173.00	Peak	H	-	-	-	-	-
2607.60	Peak	H	-	-	-	-	-
3042.20	Peak	H	-	-	-	-	-
3476.80	Peak	H	-	-	-	-	-
3911.40	Peak	H	-	-	-	-	-
4346.00	Peak	H	-	-	-	-	-

Note: Average Actual = Peak Actual – Average Factor (-2.36)

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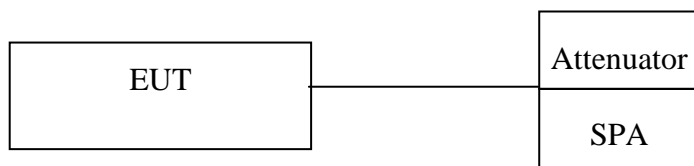
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8. 20DB OCCUPIED BANDWIDTH

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 Max hold. Mark peak, -20dB.

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
Spectrum Analyzer	Agilent	N9010A	MY53400256	2013/10/26	2014/10/25
Power Meter	Anritsu	ML2496A	1326001	2013/06/28	2014/06/27
Power Sensor	Anritsu	MA2411B	1315048	2013/06/28	2014/06/27
Power Sensor	Anritsu	MA2411B	1315049	2013/06/28	2014/06/27
Coaxial Cable 30cm	WOKEN	00100A1F1A195C	2	2014/01/06	2015/01/05
Attenuator	Mini-Circuits	BW-S10W2+	6	2014/01/06	2015/01/05
Attenuator	WOKEN	218FS-10	7	2014/01/06	2015/01/05

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8.4 Measurement Results

Refer to attached data chart.

The center frequency f_c is **433.8MHz**, according to the Rules, section 15.231(C), the Bandwidth of Center Frequency at-20dB should be calculated as following:

$$433.8 \times 0.0025 = 1.0845(\text{MHz})$$

Measurement Result:

-20dB bandwidth = 38.04 kHz and 38 kHz which within allowed limit.

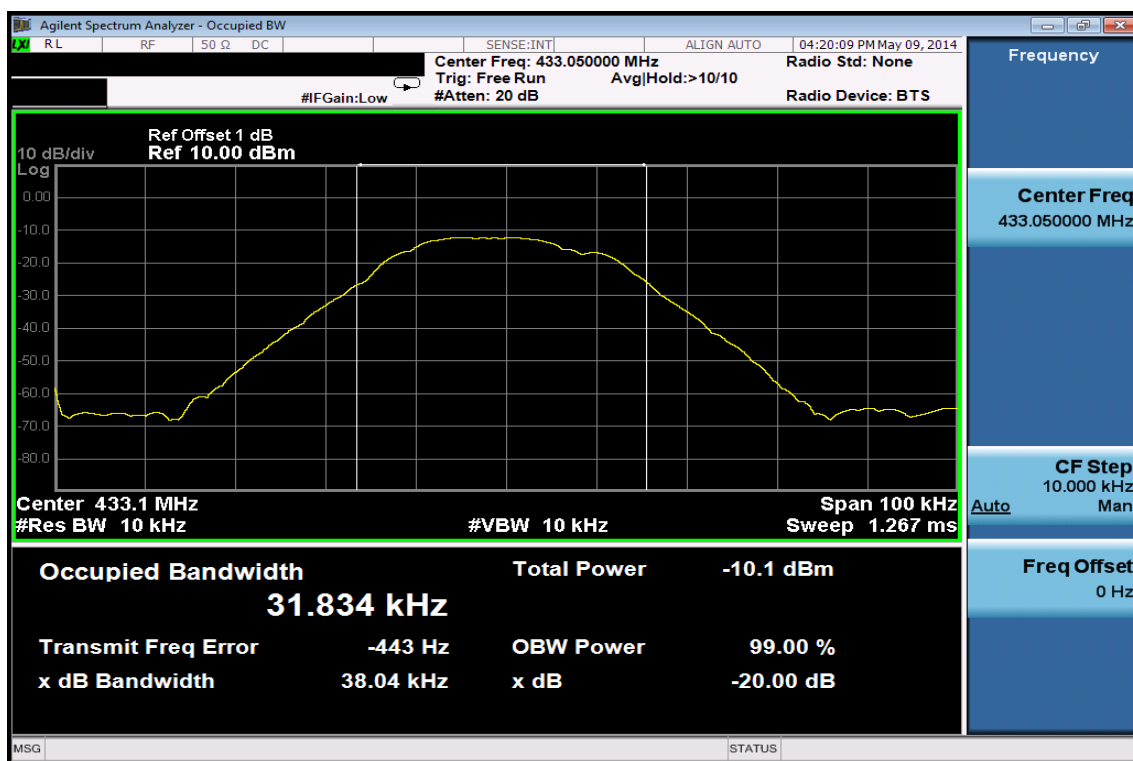
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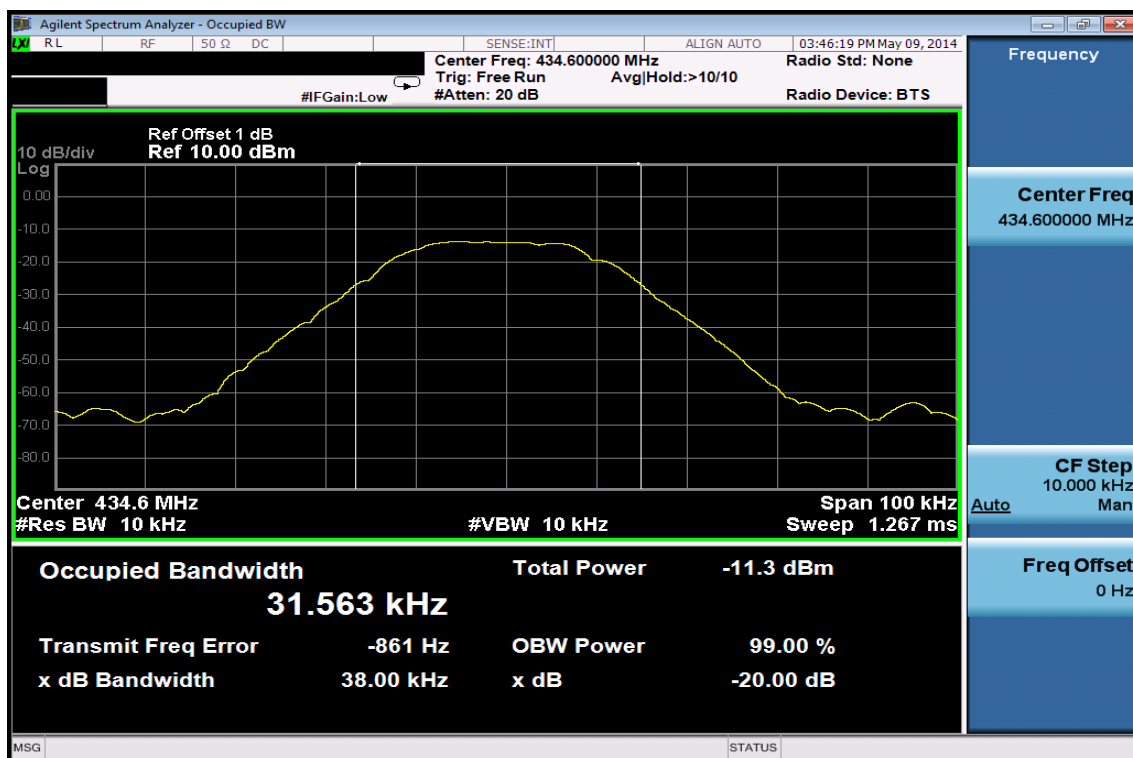
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20dB Band Width Test Data (CH Low)



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:

$T_{on} = 38.40 \text{ ms}$

$T_{on} + T_{off} = 50.40 \text{ ms}$

$$\begin{aligned} \text{Avg correct} &= 20\log(T_{on}/T_P) \\ &= 20\log(38.40/50.40) \\ &= -2.36\text{dB} \end{aligned}$$

Note: In comparison with EUT 8 buttons as examined in the section of duty cycle which has same operating mode of each button, the worst case is chosen for reported. Please refer to next page for plots.

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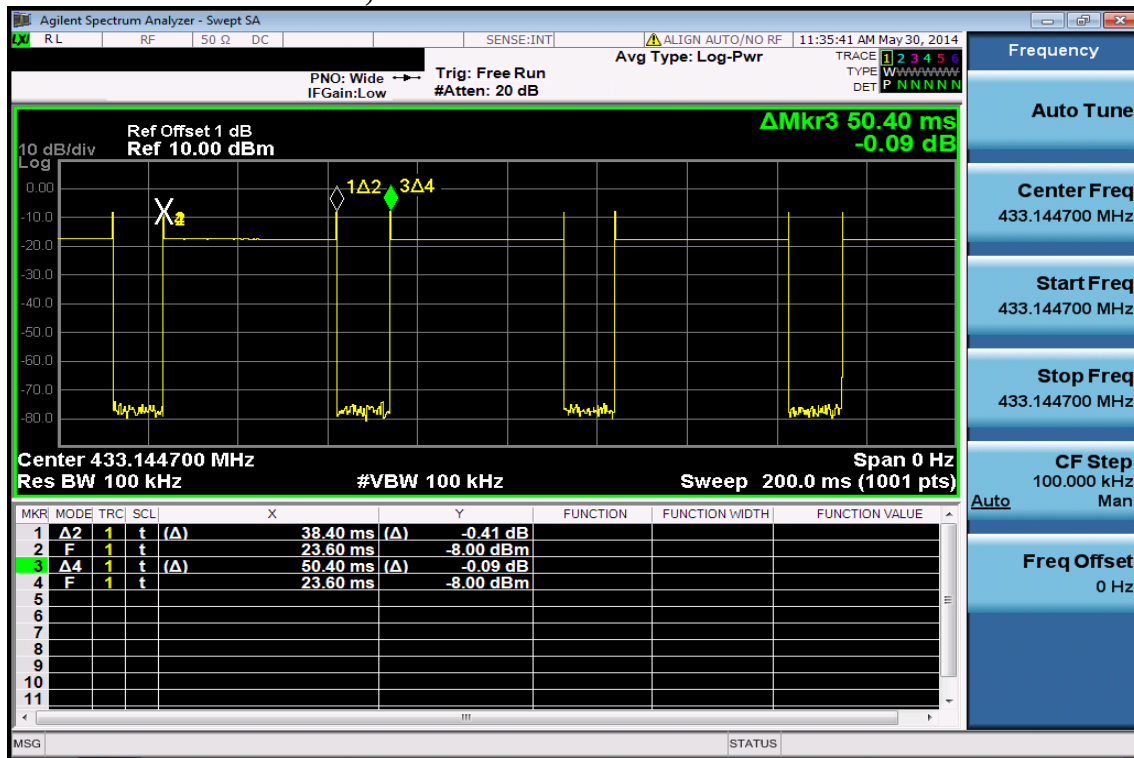
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Measurement: Ton =38.40 ms , Ton+Toff=50.40ms



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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=1MHz, VBW= 3MHz, 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.

Refer to attached data chart.

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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Note: X = release time

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