TEST REPORT

Report No.	CISRR240822147
Project No.	CISR240822147
FCC ID	2BKIQ-ZF-430
Applicant	Beijing Zero Degree Technology Co., Ltd.
Address	Room 102-LQ397, Floor 1-3, Building 26, No. 17 Huanke Middle Road, Tongzhou District, Beijing, China
Manufacturer	Beijing Zero Degree Technology Co., Ltd.
Address	Room 102-LQ397, Floor 1-3, Building 26, No. 17 Huanke Middle Road, Tongzhou District, Beijing, China
Product Name	ZF Luna Pro
Trade Mark	--
Model/Type reference	ZF-430
Listed Model(s)	--
Standard	Part 15 Subpart C Section 15.247
Test date	August 22, 2024 ~ August 27, 2024
Issue date	August 27, 2024
Test result	**Complied**

Rory Huang

Prepared by: Rory Huang

Genry Long

Approved by: Genry Long

The test results relate only to the tested samples.

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1. REPORT VERSION

Version No.	Issue date	Description
00	August 27, 2024	Original

2. SUMMARY OF TEST RESULT

Report clause	Test Item	Standard Requirement	Result
5.1	Antenna Requirement	15.203/15.247 (c)	PASS
5.2	AC Conducted Emission	15.207	PASS
5.3	Peak Output Power	15.247 (b)(1)	PASS
5.4	20 dB Bandwidth	15.247 (a)(1)	PASS
5.5	99% Occupied Bandwidth	-	PASS*1
5.6	Carrier Frequency Separation	15.247 (a)(1)	PASS
5.7	Hopping Channel Number	15.247 (a)(1)	PASS
5.8	Dwell Time	15.247 (a)(1)	PASS
5.9	Duty Cycle Correction Factor	-	PASS*1
5.10	Pseudorandom Frequency Hopping Sequence	15.247(a)(1)	PASS
5.11	Conducted Band Edge and Spurious Emission	15.247(d)/15.205	PASS
5.12	Radiated Band Edge Emission	15.205/15.209	PASS
5.13	Radiated Spurious Emission	15.247(d)/15.205/15.209	PASS

Note:

– The measurement uncertainty is not included in the test result.

– *1: No requirement on standard, only report these test data.

3. SUMMARY

3.1. Product Description

Main unit information:	
Product Name:	ZF Luna Pro
Trade Mark:	--
Model No.:	ZF-430
Listed Model(s):	--
Power supply:	Input: DC 5V DC 3.7V from Battery
Hardware version:	V1.0
Software version:	V1.0

3.2. Radio Specification Description

Technology:	Bluetooth
Transmission technology:	FHSS
Modulation:	BR/1Mbps: GFSK, EDR/2Mbps: π/4DQPSK, EDR/3Mbps: 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	Chip Antenna
Antenna gain:	2.0dBi

Channel List:

BT : BR/1Mbps: GFSK, EDR/2Mbps: π/4DQPSK, EDR/3Mbps: 8DPSK

CH00	**2402 MHz**	CH20	2421 MHz
CH01	2403 MHz	CH21	2422 MHz
CH02	2404 MHz	CH22	2423 MHz
--	--	--	--
--	--	CH39	**2441 MHz**
--	--	--	--
CH18	2419 MHz	CH77	2479 MHz
CH19	2420 MHz	CH78	**2480 MHz**

3.3. Modification of EUT

No modifications are made to the EUT during all test items.

3.4. Testing Site

Laboratory Name	Shenzhen Bangce Testing Technology Co., Ltd.
Laboratory Location	101, building 10, Yunli Intelligent Park, Shutianpu community, Matian Street, Guangming District, Shenzhen, Guangdong, China
FCC registration number	736346

3.5. 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 (dBuV/m) = RA (dBuV) + AF (dB/m) + CL (dB) – AG (dB)

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

3.6. DISTURBANCE Calculation

The AC mains conducted disturbance is calculated by adding the 10dB Pulse Limiter and Cable Factor and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

CD (dBuV) = RA (dBuV) + PL (dB) + CL (dB)

Where CD = Conducted Disturbance	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	PL = 10 dB Pulse Limiter Factor

4. TEST CONFIGURATION

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

4.1. Test frequency list

Channel	Frequency (MHz)
CH-L	2402
CH-M	2441
CH-H	2480

4.2. Test mode

For RF test items:		
The engineering test program was provided(FCC_assist_1.0.2.2) and enabled to make EUT continuous transmitting.Power setting Default.		
Test Item	Test Mode	Modulation
Conducted test item	TX CH-L	GFSK
	TX CH-M	GFSK
	TX CH-H	GFSK
	TX CH-L	π/4DQPSK
	TX CH-M	π/4DQPSK
	TX CH-H	π/4DQPSK
	TX CH-L	8DPSK
	TX CH-M	8DPSK
	TX CH-H	8DPSK
	Hopping	GFSK
	Hopping	π/4DQPSK
	Hopping	8DPSK
	Normal link	--
	Charging	--
Radiated test item	TX CH-L	GFSK
	TX CH-M	GFSK
	TX CH-H	GFSK
	TX CH-L	π/4DQPSK
	TX CH-M	π/4DQPSK
	TX CH-H	π/4DQPSK
	TX CH-L	8DPSK
	TX CH-M	8DPSK
	TX CH-H	8DPSK
	Hopping	GFSK
	Hopping	π/4DQPSK
	Hopping	8DPSK

	Normal link	--
	Charging	--
Remark: – The EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.All patterns have predictions, and the report only shows the worst pattern data.		

4.3. Support unit used in test configuration and system

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

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

Item	Equipment name	Trade Name	Model No.
1	Adapter	Huawei	HW-05002000C
2	Phone	Huawei	Mate 20

4.4. Test sample information

Type	Sample no.
Engineer sample	CISR240822147-S01
Normal sample	CISR240822147-S02

4.5. Testing environmental condition

Type	Requirement	Actual
Temperature:	15~35°C	25°C
Relative Humidity:	25~75%	50%
Air Pressure:	860~1060mbar	1000mbar

4.6. Statement of the measurement uncertainty

No.	Test Items	Measurement Uncertainty
1	AC Conducted Emission	1.63dB
2	Peak Output Power	1.34dB
3	Power Spectral Density	1.34dB
4	6dB Bandwidth	0.002%
5	99% Occupied Bandwidth	0.002%
6	Duty cycle	-
7	Conducted Band Edge and Spurious Emission	1.93dB
8	Radiated Band Edge Emission	3.76dB for 30MHz-1GHz 3.80dB for above 1GHz
9	Radiated Spurious Emission	3.76dB for 30MHz-1GHz 3.80dB for above 1GHz

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

4.7. Equipment Used during the Test

Equipment	Manufacture	Model No.	Serial No.	Last cal.	Cal Interval
9*6*6 anechoic chamber	SKET	9.3*6.3*6	N/A	2021.10.15	3Year
Spectrum analyzer	Agilent	N9020A	MY50530263	2024.01.08	1Year
Receiver	ROHDE&SCHWARZ	ESCI	100853	2024.01.08	1Year
Spectrum analyzer	R&S	FSV-40N	/	2024.01.08	1Year
Bilog Antenna	Schwarzbeck	VULB 9163	1463	2023.01.09	2Year
Horn Antenna	SCHWARZBECK	BBHA 9120 D	2487	2023.01.09	2Year
Active Loop Antenna	SCHWARZBECK	FMZB 1519B	/	2023.01.09	2Year
RF Cable	Tonscend	Cable 1	/	2024.01.08	1Year
RF Cable	Tonscend	Cable 2	/	2024.01.08	1Year
RF Cable	SKET	Cable 3	/	2024.01.08	1Year
Pre-amplifier	Tonscend	TAP9K3G32	AP21G806153	2024.01.08	1Year
Pre-amplifier	Tonscend	TAP01018050	AP22E806229	2024.01.08	1Year
L.I.S.N.#1	Schwarzbeck	NSLK8127	/	2024.01.08	1Year
L.I.S.N.#2	ROHDE&SCHWARZ	ENV216	/	2024.01.08	1 Year
Horn Antenna	SCHWARZBECK	BBHA9170	1130	2023.01.09	2 Year
Preamplifier	Tonscend	TAP18040048	AP21C806126	2024.01.08	1 Year
Antenna tower	SKET	Bk-4AT-BS	AT2021040101-V1	N/A	N/A
variable-frequency power source	Pinhong	PH1110	/	2024.01.08	1 Year
6dB Attenuator	SKET	DC-6G	/	N/A	N/A
Artificial power network	Schwarzbeck	NSLK8127	8127-01096	2024.01.08	1 Year
EMI Test Receiver	Rohde&schwarz	ESCI7	100853	2024.01.08	1 Year
8-wire Impedance Stabilization Network	Schwarzbeck	NTFM 8158	8158-00337	2024.01.08	1 Year
Antenna tower	SKET	Bk-4AT-BS	AT2021040101-V1	N/A	N/A

5. TEST CONDITIONS AND RESULTS

5.1. Antenna Requirement

Standard Applicable	**FCC CFR Title 47 Part 15 Subpart C Section 15.203:** An intentional radiator shall be designed to ensure that no antenna other than that furnished by the response-ble 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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. **FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1) (I):** (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.
Description	The EUT antenna is Chip antenna (2.0dBi), the directional gain of the antenna less than 6dBi. It comply with the standard requirement. In case of replacement of broken antenna the same antenna type must be used.Antenna structure please refer to the EUT internal photographs antenna photo.

Remark: The antenna gain is provided by the customer , if the data provided by the customer is not accurate, Shenzhen Bangce Testing Technology Co., Ltd. does not assume any responsibility.

5.2. AC Conducted Emission

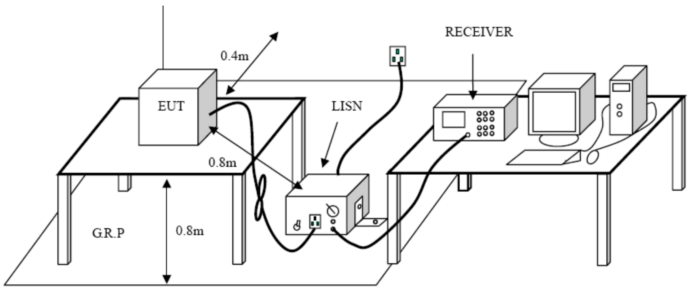
Limit:

FCC CFR Title 47 Part 15 Subpart C Section 15.207

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

Test configuration:



Test procedure:

1. The EUT was setup according to ANSI C63.10 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedances stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment.
4. The peripheral devices are also connected to the main power through a LISN. (Refer to the block diagram of the test setup and photographs)
5. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.
6. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
7. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
8. During the above scans, the emissions were maximized by cable manipulation.

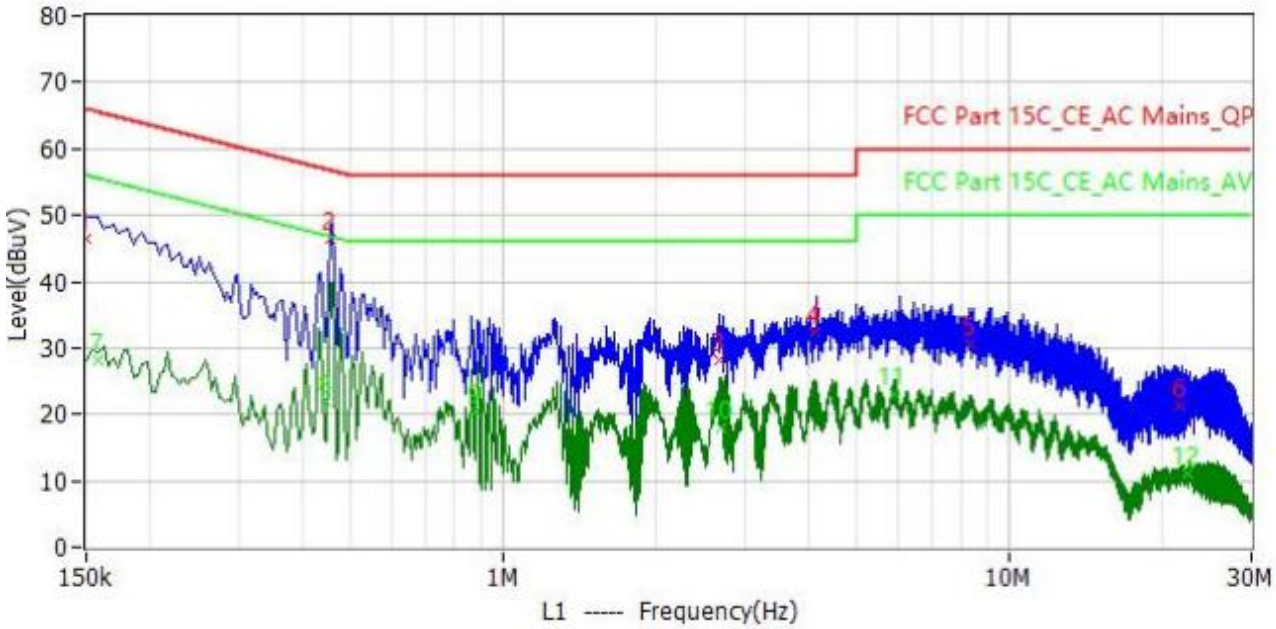
Test mode: Refer to the clause 4.2

Result: **Passed**

Note:
1. Factor = LISN Factor + Cable Factor
2. Level= Reading + Factor
3. Margin= Level – Limit

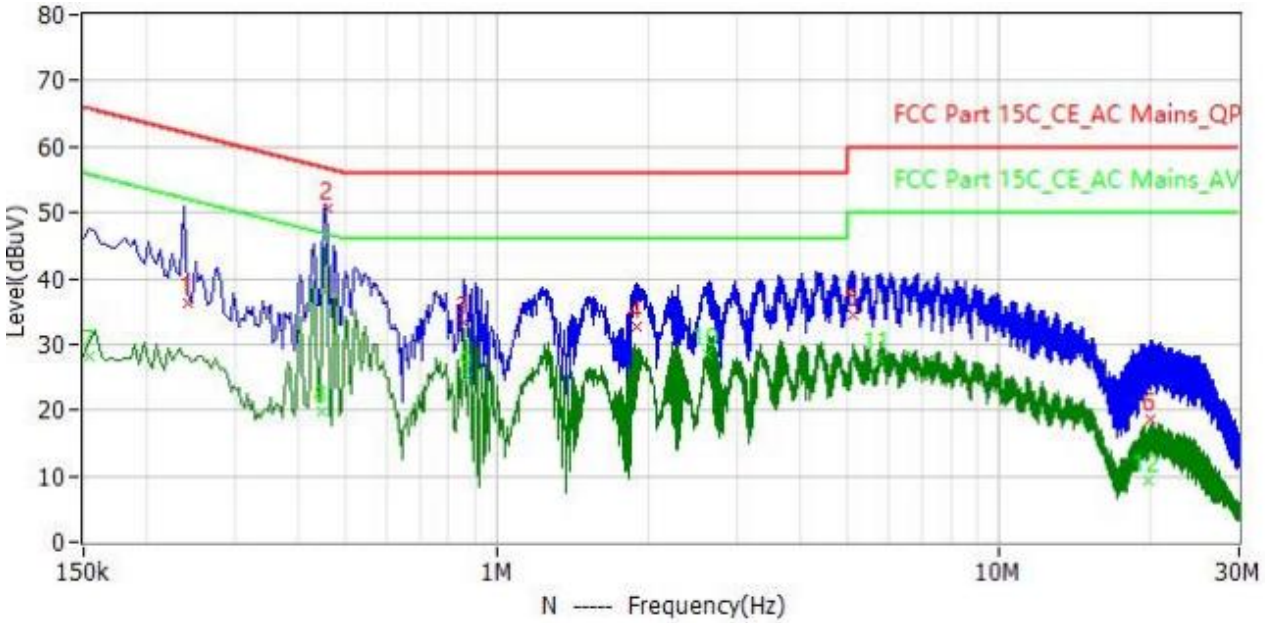
Test Mode: Charging

Test Line:	L



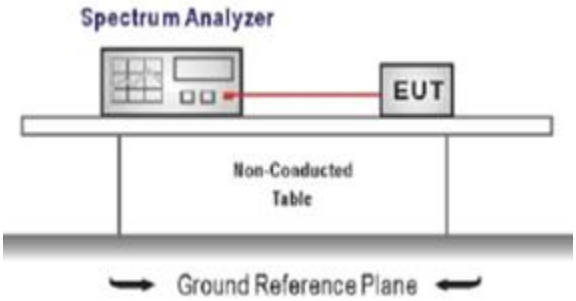
No.	Frequency	Limit dBuV	Level dBuV	Margin dB	Reading dBuV	Factor dB	Detector	Polar
1	150.000kHz	66.0	46.3	-19.7	46.3	0.0	QP	L1
2	454.000kHz	56.8	46.3	-10.5	46.2	0.1	QP	L1
3	2.662MHz	56.0	28.2	-27.8	28.1	0.1	QP	L1
4	4.130MHz	56.0	32.5	-23.5	32.3	0.2	QP	L1
5	8.362MHz	60.0	30.7	-29.3	30.4	0.3	QP	L1
6	21.698MHz	60.0	21.2	-38.8	20.7	0.5	QP	L1
7	158.000kHz	55.6	28.3	-27.3	28.3	0.0	CAV	L1
8	446.000kHz	46.9	22.0	-24.9	21.9	0.1	CAV	L1
9	878.000kHz	46.0	20.4	-25.6	20.3	0.1	CAV	L1
10	2.706MHz	46.0	18.1	-27.9	18.0	0.1	CAV	L1
11	5.910MHz	50.0	23.2	-26.8	23.0	0.2	CAV	L1
12	22.438MHz	50.0	11.1	-38.9	10.6	0.5	CAV	L1

Test Line:	N

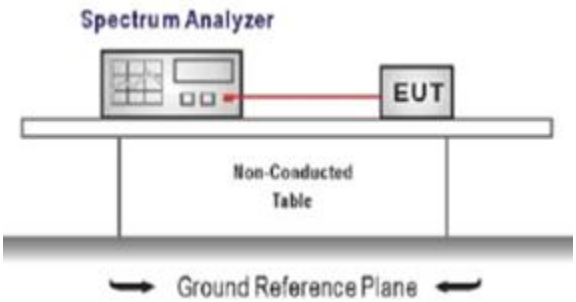


No.	Frequency	Limit dBuV	Level dBuV	Margin dB	Reading dBuV	Factor dB	Detector	Polar
1	242.000kHz	62.0	36.3	-25.7	36.3	0.0	QP	N
2	458.000kHz	56.7	50.5	-6.2	50.4	0.1	QP	N
3	854.000kHz	56.0	33.4	-22.6	33.3	0.1	QP	N
4	1.902MHz	56.0	32.8	-23.2	32.7	0.1	QP	N
5	5.114MHz	60.0	34.6	-25.4	34.4	0.2	QP	N
6	19.970MHz	60.0	18.6	-41.4	18.1	0.5	QP	N
7	154.000kHz	55.8	28.1	-27.7	28.1	0.0	CAV	N
8	446.000kHz	46.9	19.9	-27.0	19.8	0.1	CAV	N
9	870.000kHz	46.0	25.0	-21.0	24.9	0.1	CAV	N
10	2.618MHz	46.0	28.6	-17.4	28.5	0.1	CAV	N
11	5.750MHz	50.0	28.0	-22.0	27.8	0.2	CAV	N
12	19.878MHz	50.0	9.2	-40.8	8.7	0.5	CAV	N

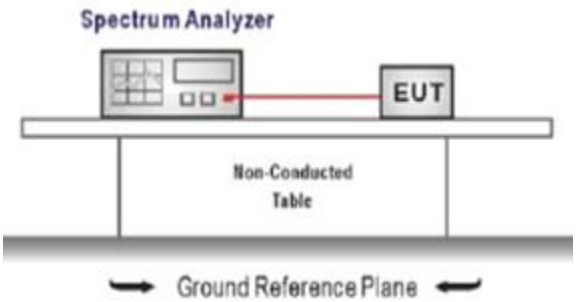
5.3. Peak Output Power

Limit:	**FCC CFR Title 47 Part 15 Subpart C Section 15.247 (b)(1):** For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
Test configuration:	
Test procedure:	1. The transmitter output was connected to the spectrum analyzer through an attenuator, the pathloss was compensated to the results for each measurement. 2. Set to the maximum power setting and enable the EUT transmit continuously 3. Use the following spectrum analyzer settings: Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel RBW≥ the 20 dB bandwidth of the emission being measured, VBW≥RBW Sweep = auto, Detector function = peak, Trace = max hold 4. Measure and record the results in the test report.
Test mode:	Refer to the clause 4.2
Test data:	Refer to the Appendix A
Result:	**Passed**

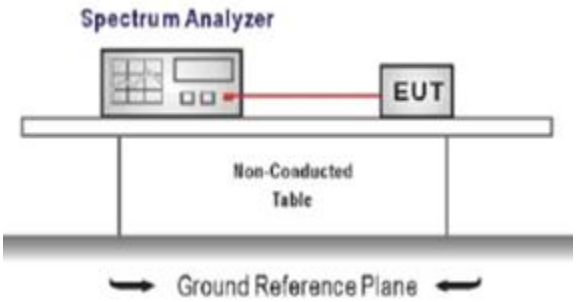
5.4. 20 dB Bandwidth

Limit:	--
Test configuration:	
Test procedure:	1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement. 2. Set to the maximum power setting and enable the EUT transmit continuously 3. Use the following spectrum analyzer settings: Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel RBW ≥ 1% of the 20 dB bandwidth, VBW ≥ RBW Sweep = auto, Detector function = peak, Trace = max hold 4. Measure and record the results in the test report.
Test mode:	Refer to the clause 4.2
Test data:	Refer to the Appendix A
Result:	**Passed**

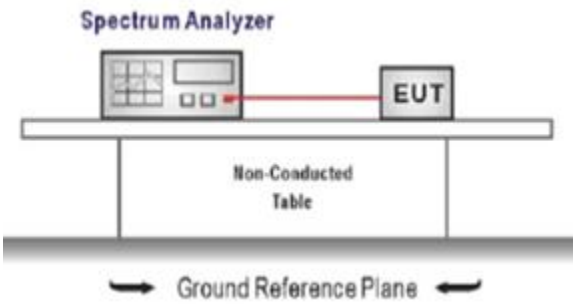
5.5. 99% Occupied Bandwidth

Limit:	--
Test configuration:	
Test procedure:	1. Connect the antenna port(s) to the spectrum analyzer input. 2. Configure the spectrum analyzer as shown below (enter all losses between the transmitter output andthe spectrum analyzer). Center Frequency =channel center frequency Span≥1.5 x OBW RBW = 1%~5%OBW, VBW ≥ 3 × RBW Sweep time= auto couple Detector = Peak, Trace mode = max hold 3. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter waveform on the spectrum analyzer.
Test mode:	Refer to the clause 4.2
Test data:	Refer to the Appendix A
Result:	**Passed**

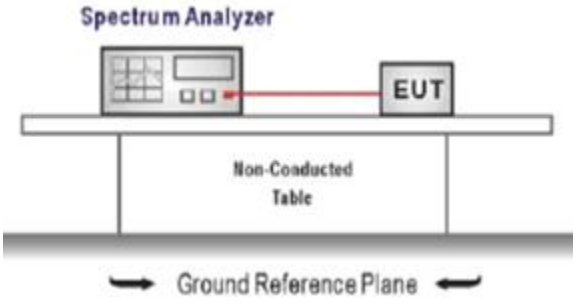
5.6. Carrier Frequencies Separation

Limit:	**FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):** Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.
Test configuration:	
Test procedure:	1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement. 2. Set to the maximum power setting and enable the EUT transmit continuously 3. Use the following spectrum analyzer settings: Span = wide enough to capture the peaks of two adjacent channels RBW ≥ 1% of the span, VBW ≥ RBW Sweep = auto, Detector function = peak, Trace = max hold 4. Measure and record the results in the test report.
Test mode:	Refer to the clause 4.2
Test data:	Refer to the Appendix A
Result:	**Passed**

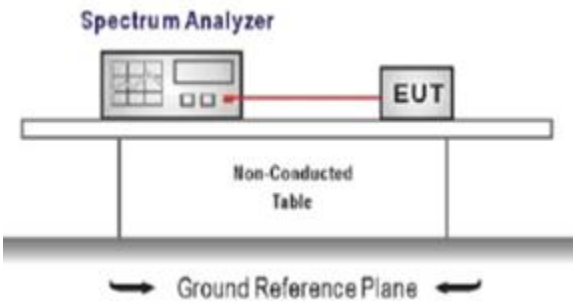
5.7. Hopping Channel Number

Limit:	**FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):** Frequency hopping systems in the 2400–2483.5 MHz band shall use at least **15** channels.
Test configuration:	
Test procedure:	1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement. 2. Set to the maximum power setting and enable the EUT transmit continuously 3. Use the following spectrum analyzer settings: Span = the frequency band of operation RBW ≥ 1% of the span, VBW ≥ RBW Sweep = auto, Detector function = peak, Trace = max hold 4. Measure and record the results in the test report.
Test mode:	Refer to the clause 4.2
Test data:	Refer to the Appendix A
Result:	**Passed**

5.8. Dwell Time

Limit:	**FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):** The average time of occupancy on any channel shall not be greater than 0.4 seconds within a pe-riod of 0.4 seconds multiplied by the number of hopping channels employed.
Test configuration:	
Test procedure:	1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement. 2. Set to the maximum power setting and enable the EUT transmit continuously 3. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel, RBW= 1 MHz, VBW ≥ RBW Sweep = as necessary to capture the entire dwell time per hopping channel, Detector function = peak, Trace = max hold 4. Measure and record the results in the test report.
Test mode:	Refer to the clause 4.2
Test data:	Refer to the Appendix A
Result:	**Passed**

5.9. Duty Cycle Correction Factor (DCCF)

Limit:	--
Test configuration:	
Test procedure:	1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement. 2. Set to the maximum power setting and enable the EUT transmit continuously 3. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel, RBW= 10 MHz, VBW ≥ RBW, Sweep = as necessary to capture the entire dwell time per hopping channel, Detector function = RMS, Trigger mode 4. Measure and record the duty cycle data
Test mode:	Refer to the clause 4.2
Test data:	Refer to the Appendix A
Result:	**Passed**

5.10. Pseudorandom Frequency Hopping Sequence

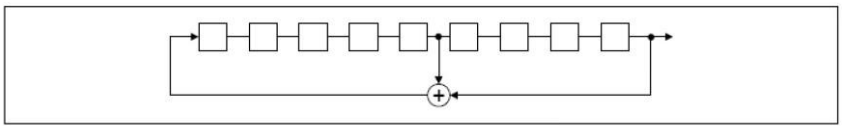
Limit:

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Al-ternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo ran-domly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hop-ping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Result:

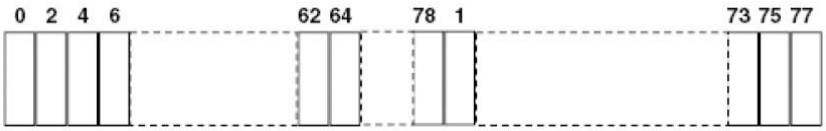
the pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones, for example: the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence:29-1=511 bits
- Longest sequence of zeros: 8 (non-inverted signal)



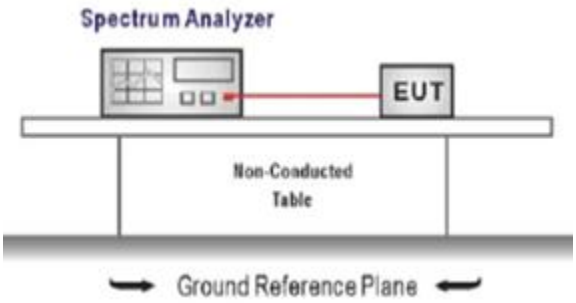
Linear Feedback Shift Register for Generation of the PRBS sequence

An explame of pseudorandom frequency hopping sequence as follows:

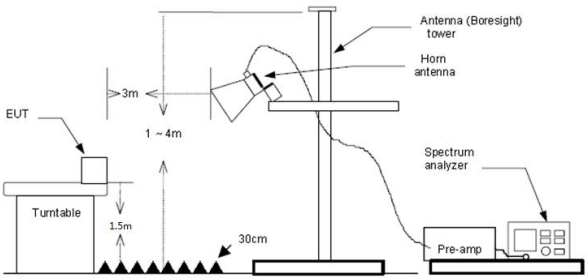


Each frequency used equally one the average by each transmitter.
The system receiver has input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

5.11. Conducted Band edge and Spurious Emission

Limit:	**FCC CFR Title 47 Part 15 Subpart C Section15.247 (d):** In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.
Test configuration:	
Test procedure:	1. Connect the antenna port(s) to the spectrum analyzer input. 2. Emission level measurement Set the center frequency and span to encompass frequency range to be measured RBW = 100 kHz, VBW ≥ 3 x RBW Detector = peak, Sweep time = auto couple, Trace mode = max hold Allow trace to fully stabilize Use the peak marker function to determine the maximum amplitude level. 3. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter waveform on the spectrum analyzer. 4. Ensure that the amplitude of all unwanted emission outside of the authorized frequency band excluding restricted frequency bands) are attenuated by at least the minimum requirements specified (at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz). Report the three highest emission relative to the limit.
Test mode:	Refer to the clause 4.2
Test data:	Refer to the Appendix A
Result:	**Passed**

5.12. Radiated Band edge Emission

Limit:	**FCC CFR Title 47 Part 15 Subpart C 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, Radiated Emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the Radiated Emissions limits specified in §15.209(a) (see §15.205(c)).
Test configuration:	
Test procedure:	1. The EUT was setup and tested according to ANSI C63.10 . 2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. 3. The EUT waspositioned such that the distance from antenna to the EUT was 3 meters. 4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. Thisis repeated for both horizontal and vertical polarization of the antenna. In order to find themaximum emission, all of the interface cables were manipulated according to ANSI C63.10 on radiated measurement. 5. Use the following spectrum analyzer settings: a) Span shall wide enough to fully capture the emission being measured b) Set RBW=100kHz for <1GHz, VBW=3*RBW, Sweep time=auto, Detector=peak, Trace=max hold c) Set RBW=1MHz, VBW=3MHz for >1GHz, Sweep time=auto, Detector=peak, Trace=max hold for Peak measurement d) Set RBW=1MHz, VBW=3MHz for >1GHz, Sweep time=auto, Detector=Average, Trace=RMS for Average measurement
Test mode:	Refer to the clause 4.2
Result:	**Passed**

Note:

1) Level= Reading + Factor; Factor =Antenna Factor+ Cable Loss- Preamp Factor
2) Margin = Limit - Level
3) Average measurement was not performed if peak level is lower than average limit
4) Have pre-scan all test channel, found GFSK DH5 mode which it was worst case, so only show the worst case’s data on this report.
5) The other emission levels were very low against the limit.

Test channel:CH00(GFSK)										
Freq. (MHz)	Reading (dBuv)	Ant. Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)	Level (dBuv)	Limit (dBuV/m)	Margin (dB)	Remark	Polarity
2390.00	70.00	28.62	4.08	38.62	-5.92	64.08	74	9.92	Peak	Horizontal
2390.00	51.28	28.62	4.08	38.62	-5.92	45.36	54	8.64	Average	Horizontal
2390.00	68.79	28.62	4.08	38.62	-5.92	62.87	74	11.13	Peak	Vertical
2390.00	50.04	28.62	4.08	38.62	-5.92	44.12	54	9.88	Average	Vertical

Test channel:CH78(GFSK)										
Freq. (MHz)	Reading (dBuv)	Ant. Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)	Level (dBuv)	Limit (dBuV/m)	Margin (dB)	Remark	Polarity
2483.50	69.33	29.45	3.91	40.17	-6.81	62.52	74	11.48	Peak	Horizontal
2483.50	49.89	29.45	3.91	40.17	-6.81	43.08	54	10.92	Average	Horizontal
2483.50	67.68	29.45	3.91	40.17	-6.81	60.87	74	13.13	Peak	Vertical
2483.50	50.37	29.45	3.91	40.17	-6.81	43.56	54	10.44	Average	Vertical

5.13. Radiated Spurious Emission

Limit:

FCC CFR Title 47 Part 15 Subpart C Section 15.209

Frequency	Limit (dBuV/m)	Value
0.009 MHz ~0.49 MHz	2400/F(kHz) @300m	Quasi-peak
0.49 MHz ~ 1.705 MHz	24000/F(kHz) @30m	Quasi-peak
1.705 MHz ~30 MHz	30 @30m	Quasi-peak

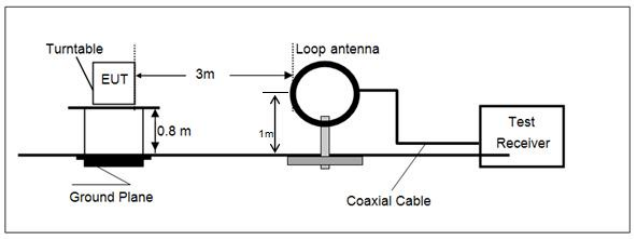
Limit dBuV/m @3m = Limit dBuV/m @300m + 40*log(300/3

Limit dBuV/m @3m = Limit dBuV/m @30m +40*log(30/3)

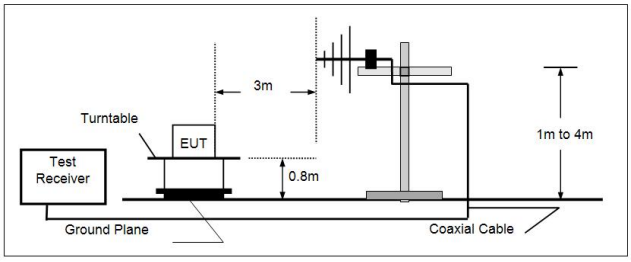
Frequency	Limit (dBuV/m @3m)	Value
30MHz~88MHz	40.00	Quasi-peak
88MHz~216MHz	43.50	Quasi-peak
216MHz~960MHz	46.00	Quasi-peak
960MHz~1GHz	54.00	Quasi-peak
Above 1GHz	54.00	Average
	74.00	Peak

Test configuration:

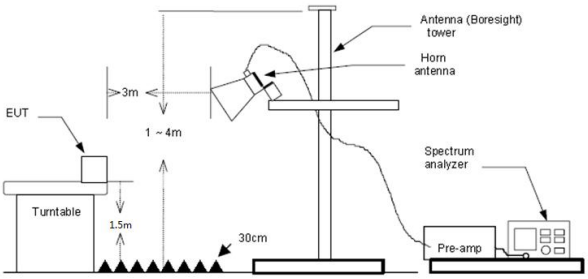
9kHz~30MHz



30 MHz ~ 1 GHz



Above 1 GHz



Test procedure:	1. The EUT was setup and tested according to ANSI C63.10. 2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1 GHz, and 1.5 m for above 1 GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level. 3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower. 4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines. 5. Set to the maximum power setting and enable the EUT transmit continuously. 6. Use the following spectrum analyzer settings a) Span shall wide enough to fully capture the emission being measured; b) Below 1 GHz: RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold; If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported. c) Set RBW=1MHz, VBW=3MHz for >1GHz, Sweep time=auto, Detector=peak, Trace=max hold for Peak measurement d) Set RBW=1MHz, VBW=3MHz for >1GHz, Sweep time=auto, Detector=Average, Trace=RMS for Average measurement
Test mode:	Refer to the clause 4.2
Result:	**Passed**

Note:

1) Level= Reading + Factor/Transd; Factor/Transd =Antenna Factor+ Cable Loss- Preamp Factor
2) Margin = Limit – Level
3) Average measurement was not performed if peak level is lower than average limit(54 dBuV/m) for above 1GHz.
4) The other emission levels were very low against the limit.
5) This test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position.

For 9 kHz ~ 30 MHz

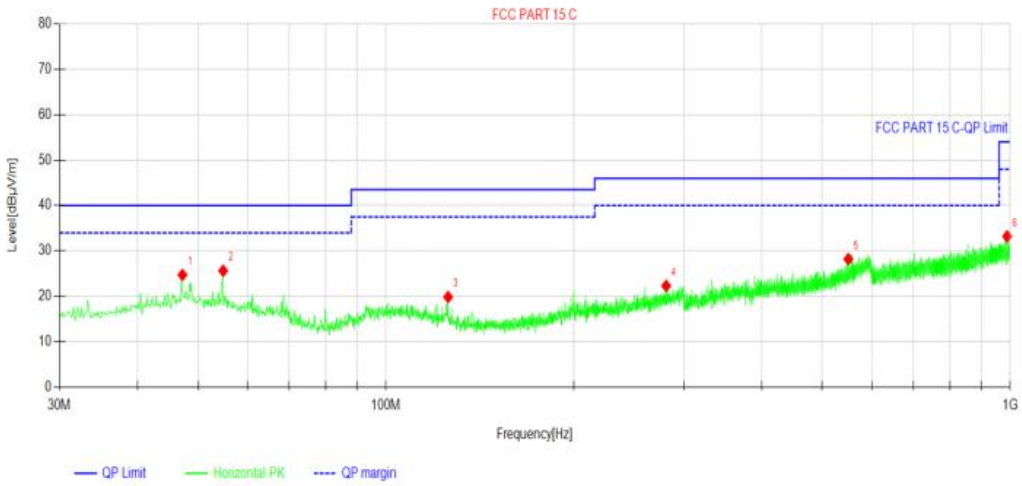
The EUT was pre-scanned this frequency band, found the radiated level 20dB lower than the limit, so don't show data on this report.

For 30 MHz ~ 1000 MHz

Have pre-scan all test channel, found GFSK DH5 mode which it was worst case, so only show the worst case's data on this report.

Polarization:	Horizontal

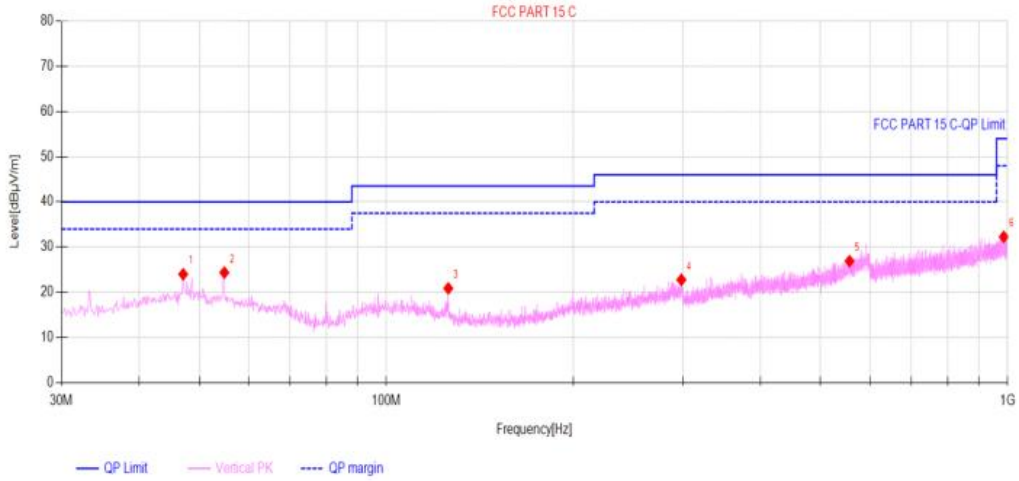
Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Polarity	Verdict
1	47.2175	9.20	24.72	15.52	40.00	15.28	Horizontal	PASS
2	54.8562	10.84	25.64	14.80	40.00	14.36	Horizontal	PASS
3	125.787	8.66	19.85	11.19	43.50	23.65	Horizontal	PASS
4	281.108	7.10	22.30	15.20	46.00	23.70	Horizontal	PASS
5	550.405	7.55	28.20	20.65	46.00	17.80	Horizontal	PASS
6	988.845	6.86	33.21	26.35	54.00	20.79	Horizontal	PASS

Polarization:	Vertical

Test Graph



Suspected Data List

NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Polarity	Verdict
1	47.0962	8.48	24.00	15.52	40.00	16.00	Vertical	PASS
2	54.8562	9.57	24.37	14.80	40.00	15.63	Vertical	PASS
3	125.787	9.68	20.87	11.19	43.50	22.63	Vertical	PASS
4	298.447	7.27	22.77	15.50	46.00	23.23	Vertical	PASS
5	556.588	6.10	26.91	20.81	46.00	19.09	Vertical	PASS
6	985.813	6.00	32.28	26.28	54.00	21.72	Vertical	PASS

For 1 GHz ~ 25 GHz

Have pre-scan all test channel, found GFSK DH5 mode which it was worst case, so only show the worst case's data on this report.

Test channel:CH00										
Freq. (MHz)	Reading (dBuv)	Ant. Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)	Level (dBuv)	Limit (dBuV/m)	Margin (dB)	Remark	Polarity
4804.00	69.05	31.33	4.23	38.62	-3.06	65.99	74	8.01	Peak	Horizontal
4804.00	49.78	31.33	4.23	38.62	-3.06	46.72	54	7.28	Average	Horizontal
4804.00	64.97	31.33	4.23	38.62	-3.06	61.91	74	12.09	Peak	Vertical
4804.00	51.21	31.33	4.23	38.62	-3.06	48.15	54	5.85	Average	Vertical

Test channel:CH39										
Freq. (MHz)	Reading (dBuv)	Ant. Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)	Level (dBuv)	Limit (dBuV/m)	Margin (dB)	Remark	Polarity
4880.00	70.38	30.26	4.09	38.29	-3.94	66.44	74	7.56	Peak	Horizontal
4880.00	50.17	30.26	4.09	38.29	-3.94	46.23	54	7.77	Average	Horizontal
4880.00	67.49	30.26	4.09	38.29	-3.94	63.55	74	10.45	Peak	Vertical
4880.00	50.23	30.26	4.09	38.29	-3.94	46.29	54	7.71	Average	Vertical

Test channel:CH78										
Freq. (MHz)	Reading (dBuv)	Ant. Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)	Level (dBuv)	Limit (dBuV/m)	Margin (dB)	Remark	Polarity
4960.00	63.99	31.97	4.11	38.47	-2.39	61.60	74	12.40	Peak	Horizontal
4960.00	49.98	31.97	4.11	38.47	-2.39	47.59	54	6.41	Average	Horizontal
4960.00	67.60	31.97	4.11	38.47	-2.39	65.21	74	8.79	Peak	Vertical
4960.00	51.20	31.97	4.11	38.47	-2.39	48.81	54	5.19	Average	Vertical

6. TEST SETUP PHOTOS

Please refer to separated files for Test Setup Photos of the EUT.

7. EXTERNAL AND INTERNAL PHOTOS

7.1 External photos

Please refer to separated files for External Photos of the EUT.

7.2 Internal photos

Please refer to separated files for Internal Photos of the EUT.

------End of the report------