

# FCC CFR47 Part 15 Subpart C IC RSS-247 Certification Test Report

For the

: Wearable device

- : Revolar Instinct : 2AHAI-INST1 : 21057-INST1 : Revolar Inc
- : CFR 47 Part 15 Subpart C
- : IC RSS 247

We hereby certify that the above product has been tested by us with the listed rules and found in compliance with the regulation. The test data and results are issued on the test report no. **TR-W1703-010** 

Signature

Youn, In-soub / Technical Manager Date: 2017-03-16

# Test Laboratory: ENG Co., Ltd.

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# FCC/IC CERTIFICATION TEST REPORT

Project Number	: EA1702Q-179
Test Report Number	: TR-W1703-010
Type of Equipment	: Wearable device
Model Name	: Revolar Instinct
FCC ID	: 2AHAI-INST1
IC	: 21057-INST1
Multiple Model Name	: N/A
Applicant	: Revolar Inc
Address	: 800 N. Grant Street, Suite 120, Denver, CO 80203, Unite States
Manufacturer	: Celestica (Thailand) Ltd
Address	: 49/18 Moo 5, Laem Chabang Industrial Estate, Tungsukhla, Chonburi 20230, Thailand
Regulation	: FCC Part 15 Subpart C Section 15.247, IC RSS-247
Total page of Report	: 38 Pages
Date of Receipt	: 2017-02-27
Date of Issue	: 2017-03-16
Test Result	: PASS

This test report only contains the result of a single test of the sample supplied for the examination. It is not a generally valid assessment of the features of the respective products of the mass-production.

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Report	No.: TR-W1703-01	10		Page 1 of 38
	Reviewed by	Youn, In-soub / Technical Manager	Nignature	2017-03-16 Date
	Prepared by	Song, In-young / Senior Engineer	Signature	2017-03-16 Date

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# **Release Control Record**

Issue Report No.	Issued Date	Revisions	Effect Section
TR-W1703-010	2017-03-16	Initial Release	All



# **1. TEST SUMMARY**

# 1.1 Regulations and results

The sample submitted for evaluation (Referred to below as the EUT) has been tested in accordance with the following regulations or standards.

FCC Reference Section	IC Reference Section	Description	P (Pass)	F (Fail)	N.T. (Not Tested)	Note
15.203	-	Antenna Requirement	Р			
15.205, 15.209	RSS247 5.5 RSS –GEN 8.9	Radiated Spurious Emissions	Ρ			
15.207	RSS-GEN 8.8	AC Power-line Conducted Emissions			N.T	Note1
15.247 (a)(2)	RSS-247 5.2(1)	6 dB Occupied Bandwidth Occupied Bandwidth	Ρ			
15.247 (b)(3)	RSS-247 5.4(4)	RF Output Power	Р			
2.1051 15.247 (d)	RSS-247 5.5	Band Edge Conducted Spurious Emissions	Ρ			
15.247 (e)	RSS-247 5.4(2)	Power Spectral Density	Р			

Note1. This EUT is operated by battery only. (used button cell battery).

# 1.2 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC Part 15 Subpart C Section 15.247 and RGG-GEN and RSS-247.

# 1.3 Test Methodology

The tests mentioned in clause 1.1 in this test report were performed according to FCC CFR 47 Part 2, CFR 47 Part 15 and ANSI C63.10-2013.

KDB 558074 D01DTS Meas Guidance v03r05: Measurement Procedure PK is used for power and PKPSD is used for power spectral density..

# 1.3 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.



# 1.4 Test Facility

The measurement facilities are located at 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do 12813, Korea. Description details of test facilities were submitted to the FCC and IC, designated by the RRA (Radio Research Agency), and accredited by Korea and accredited by KOLAS (Korea Laboratory Accreditation Scheme) in Korea according to the requirement of ISO 17025.

Agency Name	Registration No.	Mark
FCC	955964	F©
Industry Canada (IC)	IC 12721A-1	
RRA	KR0160	RR/A
Korean Agency for Technology and Standards	KT733	



# 2. EUT (Equipment Under Test) INFORMATION

# 2.1 General Description

The EUT is a device for transferring emergency alert messages to a Mobile phone through wireless communication. For wireless communication, the EUT has function for Bluetooth Low Energy, The product specification described herein was obtained from product data sheet or user's manual.

Description of equipment	Wearable device
Model Name	Revolar Instinct
Brand / Trade Name	Revolar
Serial Number	RB-17035-001D
Operating Frequency	2 402 ~ 2 480 MHz
Max. RF Output Power	-0.98 dBm (Measured)
Modulation Types	GFSK
Number of Channels	40 CH
Channel Bandwidth	2 MHz
Generated or used Freq. in EUT	37.768 kHz, 38.4 MHz
Type of Antenna	☐ Integrated Type ■ Dedicated Type(Planar antenna)
Antenna Gain	2.05 dBi
Operating Temperature	5 °C ~ 40 °C
Normal Test Voltage	DC 3 V
Electrical Rating	DC 3 V, Lithium Battery(coin cell type CR2032)

# 2.2 Additional Model

None

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# **3. TEST CONDITION**

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# 3.1 Equipment Used During Test

The following peripheral devices and/or interface cables were connected during the measurement:

Description	Model No.	Serial No.	Manufacturer.
Wearable device (EUT)	Revolar Instinct	RB-17035-001D	Celestica (Thailand) Ltd.
Mobile Phone	A1688	F17QKPSBGRY5	Apple Inc.

# 3.2 Mode of operation during the test

For finding worst case configuration and operating mode, preliminary testing was performed and radiated emission and conducted emission were performed with the EUT set to transmit at the channel with the highest output power as worst case scenario.

Based on preliminary testing following operating modes were selected for the final test as listed below.

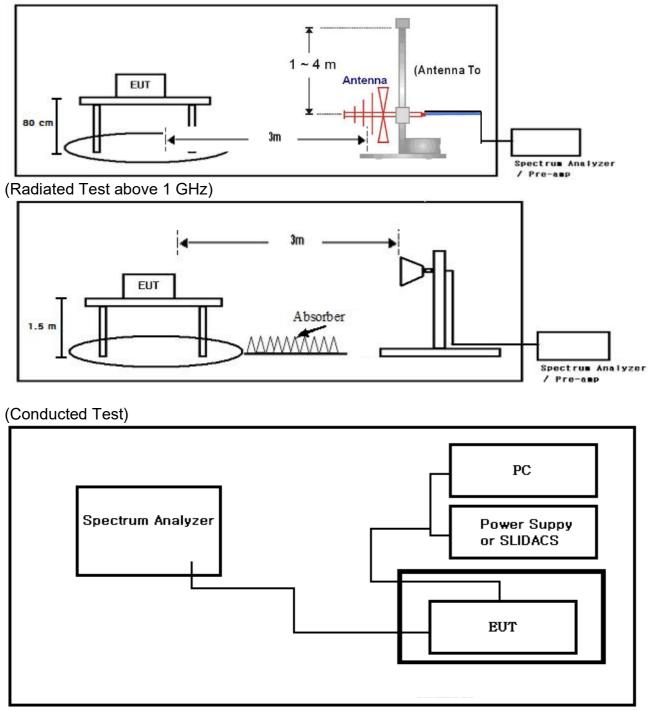
# 3.2.1 Conducted / Radiated Emission Test Mode

Operating Mode	Channel	Frequency (MHz)	Output Power (dBm)
BLE	Low	2402	-2.19
	Middle	2440	-1.23
	High	2480	-0.98



# 3.3 Test Setup Drawing

(Radiated Test below 1 GHz)



# **3.4 EUT Modifications**

Following modifications were implemented on the EUT for fixing the problem caused by EMC testing and the product will have all of the modifications incorporated into the product when manufactured and placed on the market.

- None.

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# 4. ANTENNA REQUIREMENT

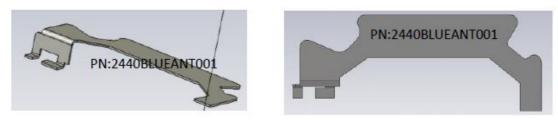
According to FCC CFR 47 Part 15 section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provision of this section.

# 4.1 Antenna Description

Frequency Band (GHz)	Antenna Type	Max Peak Gain (dBi)	Connector Type
2.400 - 2.498	Planar Antenna	2.05	Surface Mount

# 4.2 Conclusion

The antenna of the EUT is used a dedicate antenna, so the EUT met the requirement.





# 5. TEST RESULT

# 5.1 6 dB Bandwidth

# 5.1.1 Limit

The minimum 6 dB bandwidth shall be at least 500 kHz acc to Section 15.247 (a) (2)

# 5.1.2 Method of Measurement

Reference to KDB 558074 D01 DTS Meas Guidance v03r05: 8.1 Option 1

The transmitter output is connected to a spectrum analyzer with the RBW set to 100 kHz, VBW  $\geq$  3 X RBW, peak detector and max hold.

# 5.1.3 Test Data

	0017 00 00	Temperature	(21.2 ~ 21.8) °C	
Date of Test	2017-02-28	Relative humidity	(38.8 ~ 39.6) % R.H.	
Test Result	PASS	Tested by	Inyong Song	>
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	
Low	2 402	0.749		
Middle	2 440	0.740	0.5	
High	2 480	0.749		

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# 5.1.4 Test Plots

MultiView	1 🕄 Spectr	um							
Ref Level Att	10.00 dBm 20 dB <b>SV</b>	✓T 41.71 µs (~8.1	<ul> <li>RBW 10</li> <li>ms) </li> <li>VBW 30</li> </ul>	0 kHz 0 kHz <b>Mode</b> Au	to FFT				
TDF		1 110 1 µ3 ( 0.1	110) - 1017 - 50	onne moderna					●1Pk View
1 Frequenc	узмеер							M1[1]	-3.50 dBn
0 dBm				Mi					2.40191310 GH
			T1	- ×	To To				
-10 dBm			E .			1	5		
00.45-						~			
-20 dBm						/			
-30 dBm			e		-			-	
	3								
-40 dBm									
-50 dBm			2	2					
-60 dBm									
-70 dBm			1	-					-
Herein an Contraction (Contraction)									
-80 dBm				+				-	
						, <u> </u>			
CF 2.402 GI			1001 p	ots	300	).0 kHz/			Span 3.0 MHz
2 Marker T Type   F	Ref   Trc	X-Value		Y-Value	Funct	ion	F	unction Resul	t
M1 T1	1 1	2.4019131 ( 2.4015504		-3.50 dBm -9.50 dBm	ndB ndB down B'	W	7	6.0 dB 49.30 kHz	
T2	î	2.4022997	GHz	-9.44 dBm	Q Factor			3205.8	
MultiView	B Spectru	IM	Operatir	ng Mode: B	LE, Middle	Channel	Mea	suring <b>A</b>	
MultiView Ref Level 1	0.00 dBm		• RBW 100	) kHz		Channel	Mea	suring	
Ref Level 1 Att TDF	0.00 dBm 20 dB <b>SW</b>	<b>ιm</b> Τ 41.71 μs (~8.1 r	• RBW 100	) kHz		Channel	Mea	suring	
Ref Level 1 Att	0.00 dBm 20 dB <b>SW</b>		• RBW 100	) kHz		Channel	Mea	M1[1]	. v € 1Pk View
Ref Level 1 Att TDF 1 Frequency	0.00 dBm 20 dB <b>SW</b>		• RBW 100	) kHz		Channel	Mea		. v € 1Pk View
Ref Level 1 Att TDF	0.00 dBm 20 dB <b>SW</b>		● RBW 100 ms) ● VBW 300	) kHz	to FFT	Channel	Mea		● 1Pk View -2.25 dB
Ref Level 1 Att TDF 1 Frequency	0.00 dBm 20 dB <b>SW</b>		• RBW 100	) kHz	to FFT	Channel	Mea		● 1Pk View -2.25 dB
Ref Level 1 Att TDF 1 Frequency 0 dBm	0.00 dBm 20 dB <b>SW</b>		● RBW 100 ms) ● VBW 300	) kHz	to FFT	Channel	Mea		● 1Pk View -2.25 dB
Ref Level 1 Att TDF 1 Frequency 0 dBm-	0.00 dBm 20 dB <b>SW</b>		● RBW 100 ms) ● VBW 300	) kHz	to FFT		Mea		● 1Pk View -2.25 dB
Ref Level 1 Att TDF 1 Frequency 0 dBm	0.00 dBm 20 dB <b>SW</b>		● RBW 100 ms) ● VBW 300	) kHz	to FFT	Channel	Mea		● 1Pk View -2.25 dB
Ref Level 1           Att           TDF           I Frequency           0 dBm           -10 dBm           -20 dBm           -30 dBm	0.00 dBm 20 dB <b>SW</b>		● RBW 100 ms) ● VBW 300	) kHz	to FFT	Channel			● 1Pk View -2.25 dB
Ref Level 1           Att           TDF           1 Frequency           0 dBm	0.00 dBm 20 dB <b>SW</b>		● RBW 100 ms) ● VBW 300	) kHz	to FFT	Channel	Mea		● 1Pk View -2.25 dB
Ref Level 1           Att           TDF           I Frequency           0 dBm           -10 dBm           -20 dBm           -30 dBm           -40 dBm	0.00 dBm 20 dB <b>SW</b>		● RBW 100 ms) ● VBW 300	) kHz	to FFT	Channel	Mea		● 1Pk View -2.25 dB
Ref Level 1           Att           TDF           I Frequency           0 dBm           -10 dBm           -20 dBm           -30 dBm	0.00 dBm 20 dB <b>SW</b>		● RBW 100 ms) ● VBW 300	) kHz	to FFT	Channel			● 1Pk View -2.25 dB
Ref Level 1           Att           TDF           I Frequency           0 dBm           -10 dBm           -20 dBm           -30 dBm           -40 dBm	0.00 dBm 20 dB <b>SW</b>		● RBW 100 ms) ● VBW 300	) kHz	to FFT	Channel			● 1Pk View -2.25 dB
Ref Level 1           Att           TDF           I Frequency           0 dBm           -10 dBm           -20 dBm           -30 dBm           -50 dBm           -60 dBm	0.00 dBm 20 dB <b>SW</b>		● RBW 100 ms) ● VBW 300	) kHz	to FFT	Channel			● 1Pk View -2.25 dB
Ref Level 1           Att           TDF           I Frequency           0 d8m           -10 d8m           -20 d8m           -30 d8m           -40 d8m	0.00 dBm 20 dB <b>SW</b>		● RBW 100 ms) ● VBW 300	) kHz	to FFT	Channel			● 1Pk View -2.25 dB
Ref Level 1           Att           TDF           I Frequency           0 dBm           -10 dBm           -20 dBm           -30 dBm           -50 dBm           -60 dBm	0.00 dBm 20 dB <b>SW</b>		● RBW 100 ms) ● VBW 300	) kHz	to FFT	Channel			● 1Pk View -2.25 dB
Ref Level 1           Att           TDF           1           Frequency           0 dBm           -10 dBm           -20 dBm           -30 dBm           -50 dBm           -60 dBm	0.00 dBm 20 dB <b>SW</b>		● RBW 100 ms) ● VBW 300	) kHz	to FFT	Channel			● 1Pk View -2.25 dB
Ref Level 1           Att           TDF           1           Frequency           0 dBm           -10 dBm           -20 dBm           -30 dBm           -40 dBm           -50 dBm           -60 dBm           -70 dBm           -80 dBm           -80 dBm           -20 dBm	0.00 dBm 20 dB sw Sweep		● RBW 100 ms) ● VBW 300	D kHz D kHz Mode Au		Channel			● 1Pk View -2.25 dB
Ref Level 1           Att           TDF           11           Trequency           0 dBm           -10 dBm           -20 dBm           -30 dBm           -40 dBm           -50 dBm           -60 dBm           -70 dBm           -80 dBm           -80 dBm           -80 dBm           -80 dBm	0.00 dBm 20 dB sw Sweep	Τ 41.71 μs (~8.1 r	RBW 100 ms)      VBW 300	D kHz D kHz Mode Au		0.0 kHz/		M1[1]	
Ref Level 1           Att           TDF           11 Frequency           0 dBm           -10 dBm           -20 dBm           -30 dBm           -40 dBm           -50 dBm           -60 dBm           -80 dBm           -70 dBm           -70 dBm           -70 dBm           -80 dBm           -70 dBm           -70 dBm           -70 dBm           -70 dBm           -70 dBm           -70 dBm           -80 dBm           -80 dBm           -70 dBm	0.00 dBm 20 dB sw Sweep	T 41.71 μs (~8.1 r	RBW 100 ms)      VBW 300	D kHz Mode Au	The second secon	0.0 kHz/		M1[1]	© 1Pk View -2.25 dB 2.44017380 GF
Ref Level 1           Att           TDF           I Frequency           0 dBm           -10 dBm           -20 dBm           -30 dBm           -50 dBm           -60 dBm           -70 dBm           -80 dBm           -20 dBm           -21 dBm           -22 dBm           -30 dBm           -50 dBm           -60 dBm           -70 dBm           -70 dBm           -80 dBm           -70 dBm           -70 dBm           -70 dBm	ble ef   Trc	T 41.71 μs (~8.1 r	RBW 100 ms)      VBW 300	D kHz D kHz Mode Au		0.0 kHz/		M1[1]	

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			Operating Mode	: BLE, High C	hannel			
MultiView	Spectru	m						
Ref Level 10.00	0 dBm		RBW 100 kHz VBW 300 kHz Mode	Auto FFT				
1 Frequency Sw	veep							
							M1[1] 2	-2.26 dBm 47990710 GHz
0 dBm			T1		T2			
-10 dBm			<u>y</u>					
-20 dBm								
-30 dBm								
-40 dBm								
-50 dBm						7		
-60 dBm					0			
-70 dBm								
-80 dBm								
CF 2.48 GHz			1001 pts	3	00.0 kHz/			Span 3.0 MHz
2 Marker Table								
Type Ref		X-Value 2.4799071 GHz	Y-Value -2.26 dBr		ction		nction Result	
M1 T1 T2	1 1 1	2.4795475 GHz 2.4802967 GHz	-2.26 aBr -8.28 dBr -8.31 dBr	m ndB down	BW	74	6.0 dB 49.30 kHz 3309.8	
	[					Meas	uring	

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# 5.2 99 % Bandwidth

# 5.2.1 Limit

Not applicable. For reporting purpose only.

#### 5.2.2 Method of Measurement

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1 % to 5 % of the OBW.

The span is set to capture all products of the modulation process, including the emission skirts.

The VBW is set to 3 times the RBW. The sweep time is coupled and peak detection and max hold mode is used. The spectrum analyzer internal 99% bandwidth function is utilized.

# 5.2.3 Test Data

Date of Test	2017-02-	28 Relative hum	
Test Result	PASS	Tested by	Inyong Song
Channel		Frequency (MHz)	99 % Bandwidth (MHz)
Low		2 402	1.073
Middle		2 440	1.076
High		2 480	1.070



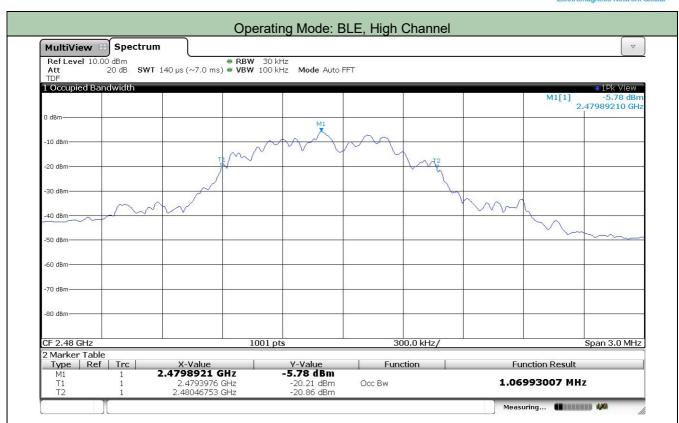
#### 5.2.4 Test Plots



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# 5.3 Maximum Peak Output Power

#### 5.3.1 Limit

Acc. To section 15.247, For system using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### 5.3.2 Method of Measurement

Reference to KDB 558074 D01 DTS Meas Guidance v03r05: 9.1.1 RBW ≥ DTS bandwidth.

The Antenna output of the EUT was connected to a spectrum analyzer directly.

The cable assembly insertion loss was entered as an offset in the spectrum analyzer to allow for direct reading of power.

#### 5.3.3 Test Data for Output Power

Date of Test	2017-02-28	2017-02-28		Temperature Relative humidity		~ 21.8) °C ~ 39.6) % R.H.
Test Result	PASS			Inyon	g Song	
Channel	Frequency (MHz)	Measured	d Value (dBm)	Limit (dE	Sm)	Margin (dB)
Low	2 402	-	-2.19			32.19
Middle	2 440	-	-1.23	30		31.23
High	2 480	-	-0.98			30.98

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# 5.2.4 Test Plots

MultiView	🖽 Spectrun								▽
Ref Level 10. Att	00 dBm 20 dB <b>SWT</b>	• RE	BW 3 MHz BW 10 MHz Mode	e Auto Sweep					4. T
TDF 1 Frequency S			orașot acostrativitat estre de compositiones de la compositione de la compositione de la compositione de la composition de la compositio						●1Pk View
Thequency	ПССР							M1[1]	-2.19 dBn
									2.40219000 GH
0 dBm					M1				
97 - 1976.		y							
-10 dBm					-				-
1999 - 20									
-20 dBm									
-30 dBm	5		2	2-	2-				2
40 JD									
-40 dBm									2
-50 dBm									
-60 dBm							-		
-70 dBm								-	
-80 dBm		-					-		
CF 2.402 GHz			1001 pt			0 MHz/			Span 10.0 MHz
			Operatin	g Mode: B	LE, Middle	e Channel		suring (1999)	
MultiView	B Spectrun	ı	Operatin	g Mode: B	LE, Middle	e Channel		suring (1999)	
Ref Level 10.	00 dBm	• RE	BW 3 MHz		LE, Middle	e Channel		suring (Man	
Ref Level 10. Att TDF	00 dBm 20 dB <b>SWT</b>	• RE			LE, Middle	e Channel		suring	
Ref Level 10. Att	00 dBm 20 dB <b>SWT</b>	• RE	BW 3 MHz		LE, Middle	e Channel			●1Pk View
Ref Level 10. Att TDF	00 dBm 20 dB <b>SWT</b>	• RE	BW 3 MHz	e Auto Sweep	LE, Middle	Channel		M1[1]	
Ref Level 10. Att TDF	00 dBm 20 dB <b>SWT</b>	• RE	BW 3 MHz		LE, Middle	Channel		M1[1]	● 1Pk View -1.23 dBn
Ref Level 10. Att TDF 1 Frequency S	00 dBm 20 dB <b>SWT</b>	• RE	BW 3 MHz	e Auto Sweep	LE, Middle	e Channel		M1[1]	● 1Pk View -1.23 dBn
Ref Level 10. Att TDF 1 Frequency S	00 dBm 20 dB <b>SWT</b>	• RE	BW 3 MHz	e Auto Sweep	LE, Middle			M1[1]	● 1Pk View -1.23 dBn
Ref Level 10. Att TDF 1 Frequency S 0 dBm	00 dBm 20 dB <b>SWT</b>	• RE	BW 3 MHz	e Auto Sweep	LE, Middle	Channel		M1[1]	● 19k View -1.23 dBn
Ref Level 10. Att TDF 1 Frequency S 0 dBm	00 dBm 20 dB <b>SWT</b>	• RE	BW 3 MHz	e Auto Sweep	LE, Middle	Channel		M1[1]	● 19k View -1.23 dBn
Ref Level 10. Att TDF 1 Frequency S 0 dBm	00 dBm 20 dB <b>SWT</b>	• RE	BW 3 MHz	e Auto Sweep	LE, Middle	Channel		M1[1]	● 19k View -1.23 dBn
Ref Level 10. Att TDF 1 Frequency S 0 dBm	00 dBm 20 dB <b>SWT</b>	• RE	BW 3 MHz	e Auto Sweep	LE, Middle	Channel		M1[1]	● 19k View -1.23 dBn
Ref Level 10.           Att           TDF           1 Frequency S           0 dBm           -10 dBm           -20 dBm           -30 dBm	00 dBm 20 dB <b>SWT</b>	• RE	BW 3 MHz	e Auto Sweep	LE, Middle	Channel		M1[1]	● 19k View -1.23 dBn
Ref Level 10. Att TDF 1 Frequency S 0 dBm	00 dBm 20 dB <b>SWT</b>	• RE	BW 3 MHz	e Auto Sweep	LE, Middle	Channel		M1[1]	● 19k View -1.23 dBn
Ref Level 10.           Att           TDF           1 Frequency S           0 dBm           -10 dBm           -20 dBm           -30 dBm	00 dBm 20 dB <b>SWT</b>	• RE	BW 3 MHz	e Auto Sweep	LE, Middle	e Channel		M1[1]	● 19k View -1.23 dBn
Ref Level 10.           Att           TDF           1 Frequency S           0 dBm           -10 dBm           -20 dBm           -30 dBm	00 dBm 20 dB <b>SWT</b>	• RE	BW 3 MHz	e Auto Sweep	LE, Middle	e Channel		M1[1]	● 19k View -1.23 dBn
Ref Level 10.           Att           TDF           1 Frequency 2           0 dBm           -10 dBm           -20 dBm           -30 dBm           -40 dBm           -50 dBm	00 dBm 20 dB <b>SWT</b>	• RE	BW 3 MHz	e Auto Sweep	LE, Middle	e Channel		M1[1]	● 19k View -1.23 dBn
Ref Level 10.           Att           TDF           1 Frequency S           0 dBm           -10 dBm           -20 dBm           -30 dBm	00 dBm 20 dB <b>SWT</b>	• RE	BW 3 MHz	e Auto Sweep	LE, Middle	e Channel		M1[1]	● 19k View -1.23 dBn
Ref Level 10.           Att           TDF           1 Frequency S           0 dBm           -10 dBm           -20 dBm           -30 dBm           -50 dBm           -50 dBm	00 dBm 20 dB <b>SWT</b>	• RE	BW 3 MHz	e Auto Sweep	LE, Middle	e Channel		M1[1]	● 19k View -1.23 dBn
Ref Level 10.           Att           TDF           1 Frequency 2           0 dBm           -10 dBm           -20 dBm           -30 dBm           -40 dBm           -50 dBm	00 dBm 20 dB <b>SWT</b>	• RE	BW 3 MHz	e Auto Sweep	LE, Middle	e Channel		M1[1]	● 19k View -1.23 dBn
Ref Level 10.           Att           TDF           1 Frequency S           0 dBm           -10 dBm           -20 dBm           -30 dBm           -50 dBm           -50 dBm           -60 dBm	00 dBm 20 dB <b>SWT</b>	• RE	BW 3 MHz	e Auto Sweep	LE, Middle	e Channel		M1[1]	● 19k View -1.23 dBn
Ref Level 10.           Att           TDF           1 Frequency S           0 dBm           -10 dBm           -20 dBm           -30 dBm           -40 dBm           -50 dBm	00 dBm 20 dB <b>SWT</b>	• RE	BW 3 MHz	e Auto Sweep	LE, Middle	e Channel		M1[1]	● 19k View -1.23 dBn
Ref Level 10.           Att           TDF           1 Frequency S           0 dBm           -10 dBm           -20 dBm           -30 dBm           -50 dBm           -50 dBm           -60 dBm	00 dBm 20 dB <b>SWT</b>	• RE	BW 3 MHz	e Auto Sweep	LE, Middle	Channel		M1[1]	● 19k View -1.23 dBn
Ref Level 10.           Att           TDF           1 Frequency S           0 dBm           -10 dBm           -20 dBm           -30 dBm           -50 dBm           -50 dBm           -60 dBm	00 dBm 20 dB <b>SWT</b>	• RE	BW 3 MHz	Auto Sweep		Channel		M1[1] ;	● 19k View -1.23 dBn

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£	N	
Electromag	netic Net	work Global

MultiView 🗄 Sp	ectrum					
Ref Level 10.00 dBm           Att         20 dB           TDF		3W 3 MHz 3W 10 MHz Mode	Auto Sweep			
1 Frequency Sweep					M1[1] 2.4	● 1 Pk View -0.98 dBi 7966000 GF
0 dBm			M1			
-10 dBm						
-20 dBm						
-30 dBm					3	
-40 dBm						
-50 dBm						
-60 dBm						
-70 dBm						
-80 dBm						



# 5.4 Peak Power Spectral Density

# 5.4.1 Limit

Acc. To section 15.247, the power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

# 5.4.2 Method of Measurement

Reference to KDB 558074 D01 DTS Meas Guidance v03r05: 10.2 Method PKPSD (peak PSD).

The transmitter output is connected to a spectrum analyzer with the RBW set from 3 kHz to 100 kHz, VBW  $\geq$  3 X RBW, peak detector and max hold.

#### 5.4.3 Test Data

		Temperature	(21.2 ~ 21.8) °C
Date of Test	2017-02-28	Relative humidity	(38.8 ~ 39.6) % R.H.
Test Result	PASS	Tested by	Inyong Song

Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
Low	2 402	-2.97		10.97
Middle	2 440	-2.32	8	10.32
High	2 480	-1.79		9.79

Remark. Margin = Limit – Measured Value

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# 5.4.4 Test Plots

TUF	.00 dBm 20 dB <b>SWT</b>	41.68 µs (~10 ms	• RBW 100   s) • VBW 300	<hz <hz auto<="" mode="" th=""><th>o FFT</th><th></th><th></th><th></th><th></th></hz></hz 	o FFT				
1 Frequency	Sweep							M1[1]	● 1Pk View -2.97 dBr 2.40217461 GH
0 dBm						M1		(48) 	
-10 dBm						~			
-20 dBm									
-30 dBm									
-40 dBm									
-50 dBm									
-60 dBm									
-70 dBm									
-80 dBm									
CF 2.402 GHz			1001 pt	s	16	1.84 kHz/		Span 1.6	18381618 MHz
RefLevel 10. Att	Spectrum 00 dBm 20 dB SWT 4	41.75 µs (~10 ms	• RBW 100 k	Hz	LE, Middle	Channel	Meas	uring	
Ref Level 10.	00 dBm 20 dB <b>SWT</b> 4		• RBW 100 k	Hz		Channel	Meas		▼ ● 1Pk View
RefLevel 10. Att TDF	00 dBm 20 dB <b>SWT</b> 4		• RBW 100 k	Hz		Channel	Meas	M1[1]	⊽
RefLevel 10. Att TDF	00 dBm 20 dB <b>SWT</b> 4		• RBW 100 k	Hz		Channel	Meas	M1[1]	● 1Pk View -2.32 dB
Ref Level 10. Att TDF 1 Frequency S	00 dBm 20 dB <b>SWT</b> 4		• RBW 100 k	Hz			Meas	M1[1]	● 1Pk View -2.32 dB
Ref Level 10. Att TDF 1 Frequency S 0 dBm	00 dBm 20 dB <b>SWT</b> 4		• RBW 100 k	Hz			Meas	M1[1]	● 1Pk View -2.32 dB
Ref Level 10, Att TDF           1 Frequency S           0 d8m           -10 d8m           -20 d8m	00 dBm 20 dB <b>SWT</b> 4		• RBW 100 k	Hz		Channel	Meas	M1[1]	● 1Pk View -2.32 dB
Ref Level 10. Att TDF 1 Frequency \$ 0 dBm	00 dBm 20 dB <b>SWT</b> 4		• RBW 100 k	Hz			Meas	M1[1]	● 1Pk View -2.32 dB
Ref Level 10, Att TDF           1 Frequency S           0 d8m           -10 d8m           -20 d8m	00 dBm 20 dB <b>SWT</b> 4		• RBW 100 k	Hz		Channel	Meas	M1[1]	● 1Pk View -2.32 dB
Ref Level 10.           Att           TDF           1 Frequency S           0 d8m           -10 d8m           -20 d8m           -30 d8m	00 dBm 20 dB <b>SWT</b> 4		• RBW 100 k	Hz		Channel	Meas	M1[1]	● 1Pk View -2.32 dB
Ref Level 10, Att TDF           1 Frequency S           0 dBm           -10 dBm           -20 dBm           -30 dBm           -50 dBm	00 dBm 20 dB <b>SWT</b> 4		• RBW 100 k	Hz			Meas	M1[1]	● 1Pk View -2.32 dB
Ref Level 10.           Att           TDF           1 Frequency S           0 d8m           -10 d8m           -20 d8m           -30 d8m           -40 d8m	00 dBm 20 dB <b>SWT</b> 4		• RBW 100 k	Hz		Channel	Meas	M1[1]	● 1Pk View -2.32 dB
Ref Level 10, Att TDF           1 Frequency S           0 dBm           -10 dBm           -20 dBm           -30 dBm           -50 dBm	00 dBm 20 dB <b>SWT</b> 4		• RBW 100 k	Hz		Channel	Meas	M1[1]	● 1Pk View -2.32 dB
Ref Level 10, Att TDF           1 Frequency S           0 d8m           -10 d8m           -20 d8m           -30 d8m           -50 d8m           -50 d8m	00 dBm 20 dB <b>SWT</b> 4		• RBW 100 k	Hz		e Channel	Meas	M1[1]	● 1Pk View -2.32 dB
Ref Level 10.           Att           TDF           1 Frequency S           0 d8m           -10 d8m           -20 d8m           -30 d8m           -40 d8m           -50 d8m           -60 d8m           -70 d8m           -80 d8m	00 dBm 20 dB <b>SWT</b> 4		• RBW 100 k	Hz Mode Auto	D FFT			M1[1]	● 1Pk View -2.32 dBt 2.43967481 GH
Ref Level 10, Att TDF           1 Frequency S           0 d8m           -10 d8m           -20 d8m           -30 d8m           -40 d8m           -50 d8m           -60 d8m           -70 d8m	00 dBm 20 dB <b>SWT</b> 4		• RBW 100 k	Hz Mode Auto	D FFT	2.74 kHz/		M1[1]	● 1Pk View -2.32 dBi 2.43967481 GF

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MultiView 🔠 Spectrum					
Ref Level 10.00 dBm	● RBW 1.68 µs (~10 ms) ● VBW		T		
Frequency Sweep				M	●1Pk View 11[1] -1.79 dB 2.47992241 GI
dBm		MI			
10 dBm					
20 dBm					
30 dBm					
40 dBm					
50 dBm					
00 dBm					
70 dBm					
30 dBm					
F 2.48 GHz	100	)1 pts	161.84 kHz/		oan 1.618381618 Mi



# 5.5 Out of Band Emission

#### 5.5.1 Limit

Acc. To section 15.247(d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in 15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section §15.205(a), must also comply the radiated emission limits specified in section §15.209(a) (see section §15.205(c))

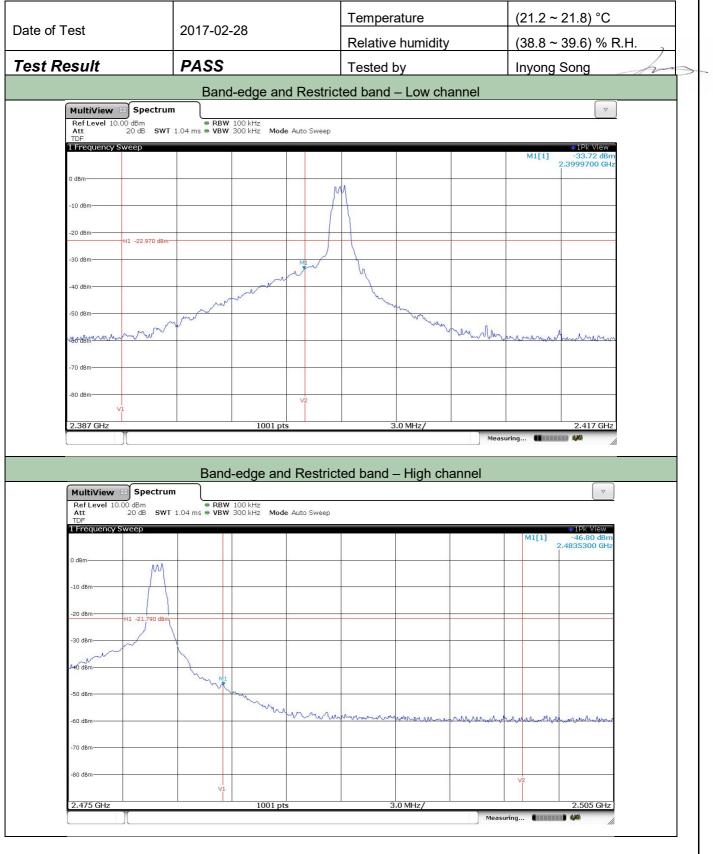
#### 5.5.2 Method of Measurement

Reference to KDB 558074 D01 DTS Meas Guidance v03r05: 11.0 Emissions in non-restricted frequency bands. The transmitter output is connected to a spectrum analyzer with the RBW set to 100 kHz, VBW  $\geq$  3 X RBW, peak detector and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

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#### 5.5.3 Test Data



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MultiView	🖽 Spectrum								
Ref Level 10	0.00 dBm	• RE	3W 100 kHz	••••••• =					
Att TDF		24.7 ms 🔍 VB	3W 300 kHz Mo	de Auto Sweep					
. Frequency	Sweep							M1[1]	1Pk View -1.40 dBr
									2.47900 GH
) dBm					<i>k</i>				N
10 dBm									
20 dBm									
	H1 -21.790 dBm-								
30 dBm									
40 dBm									
50 dBm			1	1					14
60 d0m	. Milled.	de solution and	Laderbeck and	in a					a morde working
ou asm	www.www.weburle	and the state of the second	wooden with a strangent	howborkownersaw	Wyoll all and a stand	bole share my	la abhan a board a bard a b	any peter the base when the stand	M. Martin and Martin and
70 dBm					1				
80 dBm		-							
30.0 MHz					24	7.0 MHz/			2.5 GH
4ulti\/iow	B Spectrum				24	710 11127	Measi	uring <b>(</b> AAAAAA	
					23		Measu	aring <b>(</b> anala	
Ref Level 10 Att	0.00 dBm	• RB	W 100 kHz W 300 kHz Moo		23		Measi	uring <b>Carata</b>	
Ref Level 10 Att TDF	0.00 dBm 20 dB <b>SWT</b>	• RB	<b>W</b> 100 kHz		24	, io mile,	Measi	uring <b>(</b>	<b></b>
RefLevel 10 Att TDF	0.00 dBm 20 dB <b>SWT</b>	• RB	<b>W</b> 100 kHz				Measu	uring <b>()</b>	• 1Pk View -2.14 dB
Ref Level 10 Att TDF Frequency	0.00 dBm 20 dB <b>SWT</b>	• RB	<b>W</b> 100 kHz				Measu		● 1Pk View -2.14 dB 2.4020 Gł -54.60 dB
Ref Level 10 Att TDF Frequency	0.00 dBm 20 dB <b>SWT</b>	• RB	<b>W</b> 100 kHz				Measu	M1[1]	● 1Pk View -2.14 dB 2.4020 Gi -54.60 dB
Ref Level 10 Att TDF Frequency	0.00 dBm 20 dB <b>SWT</b>	• RB	<b>W</b> 100 kHz				Measu	M1[1]	● 1Pk View -2.14 dB 2.4020 Gi -54.60 dB
Ref Level 10 Att TDF Frequency	0.00 dBm 20 dB <b>SWT</b>	• RB	<b>W</b> 100 kHz				Measu	M1[1]	● 1Pk View -2.14 dB 2.4020 Gi -54.60 dB
Ref Level 10 Att TDF Frequency dBm	0.00 dBm 20 dB <b>SWT</b>	• RB	<b>W</b> 100 kHz				Measu	M1[1]	● 1Pk View -2.14 dB 2.4020 Gi -54.60 dB
Ref Level 10 Att TDF Frequency dBm 10 dBm	0.00 dBm 20 dB SWT Sweep	• RB	<b>W</b> 100 kHz				Measu	M1[1]	● 1Pk View -2.14 dB 2.4020 Gi -54.60 dB
Ref Level 10 Att TDF Frequency dBm	0.00 dBm 20 dB <b>SWT</b>	• RB	<b>W</b> 100 kHz				Measu	M1[1]	● 1Pk View -2.14 dB 2.4020 Gi -54.60 dB
Ref Level 10 Att IDF Frequency dBm	0.00 dBm 20 dB SWT Sweep	• RB	<b>W</b> 100 kHz				Measure and the second	M1[1]	● 1Pk View -2.14 dB 2.4020 Gi -54.60 dB
Ref Level 10 Att IDF Frequency dBm	0.00 dBm 20 dB SWT Sweep	• RB	<b>W</b> 100 kHz				Measure and the second	M1[1]	● 1Pk View -2.14 dB 2.4020 Gi -54.60 dB
Ref Level 10           Att           TDF           Frequency           dBm           10 dBm           20 dBm           30 dBm	0.00 dBm 20 dB SWT Sweep	• RB	<b>W</b> 100 kHz				Measure and a second se	M1[1]	● 1Pk View -2.14 dB 2.4020 Gi -54.60 dB
Ref Level 10           Att           TDF           Frequency           dBm           10 dBm           20 dBm           30 dBm	0.00 dBm 20 dB SWT Sweep	• RB	<b>W</b> 100 kHz				Measure and the second	M1[1]	● 1Pk View -2.14 dB 2.4020 Gi -54.60 dB
Ref Level 10           Att           TDF           Frequency           dBm           10 dBm           20 dBm           30 dBm           40 dBm	.00 dBm 20 dB <b>SWT</b> Sweep H1 -22.970 dBm	• RB	<b>W</b> 100 kHz					M1[1]	● 1Pk View -2.14 dB 2.4020 Gł -54.60 dB 4.8060 Gł
Ref Level 10           Att           TDF           Frequency           0 dBm           10 dBm           20 dBm           30 dBm           40 dBm	0.00 dBm 20 dB SWT Sweep	• RB	<b>W</b> 100 kHz					M1[1]	● 1Pk View -2.14 dB 2.4020 Gł -54.60 dB 4.8060 Gł
Ref Level 10           Att           TDF           Frequency           dBm           10 dBm           20 dBm           30 dBm           40 dBm           50 dBm	оо dBm 20 dB <b>SWT</b> Sweep H1 -22.970 dBm H1 -22.970 dBm	• RB 227 ms • VB	<b>W</b> 100 kHz		24	man	Measu	M1[1] M2[1]	● 1Pk View -2.14 dB 2.4020 Gi -54.60 dB 4.8060 Gi
Ref Level 10           Att           TDF           Frequency           dBm           10 dBm           20 dBm           30 dBm           40 dBm           50 dBm	.00 dBm 20 dB <b>SWT</b> Sweep H1 -22.970 dBm	• RB	<b>W</b> 100 kHz					M1[1] M2[1]	● 1Pk View -2.14 dB 2.4020 Gł -54.60 dB 4.8060 Gł
Ref Level 10           Att           TDF           Frequency           dBm           10 dBm           20 dBm           30 dBm           30 dBm           50 dBm	оо dBm 20 dB <b>SWT</b> Sweep H1 -22.970 dBm H1 -22.970 dBm	• RB 227 ms • VB	<b>W</b> 100 kHz					M1[1] M2[1]	● 1Pk View -2.14 dB 2.4020 Gł -54.60 dB 4.8060 Gł
MultiView           Ref Level 10           Att           TDF           Frequency           0 dBm           10 dBm           20 dBm           30 dBm           30 dBm           50 dBm           50 dBm           50 dBm           70 dBm	оо dBm 20 dB <b>SWT</b> Sweep H1 -22.970 dBm H1 -22.970 dBm	• RB 227 ms • VB	<b>W</b> 100 kHz					M1[1] M2[1]	● 1Pk View -2.14 dB 2.4020 Gł -54.60 dB 4.8060 Gł
Ref Level 10           Att           TDF           Frequency           0 dBm           10 dBm           20 dBm           30 dBm           30 dBm           50 dBm           50 dBm           70 dBm	оо dBm 20 dB <b>SWT</b> Sweep H1 -22.970 dBm H1 -22.970 dBm	• RB 227 ms • VB	<b>W</b> 100 kHz					M1[1] M2[1]	● 1Pk View -2.14 dB 2.4020 Gł -54.60 dB 4.8060 Gł
Ref Level 10           Att           TDF           Frequency           i dBm           i dBm           20 dBm           30 dBm           30 dBm           50 dBm	оо dBm 20 dB <b>SWT</b> Sweep H1 -22.970 dBm H1 -22.970 dBm	• RB 227 ms • VB	<b>W</b> 100 kHz					M1[1] M2[1]	● 1Pk View -2.14 dB 2.4020 Gł -54.60 dB 4.8060 Gł
Ref Level 10           Att           TDF           Frequency           0 dBm           10 dBm           20 dBm           30 dBm           30 dBm           50 dBm           50 dBm           70 dBm	оо dBm 20 dB <b>SWT</b> Sweep H1 -22.970 dBm H1 -22.970 dBm	• RB 227 ms • VB	<b>W</b> 100 kHz					M1[1] M2[1]	● 1Pk View -2.14 dB 2.4020 Gi -54.60 dB 4.8060 Gi

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MultiView	B Spectrun	1							
Ref Level 1	0.00 dBm	■ RBV	<b>V</b> 100 kHz						
Att TDF		24./ ms 🖷 VBV	V 300 kHz Mod	e Auto Sweep					
1 Frequency	/ Sweep							M1[1]	1Pk View -1.79 dBr
									2.43950 GH
0 d8m				-				M2[1]	-55.49 dBr 2.46420 GH
									2,40420 81
-10 dBm									
10 abin									
200 - 20									1
-20 dBm	H1 -22.320 dBm-		1						
-30 dBm			1	-			-		
-40 dBm				2					
-50 dBm		ŝ			-	-	-		
		87.7							M2
-60 dBm	- Inthe	where the work	to all and						an arman well
-membradentermon	when have a white	a more entrolled		a manufather and the	for a construction of the	ununullunum,	Rysbury Many Muny Mil	power www.webritte	1
70 40-									
-70 dBm									
-80 dBm									
		1			1	1	<u> </u>		
MultiView			1001 pt	S	24	7.0 MHz/	Meas	uring (IIIIIII	2.5 GH
<b>MultiView</b> Ref Level 1 Att	0.00 dBm	• RBW	1001 pt 100 kHz 300 kHz Mode		24	7.0 MHz/	Meas	uring <b>(MARKA</b>	
MultiView Ref Level 1 Att TDF	0.00 dBm 20 dB <b>SWT</b>	• RBW	/ 100 kHz		24	7.0 MHz/	Meas	uring (MANN	
MultiView Ref Level 1 Att TDF	0.00 dBm 20 dB <b>SWT</b>	• RBW	/ 100 kHz		24	7.0 MHz/	Meas	uring (11111) M1[1]	• 1Pk View -1.93 dB
MultiView Ref Level 1 Att TDF	0.00 dBm 20 dB <b>SWT</b>	• RBW	/ 100 kHz		24	7.0 MHz/	Meas		■ ₩ ⊽
MultiView Ref Level 1 Att TDF Frequency	0.00 dBm 20 dB <b>SWT</b>	• RBW	/ 100 kHz		24	7.0 MHz/	Meas		• 1Pk View -1.93 dB
30.0 MHz MultiView Ref Level 1 Att TDF Frequency	0.00 dBm 20 dB <b>SWT</b>	• RBW	/ 100 kHz		24	7.0 MHz/	Meas		• 1Pk View -1.93 dB
MultiView Ref Level 1 Att TDF I Frequency	0.00 dBm 20 dB <b>SWT</b>	• RBW	/ 100 kHz		24	7.0 MHz/	Meas		• 1Pk View -1.93 dB
MultiView Ref Level 1 Att TDF I Frequency	0.00 dBm 20 dB <b>SWT</b>	• RBW	/ 100 kHz			7.0 MHz/	Meas		• 1Pk View -1.93 dB
MultiView Ref Level 1 Att TDF Frequency dBm 10 dBm	D.00 dBm 20 dB SWT Sweep	• RBW	/ 100 kHz			7.0 MHz/	Meas		• 1Pk View -1.93 dB
MultiView Ref Level 1 Att TDF Frequency dBm 10 dBm	0.00 dBm 20 dB <b>SWT</b>	• RBW	/ 100 kHz			7.0 MHz/	Meas		• 1Pk View -1.93 dB
MultiView Ref Level 1 Att TDF Frequency dBm 10 dBm 20 dBm	D.00 dBm 20 dB SWT Sweep	• RBW	/ 100 kHz		24	7.0 MHz/	Meas		• 1Pk View -1.93 dB
MultiView Ref Level 1 Att TDF Frequency dBm 10 dBm 20 dBm	D.00 dBm 20 dB SWT Sweep	• RBW	/ 100 kHz		24	7.0 MHz/	Meas		• 1Pk View -1.93 dB
MultiView Ref Level 1 Att DF Frequency dBm 10 dBm 20 dBm 30 dBm	D.00 dBm 20 dB SWT Sweep	• RBW	/ 100 kHz			7.0 MHz/	Meas		• 1Pk View -1.93 dB
MultiView Ref Level 1 Att DF Frequency dBm 10 dBm 20 dBm 30 dBm	D.00 dBm 20 dB SWT Sweep	• RBW	/ 100 kHz			7.0 MHz/	Meas		• 1Pk View -1.93 dB
MultiView Ref Level 1 Att DF Frequency dBm 10 dBm 20 dBm 30 dBm	D.00 dBm 20 dB SWT Sweep	• RBW	/ 100 kHz			7.0 MHz/	Meas	M1[1]	• 1Pk View -1.93 dB 2.4470 Gi
MultiView Ref Level 1 Att TDF Frequency 10 dBm 10 dBm 20 dBm 30 dBm 40 dBm	D.00 dBm 20 dB SWT Sweep	• RBW	100 kHz					M1[1]	• 1Pk View -1.93 dB 2.4470 Gi
MultiView           Ref Level 1           Att           TDF           Frequency           dBm           10 dBm           20 dBm           30 dBm           30 dBm           50 dBm	D.00 dBm 20 dB SWT Sweep	• RBW	100 kHz	Auto Sweep.				M1[1]	• 1Pk View -1.93 dB 2.4470 Gi
MultiView           Ref Level 1           Att           TDF           Frequency           dBm           10 dBm           20 dBm           30 dBm           30 dBm           50 dBm	0.00 dBm 20 dB SWT Sweep H1 -22.320 dBm-	• RBW	100 kHz				Meas	M1[1]	• 1Pk View -1.93 dB
MultiView           Ref Level 1           Att           TDF           Frequency           dBm           10 dBm           20 dBm           30 dBm           30 dBm           50 dBm	D.00 dBm 20 dB SWT Sweep	• RBW	100 kHz	Auto Sweep.				M1[1]	• 1Pk View -1.93 dB 2.4470 Gi
MultiView           Ref Level 1           Att           TDF           In dBm           10 dBm           20 dBm           30 dBm           30 dBm           50 dBm	0.00 dBm 20 dB SWT Sweep H1 -22.320 dBm-	• RBW	100 kHz	Auto Sweep.				M1[1]	• 1Pk View -1.93 dB 2.4470 Gi
MultiView Ref Level 1 Att TDF Frequency 10 dBm 10 dBm 20 dBm 30 dBm 40 dBm	0.00 dBm 20 dB SWT Sweep H1 -22.320 dBm-	• RBW	100 kHz	Auto Sweep.				M1[1]	• 1Pk View -1.93 dB 2.4470 Gi
MultiView           Ref Level 1           Att           TDF           Frequency           dBm           10 dBm           20 dBm           30 dBm           30 dBm           50 dBm           50 dBm           70 dBm	0.00 dBm 20 dB SWT Sweep H1 -22.320 dBm-	• RBW	100 kHz	Auto Sweep.				M1[1]	• 1Pk View -1.93 dB 2.4470 Gi
MultiView           Ref Level 1           Att           TDF           In dBm           10 dBm           20 dBm           30 dBm           30 dBm           50 dBm	0.00 dBm 20 dB SWT Sweep H1 -22.320 dBm-	• RBW	100 kHz	Auto Sweep.				M1[1]	• 1Pk View -1.93 dB 2.4470 Gi
MultiView           Ref Level 1           Att           TDF           Frequency           dBm           10 dBm           20 dBm           30 dBm           30 dBm           50 dBm           50 dBm           70 dBm	0.00 dBm 20 dB SWT Sweep H1 -22.320 dBm-	• RBW	100 kHz	Auto Sweep.				M1[1]	• 1Pk View -1.93 dB 2.4470 Gi
MultiView           Ref Level 1           Att           TDF           Image: Frequency           dBm           dBm           10 dBm           20 dBm           30 dBm           30 dBm           50 dBm           50 dBm           70 dBm	0.00 dBm 20 dB SWT Sweep H1 -22.320 dBm-	• RBW	100 kHz	Auto Sweep				M1[1]	• 1Pk View -1.93 dB 2.4470 Gi

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0 MHz MultiView Ref Level 10 Att TDF Frequency	0.00 dBm 20 dB <b>SWT</b>	• P			2	47.0 MHz/	M			▼ 1Pk View -1.50 dBn
0 MHz MultiView Ref Level 10 Att TDF Frequency	0.00 dBm 20 dB <b>SWT</b>	• P				47.0 MHz/	M			▼ 1Pk View -1.50 dBn
0 MHz MultiView Ref Level 10 Att TDF Frequency	3.00 dBm 20 dB swT Sweep	227 ms • V				47.0 MHz/	M			▼ 1Pk View -1.50 dBn
0 MHz MultiView Ref Level 10 Att TDF Frequency	0.00 dBm 20 dB <b>SWT</b>	227 ms • V				47.0 MHz/	M			▼ 1Pk View -1.50 dBn
0 MHz MultiView Ref Level 10 Att TDF Frequency	3.00 dBm 20 dB swT Sweep	227 ms • V				47.0 MHz/	M			▼ 1Pk View -1.50 dBn
O MHz  MultiView Ref Level 10 Att TDF Frequency dBm 20 dBm 30 dBm	3.00 dBm 20 dB swT Sweep	227 ms • V				47.0 MHz/	M			▼ 1Pk View -1.50 dBn
0 MHz MultiView Ref Level 10 Att TDF Frequency dBm 10 dBm 20 dBm	3.00 dBm 20 dB swT Sweep	227 ms • V				47.0 MHz/	M			▼ 1Pk View -1.50 dBn
O MHz  MultiView Ref Level 10 Att TDF Frequency dBm 20 dBm 30 dBm	3.00 dBm 20 dB swT Sweep	227 ms • V				47.0 MHz/				
0 MHz MultiView Ref Level 10 Att TDF Frequency dBm 10 dBm 20 dBm 40 dBm 50 dBm	3.00 dBm 20 dB swT Sweep	• R 227 ms • V	<b>RBW</b> 100 kHz <b>/BW</b> 300 kHz Mod	le Auto Sweep		47.0 MHz/				▼ 1Pk View -1.50 dBn
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0 MHz  MultiView Ref Level 10 Att TDF  Frequency dam  dam  20 dBm  30 dBm  40 dBm  50 dBm  50 dBm	20.00 dBm 20 dB SWT Sweep H1 -21.790 dBm	227 ms • V	XBW 100 kHz Mod	le Auto Sweep						
0 MHz MultiView Ref Level 10 Att TDF Frequency dBm 10 dBm 20 dBm 40 dBm 50 dBm	20.00 dBm 20 dB SWT Sweep H1 -21.790 dBm	227 ms • V	XBW 100 kHz Mod	le Auto Sweep			M			
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O MHz	20.00 dBm 20 dB SWT Sweep H1 -21.790 dBm	227 ms • V	XBW 100 kHz Mod	le Auto Sweep						

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# 5.6 Radiated Emission

# 5.6.1 Limit

Acc. To section 15.205 and 15.209, following table shall be applied.

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 – 88	100	40
88 – 216	150	43.5
216 – 960	200	46
Above 960	500	24

# 5.6.2 Method of Measurement

Reference to KDB 558074 D01 DTS Meas Guidance v03r05: 12.1 Radiated emission measurements.

The radiated emissions measurements were on 3 m, semi-anechoic chamber. The EUT and other support equipment were placed on a non-conductive table 80 cm for below 1 GHz and 1.5 m for above 1 GHz above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

The frequency spectrum from 30 MHz to 26.5 GHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

For measurement below 1 GHz, the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For peak emission measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz and for average measurement, resolution bandwidth is set to 1 MHz; and the video bandwidth is set to 10 Hz, when duty cycle is more than 98 %. If duty cycle is less than 98 %, the video bandwidth is set to  $\frac{1}{T}$ , where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

# 5.6.3 Test Site Requirement for KDB 937606

Acc. to KDB 937606, Semi Anechoic Chamber (SAC) shall be verified test results below 30 MHz with Open Area Test Site (OATS), so we compared test results between the measurements from our SAC and an OATS and found test results almost same, so we declare test result for below 30 MHz from our SAC is valid and met the requirement acc. to KDB 937606.

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# 5.6.4 Measurement Uncertainty

Measurement uncertainties were not taken into account and following uncertainty levels have been estimated for tests performed on the apparatus. The measurement uncertainties are given with at least 95 % confidence.

Frequency Range	Uncertainty	Frequency Range	Uncertainty
9 kHz ~ 30 MHz	$\pm$ 3.2 dB	30 MHz ~ 1 GHz	$\pm$ 3.8 dB
1 GHz ~ 18 GHz	± 4.9 dB	18 GHz ~ 40 GHz	± 5.1 dB

#### 5.6.5 Sample Calculated Example

At 80 MHz

Limit = 40.0 dBuV/m

Result =Receiver reading value + Antenna Factor + Cable Loss – Pre-amplifier gain = 30 dBuV/m Margin = Limit – Result = 40 – 30 = 10 so the EUT has 10.0 dB margin at 80 MHz

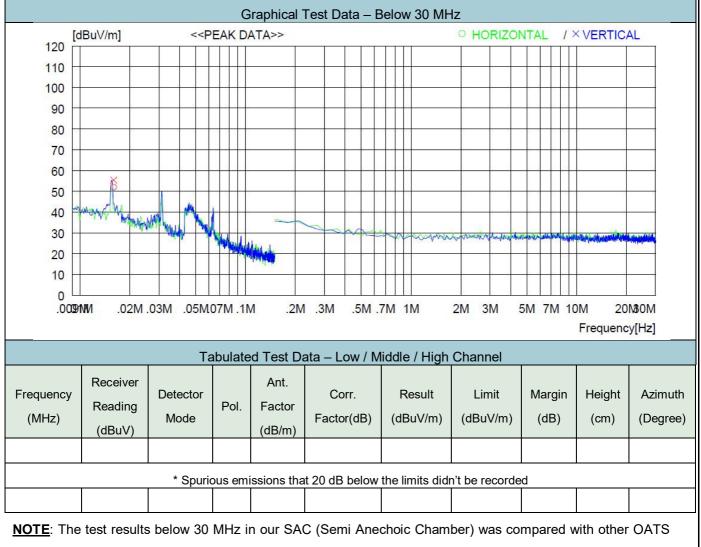
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# 5.6.6 Test Data

Data of Toot	2017 02 04	2017-03-04		ure	(18.4 ~ 19.3)	°C		
Date of Test	2017-03-04			umidity	(28.1 ~ 29.4)	% R.H.		
Measurement Freq	uency Range		9 kHz ~ 2	6 GHz		2		
Test Result	Test Result PASS			,	In-yong Song	In-yong Song		
Frequency range	Detector Mode	Detector Mode Resol		Video BW	Video Filtering	Measurement distance		
Below 30 MHz	Peak or Q.P.		9 kHz	100 kHz	-	3 m		
30 MHz ~ 1 000 MHz	Peak or Q.P.			300 kHz	-	3 m		

# 5.6.6.1 Test Data below 30 MHz



(Open Area Test Site) and found the result was almost same with OATS.

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5.6.6.2 Test Data from 30 MHz to 1 GHz

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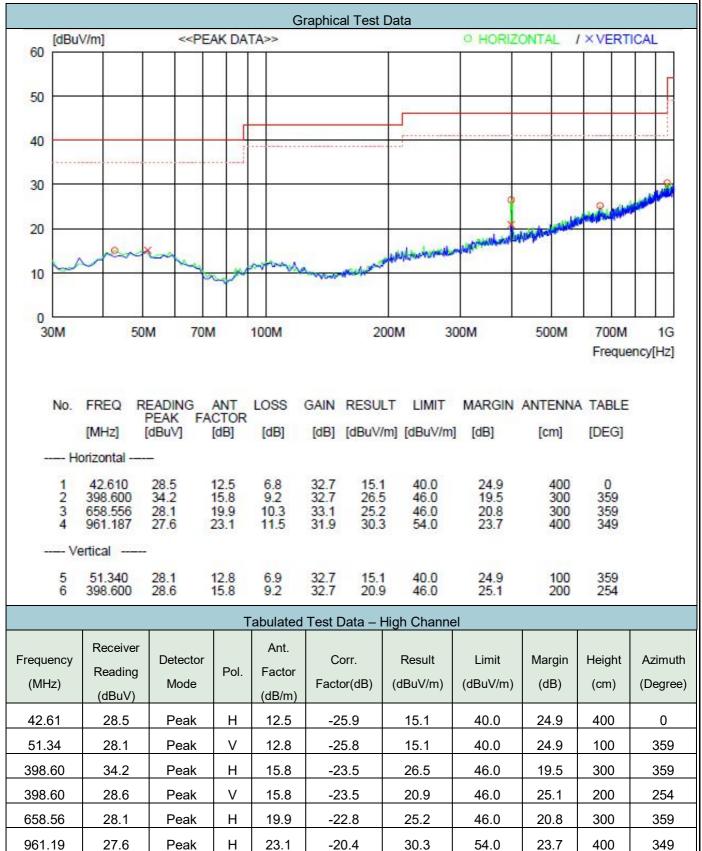
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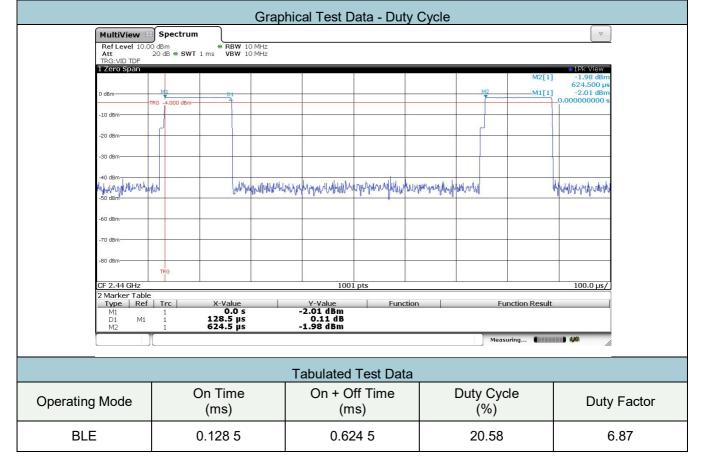
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# 5.6.6.3Test Data above 1 GHz

# 5.6.6.3.1 Duty Cycle



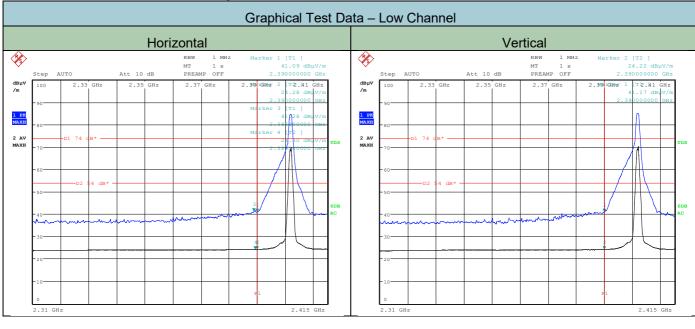
For the RMS measurement, following setting condition and span was set to (SPAN/(501)  $\leq$  500 kHz (=RBW/2) and performed a trace average of at least 100 traces.

Detector Mode	Resolution BW	Video BW	Sweep Time	Measurement distance
Peak	1 MHz	3 MHz	Auto	3 m
RMS	1 MHz	3 MHz	Auto	3 m

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# 5.6.6.3.2 Test Data for Band edge (Restricted band)

	Tabulated Test Data – Low Channel										
Freq. (MHz)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor (dB)	Receiver Reading (dBuV/m)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Deg)
2 390.0	Peak	н	28.9	-26.5	41.28	-	41.28	74	32.72	100	134
2 390.0	Average	Н	28.9	-26.5	24.30	6.87	31.17	54	22.83	100	134
2 390.0	Peak	V	28.9	-26.5	41.17	-	41.17	74	32.83	275	0
2 390.0	Average	V	28.9	-26.5	24.22	6.87	31.09	54	22.91	275	0

**NOTE:** Peak results are met average limit, so average measurement is not necessary, but performed.

"H" means Horizontal polarity, "V" means Vertical polarity.

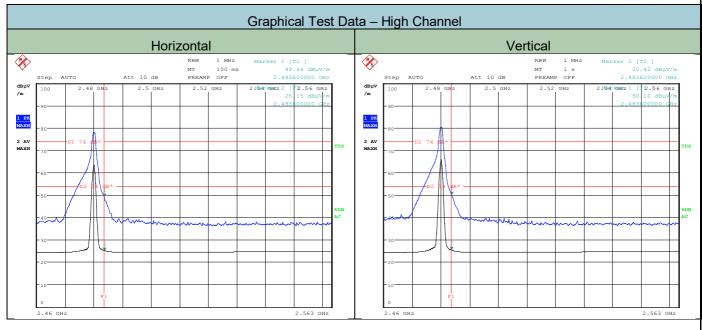
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	Tabulated Test Data – High Channel										
Frog	Detector		Ant.	Corr.	Receiver	Duty	Decult	Limit	Morgin	l laiseht	0 —ius utb
Freq.	Detector	Pol.	Factor	Factor	Reading	Factor	Result	Limit	Margin	Height	Azimuth
(MHz)	Mode		(dB/m)	(dB)	(dBuV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(Deg)
2 483.6	Peak	Н	29.1	-26.5	49.34	-	49.34	74	24.66	135	138
2 483.6	Average	Н	29.1	-26.5	25.15	6.87	32.02	54	21.98	135	138
2 483.6	Peak	V	29.1	-26.5	50.10	-	50.10	74	23.90	270	350
2 483.6	Average	V	29.1	-26.5	25.42	6.87	32.29	54	21.71	270	350

**NOTE:** Peak results are met average limit, so average measurement is not necessary, but performed.

"H" means Horizontal polarity, "V" means Vertical polarity.

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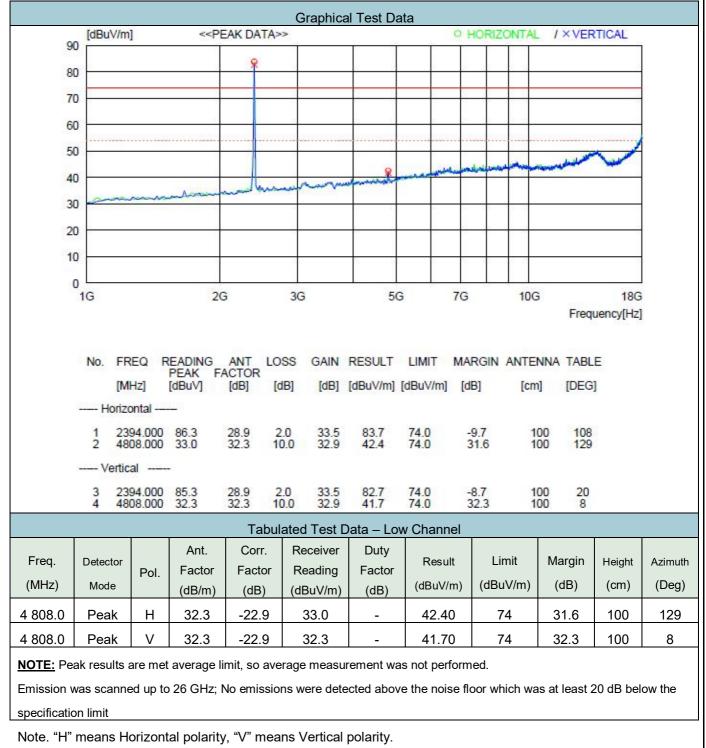
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# 5.6.6.3.3 Test Data for Harmonic & Spurious emission

#### 5.6.6.3.3.1 Low Channel



"\*" indicates frequency in Band edge (Restricted band)

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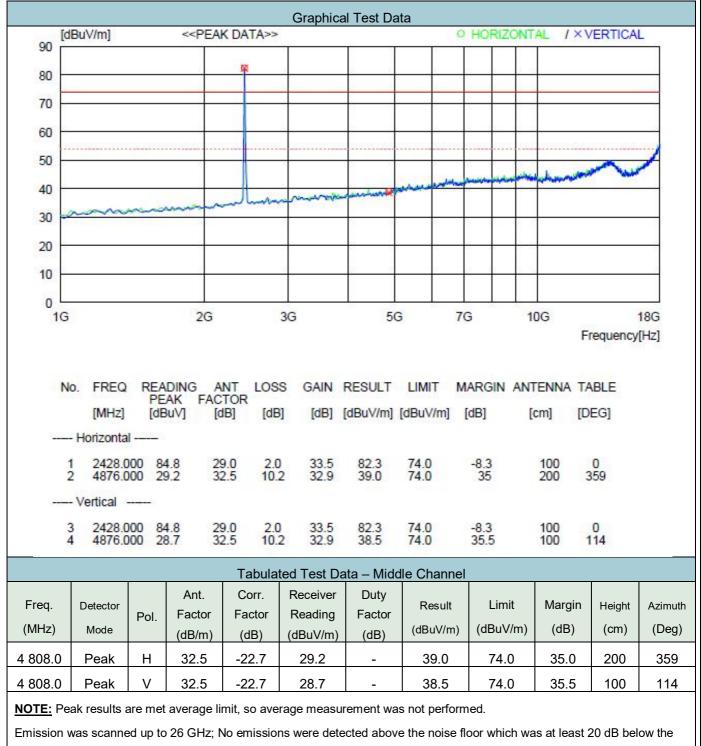
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#### 5.6.6.3.3.2 Middle Channel



specification limit

Note. "H" means Horizontal polarity, "V" means Vertical polarity.

"\*" indicates frequency in Band edge(Restricted band).

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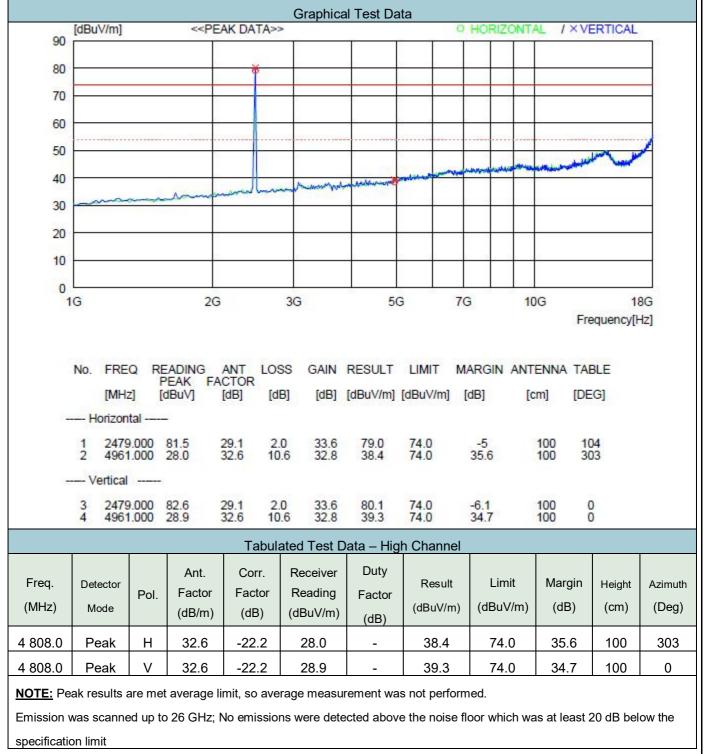
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#### 5.6.6.3.3.3 High Channel

Note. "H" means Horizontal polarity, "V" means Vertical polarity.

"\*" indicates frequency in Band edge(Restricted band).

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# Appendix I – Test Instrumentation

Description	Model No.	Serial No.	Manufacturer.	Due for Cal Date
Signal & Spectrum Analyzer	FSW 43	100578	Rohde & Schwarz	2017-05-04
Power Module	OSP 120	101389	Rohde & Schwarz	2018-01-19
Signal Generator	SMF100A	101441	Rohde & Schwarz	2018-01-19
Vector Signal Generator	SMBV100A	257560	Rohde & Schwarz	2018-01-19
DC Power Supply	U8001A	MY51080019	AGILENT	2017-07-29
Slidacs	DSD-1005	M06-117	Digitek Power	N/A
Attenuator	56-10	58769	WEINSCHEL	2018-01-19
Attenuator	10dB	N/A	Rohde & Schwarz	2018-01-19
Temperature & Humidity Chamber	PR-3KP	14004209	Espec	2017-07-29
Test Receiver	ESU 26	100303	Rohde & Schwarz	2018-01-19
Loop Antenna	HFH2-Z2	100341	Rohde & Schwarz	2017-06-04
TRILOG Broadband Antenna	VULB9163	9163.770	Schwarzbeck	2019-02-13
Dipole Antenna	UHA9105	N/A	Schwarzbeck	2017-07-17
Horn Antenna	HF 907	102426	Rohde & Schwarz	2019-01-06
DOPPEL STEG Horn Antenna	HF 906	100332	Rohde & Schwarz	2019-02-13
Attenuator	6dB	272.4110.50	Rohde & Schwarz	2018-01-19
Pre-Amplifier	310N	344015	Sonoma Instrument	2018-01-19
Pre-Amplifier	SCU 18D	19006450	Rohde & Schwarz	2018-01-19
Turn Table	DT3000-3t	1310814	INNCO SYSTEM	N/A
Antenna Master	MA4000-EP	4600814	INNCO SYSTEM	N/A
Camera Controller	HDCon4102	6531445048	PONTIS	N/A
CO3000 Controller	Co3000-4Port	CO3000/806/ 34130814/L	INNCO SYSTEM	N/A
EMI Test Receiver	ESCI 7	100722	Rohde & Schwarz	2018-01-19
LISN	ENV216	100110	Rohde & Schwarz	2017-07-29
LISN	LS16C	16011403310	AFJ	2017-07-29

The measuring equipment utilized to perform the tests documented in this test report has been calibrated in accordance with manufacturer's recommendations, and is traceable to recognized national standards.

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