Prüfbericht-Nr.: *Test report No.:*	**60378796 001**	**Auftrags-Nr.:** *Order No.:*	168257879	Seite 1 von 22 *Page 1 of 22*
Kunden-Referenz-Nr.: *Client reference No.:*	N/A	**Auftragsdatum:** *Order date:*	24.03.2020	
Auftraggeber: *Client:*	**Ring LLC** 1523 26th St, Santa Monica, CA 90404, USA			
Prüfgegenstand: *Test item:*	Motion Sensor			
Bezeichnung / Typ-Nr.: *Identification / Type No.:*	5SM1S8			
Auftrags-Inhalt: *Order content:*	FCC/IC testing			
Prüfgrundlage: *Test specification:*	CFR47 FCC Part 15: Subpart C Section 15.247 CFR47 FCC Part 15: Subpart C Section 15.209 RSS-247 Issue 2 February 2017 RSS-Gen Issue 5 March 2019			

Wareneingangsdatum: *Date of receipt:*	07.04.2020	Refer to photos
Prüfmuster-Nr.: *Test sample No.:*	A002804427-001 A002815284-001	
Prüfzeitraum: *Testing period:*	08.04.2020 - 29.05.2020	
Ort der Prüfung: *Place of testing:*	TÜV Rheinland (Shenzhen) Co., Ltd.	
Prüflaboratorium: *Testing laboratory:*	TÜV Rheinland (Shenzhen) Co., Ltd.	
Prüfergebnis*: *Test result*:*	Pass	

geprüft von / *tested by:*

Jackson Yang

Datum *Date*	Name/Stellung *Name/Position*	Unterschrift *Signature*
28.06.2020	Jackson Yang / Project Engineer	

kontrolliert von / *reviewed by:*

Winnie Hou

Datum *Date*	Name/Stellung *Name/Position*	Unterschrift *Signature*
28.06.2020	Winnie Hou / Technical Certifier	

Sonstiges / *Other:*

FCC ID: 2AEUPRBMS002

IC: 20271- RBMS002

Note: The Bluetooth low energy Radiated Spurious Emission above 1GHz of this product are evaluated in this report. All other tests refer to test report 50361124 001.

Zustand des Prüfgegenstandes bei Anlieferung: *Condition of the test item at delivery:* Prüfmuster vollständig und unbeschädigt *Test item complete and undamaged:*

* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhalt
	P(ass) = entspricht o.g. Prüfgrundlage(n)		F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
Legend:	1 = very good	2 = good	3 = satisfactory	4 = sufficient	5 = poor
	P(ass) = passed a.m. test specifications(s)		F(ail) = failed a.m. test specifications(s)	N/A = not applicable	N/T = not tested

Test Summary

5.1.1 RADIATED SPURIOUS EMISSIONS
RESULT: Pass

Table of Contents

1 General Remarks

1.1 Complementary Materials

N/A

2 Test Sites

2.1 Test Facilities

TÜV Rheinland (Shenzhen) Co., Ltd.

362 Huanguan Road Middle Longhua District, Shenzhen 518110 People's Republic of China

FCC Registration No.: 694916

IC Registration No.: 25069

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Unwanted Emission Testing (TS9975)				
Equipment	**Manufacturer**	**Model**	**Serial No.**	**Cal. until**
EMI Test Receiver	R&S	ESR 7	102021	19.08.2020
Signal Analyzer	R&S	FSV 40	101439	21.08.2020
System Controller Interface	R&S	SCI-100	S10010038	N/A
Filterbank	R&S	Wlan	100759	21.08.2020
OSP	R&S	OSP 120	102040	N/A
Pre-amplifier	R&S	SCU08F1	08320031	20.08.2020
Amplifier	R&S	SCU-18F	180070	20.08.2020
Amplifier	R&S	SCU40A	100475	20.09.2020
Trilog Broadband Antenna (30 MHz - 7 GHz)	Schwarzbeck	VULB 9162	193	02.09.2020
Double-Ridged Antenna (1 -18 GHz)	ETS-LINDGREN	3117	00218717	02.09.2020
Wideband Ridged Horn Antenna (18-40 GHz)	Steatite	QMS-00880	19067	02.09.2020
Active Loop Antenna	Schwarzbeck	FMZB 1513	302	01.09.2020
Wideband Ridged Horn Antenna (12-18 GHz)	Steatite	QMS-00208	18313	02.09.2020
Test software	R&S	EMC32 (V10.50.40)	N/A	N/A
Control PC	Dell	OptiPlex 7050	36NV9P2	N/A
3m Semi-Anechoic Chamber	Albatross	SAC-3m	APC17151-SAC	06.07.2020

2.3 Traceability

All measurement equipment calibrations are traceable to NIM (National Institute of Metrology) or where calibration is performed in other countries, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basics using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements as below table:

Table 2: Measurement Uncertainty

Items	Extended Uncertainty
Radiated Spurious Emissions (up to 1GHz)	± 4.84 dB
Radiated Spurious Emissions (1GHz to 26.5GHz)	± 4.76 dB

2.6 Location of Original Data

The original copies of all test data taken during actual testing were attached in this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Shenzhen) Co., Ltd. file for certification follow-up purposes.

2.7 Status of Facility Used for Testing

The TÜV Rheinland (Shenzhen) Co., Ltd. Test facility located at 362 Huanguan Road Middle Longhua District, Shenzhen 518110 People's Republic of China is listed on the US Federal Communications Commission list of facilities approved to perform measurements.

3 General Product Information

3.1 Product Function and Intended Use

The EUTs are Motion Sensor which support Bluetooth, LoRa DTSs, LoRa FHSs and FSK FHSs function operated at 2400-2483.5MHz and 902-928MHz respectively.

For details refer to the User Manual, Technical Description and Circuit Diagram.

3.2 Ratings and System Details

Table 3: Technical Specification of EUT

General Information of EUT	Value
Kind of Equipment	Motion Sensor
Type Designation	5SM1S8
Operating Voltage	DC 4.5V (1.5V*3)
Testing Voltage	Fully charged battery

Technical Specification of BLE

Technical Specification	BLE
Operating Frequency band	2402 – 2480 MHz
Bluetooth Core Version	Bluetooth Low Energy 4.2
Channel separation	2MHz
Extreme Temperature Range	-20℃ ~ 50℃
Modulation	GFSK
Antenna Type	PCB Layout Antenna
Antenna Gain(dBi)	3.26
Channel	0~39

Technical Specification of LoRa DTS

Technical Specification	LoRa DTS 500kHz 902.5-926.5MHz
Operating Frequency band	902 – 928 MHz
Extreme Temperature Range	-20℃ ~ 50℃
Bandwidth(kHz)	500
Modulation	LoRa DTS
Antenna Type	LTCC Antenna
Antenna Gain(dBi)	1.1
Channel Separation (kHz)	800
Channel Number	31
Channel (MHz)	902.5, 903.3, 904.1, 904.9, 905.7, 906.5, 907.3, 908.1, 908.9, 909.7, 910.5, 911.3, 912.1, 912.9, 913.7, 914.5, 915.3, 916.1, 916.9, 917.7, 918.5, 919.3, 920.1, 920.9, 921.7, 922.5, 923.3, 924.1, 924.9, 925.7, 926.5

Technical Specification of LoRa FHSS

Technical Specification	LoRa 125kHz FHSS 902.2-927.8MHz
Operating Frequency band	902 – 928 MHz
Extreme Temperature Range	-20℃ ~ 50℃
Modulation	LoRa FHSS
Antenna Type	LTCC Antenna
Antenna Gain(dBi)	1.1
Channel Separation (kHz)	200

Channel Number	129
Bandwidth (kHz)	125
Hopping channel(MHz)	902.2-927.8

Technical Specification of FSK FHSS

Technical Specification	FSK150Kbps FHSS	FSK 50Kbps FHSS	FSK 250Kbps FHSS
Operating Frequency band	902 – 928 MHz		
Extreme Temperature Range	-20℃ ~ 50℃		
Modulation	FSK FHSS		
Antenna Type	LTCC Antenna		
Antenna Gain(dBi)	1.1		
Channel Separation (kHz)	400	200	500
Channel Number	64	129	51
Data Rate (Kbps)	150	50	250
Hopping Channel(MHz)	902.4~927.6	902.2~927.8	902.5~927.5

3.3 Independent Operation Modes

The basic operation modes are:

A. On, BLE Transmitting Continuously mode
   1. Low channel
   2. Middle channel
   3. High channel

B. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

3.5 Submitted Documents

N/A

4 Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

Emissions: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

According to the model differences description at section 3.1, all tests were performed on the model 5AT1S7.

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5. All testing were performed according to the procedures in ANSI C63.10: 2013.

4.3 Special Accessories and Auxiliary Equipment

Table 4: List of Accessories and Auxiliary Equipment

Description	Manufacturer	Model	S/N	Rating
Laptop	Lenovo	T480	PF-16A6N8	N/A

4.4 Countermeasures to Achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Technical Construction File (TCF).

No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test (Below 1GHz)

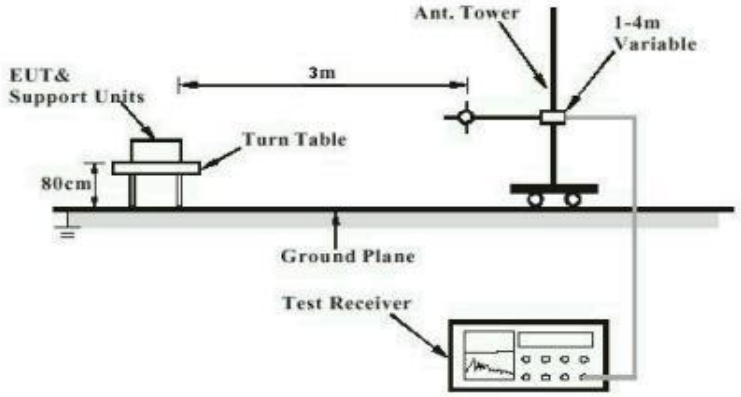
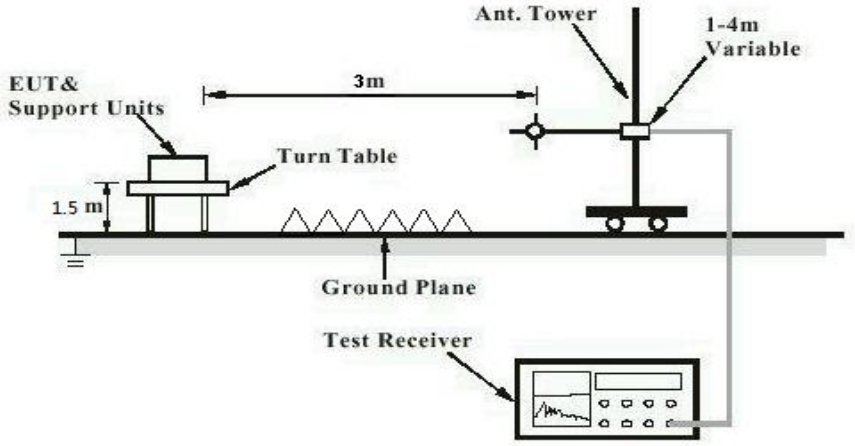


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)



5 Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Radiated Spurious Emissions

RESULT: **Pass**

Test Specification

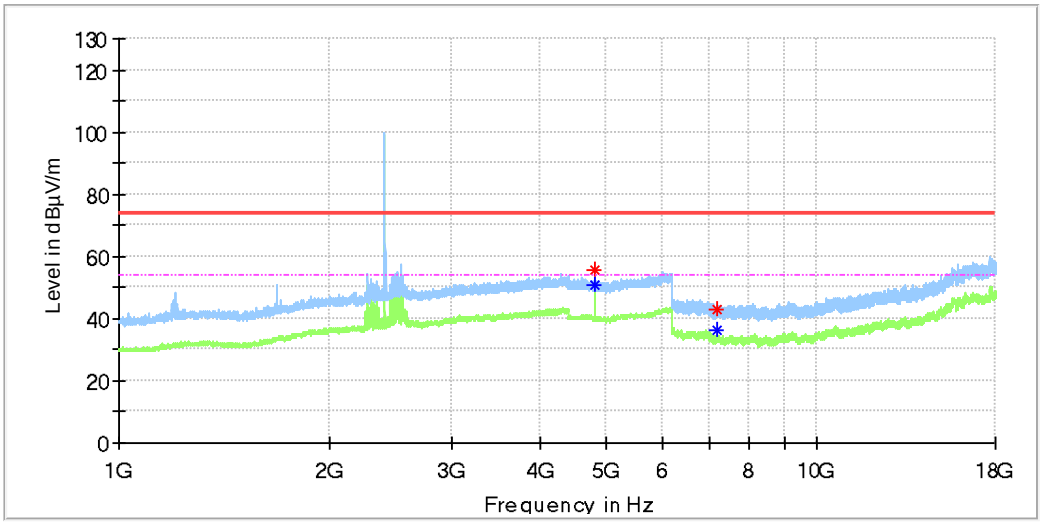
Test standard	:	FCC Part 15.247 (d) & FCC Part 15.205 RSS-GEN Clause 8.9 & RSS-247 Clause 3.3
Basic standard	:	ANSI C63.10: 2013
Limits	:	Refer to 15.209(a) of FCC part 15.247(d) RSS-Gen Table 5
Kind of test site	:	3m Semi-anechoic Chamber

Test Setup

Date of testing	:	07.05.2020 - 28.05.2020
Input voltage	:	AC 120V@60Hz
Operation mode	:	A.1, A.2, A.3
Earthing	:	Not Connected
Ambient temperature	:	23 ℃
Relative humidity	:	45 %
Atmospheric pressure	:	101 kPa

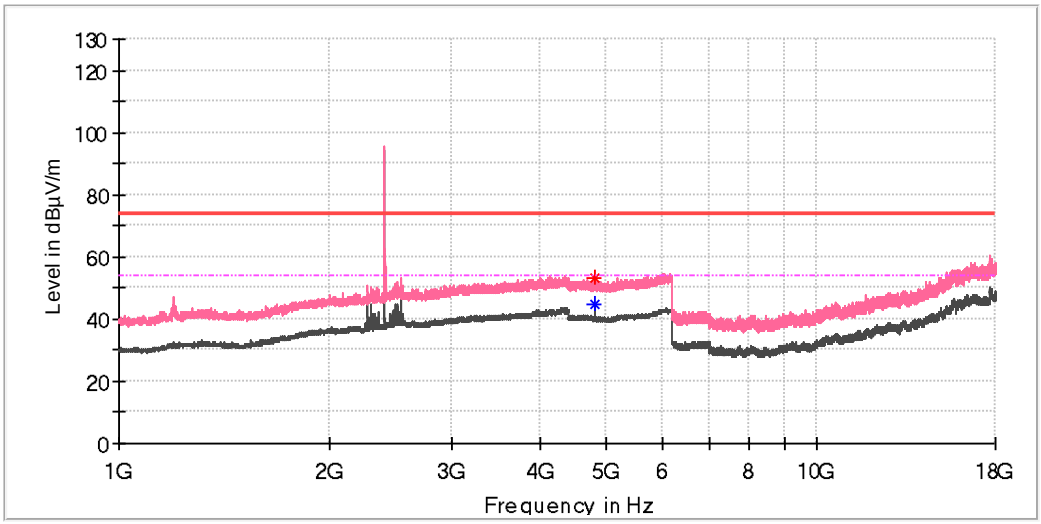
For details refer to following test result, only the worst case was shown.

Mode A.1
Horizontal



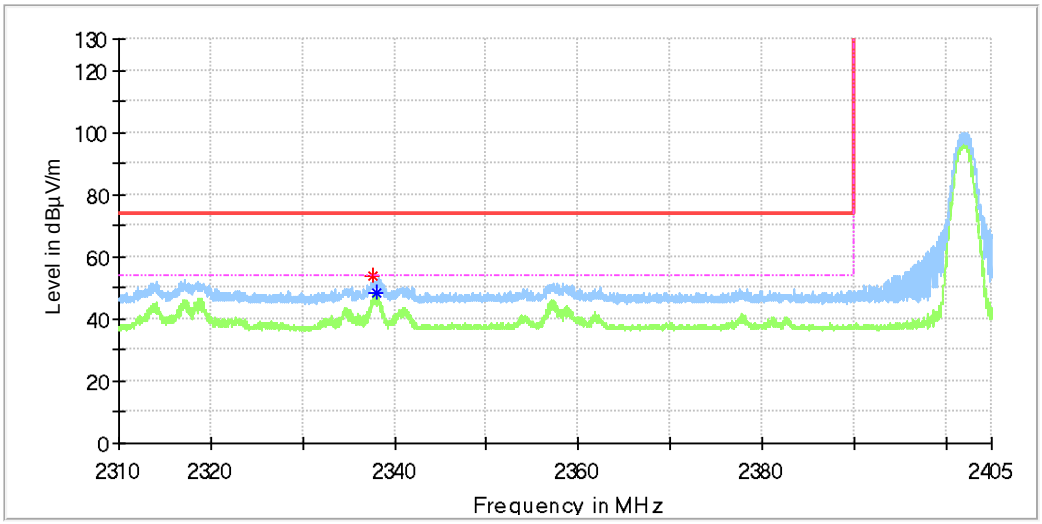
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4803.500000	---	50.83	54.00	3.17	100.0	H	309.0	13.6
4804.000000	55.85	---	74.00	18.15	100.0	H	300.0	13.6
7199.558333	43.15	---	74.00	30.85	100.0	H	166.0	8.8
7204.966667	---	36.14	54.00	17.86	100.0	H	184.0	8.8

Vertical



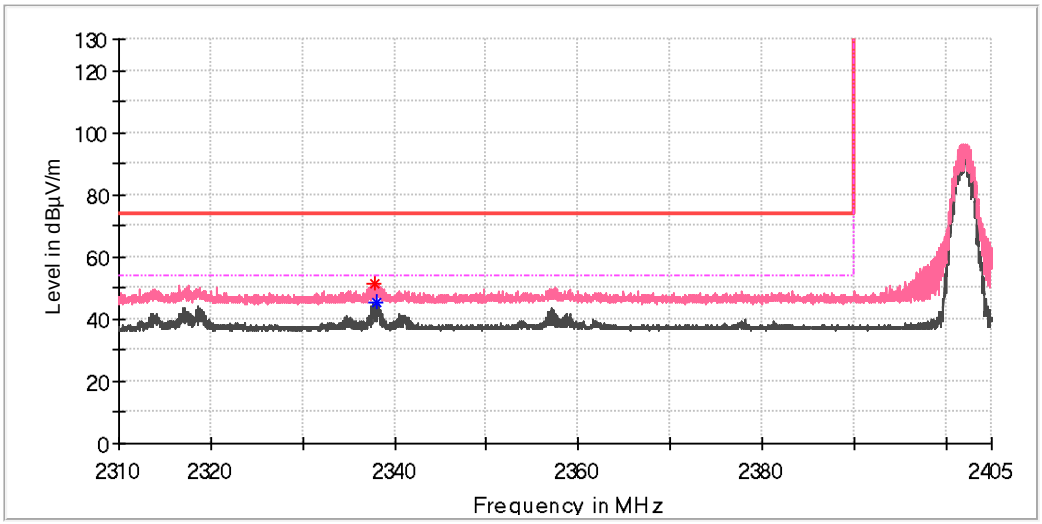
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4803.500000	---	44.95	54.00	9.05	100.0	V	263.0	13.6
4804.000000	53.26	---	74.00	20.74	100.0	V	288.0	13.6

Horizontal



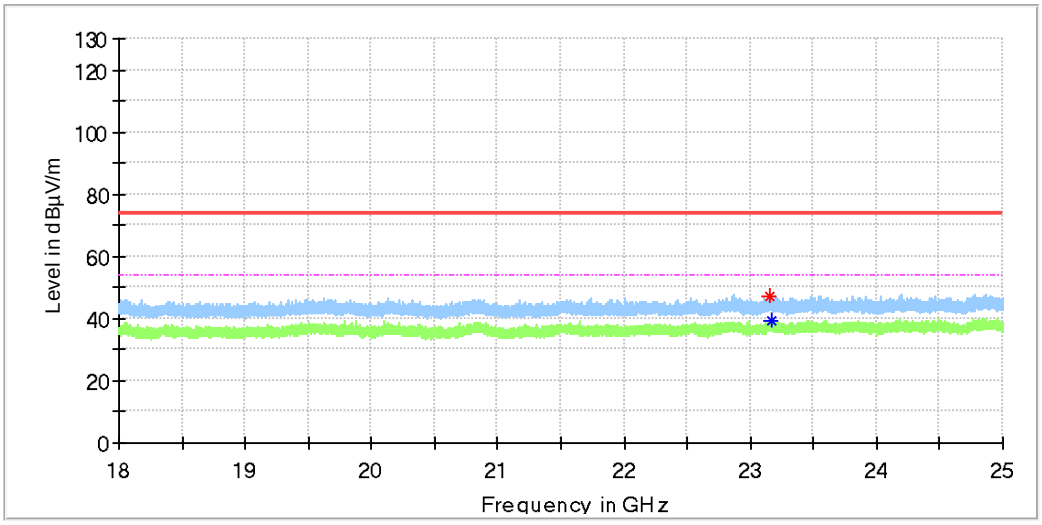
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2337.717647	53.64	---	74.00	20.36	100.0	H	167.0	6.8
2337.969118	---	48.19	54.00	5.81	100.0	H	167.0	6.8

Vertical



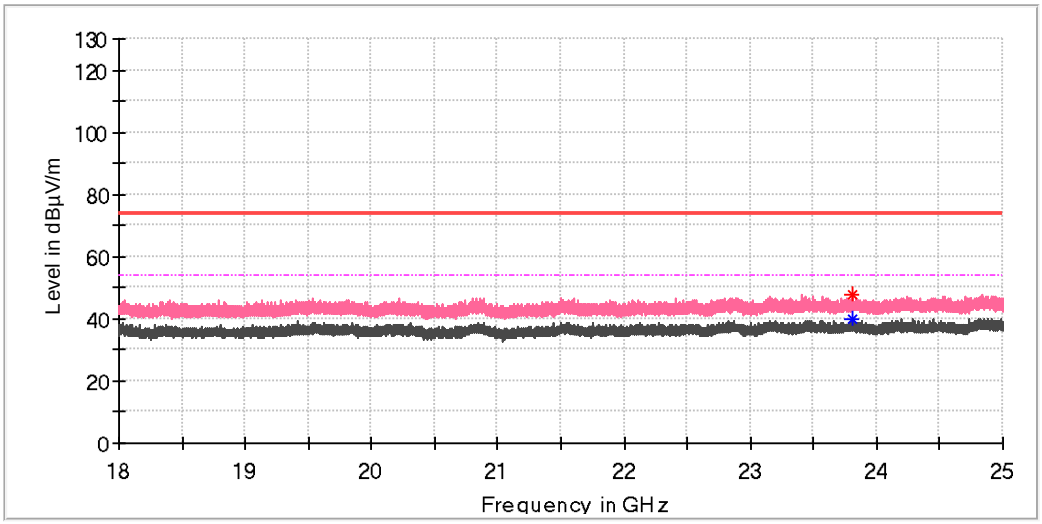
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2337.787500	51.46	---	74.00	22.54	100.0	V	236.0	6.8
2338.038971	---	45.61	54.00	8.39	100.0	V	236.0	6.8

Horizontal



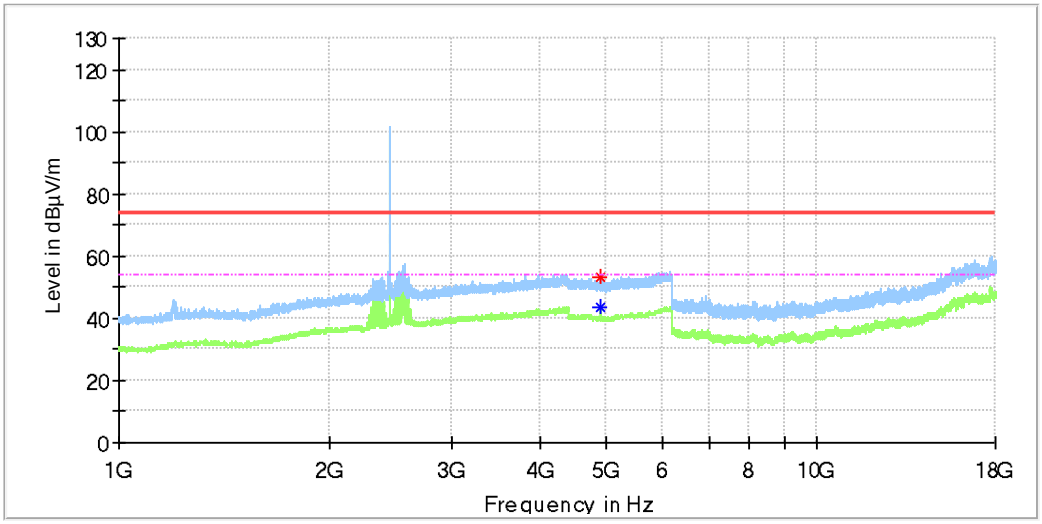
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
23154.187500	47.19	---	74.00	26.81	100.0	H	2.0	-10.7
23161.187500	---	39.05	54.00	14.95	100.0	H	0.0	-10.7

Vertical



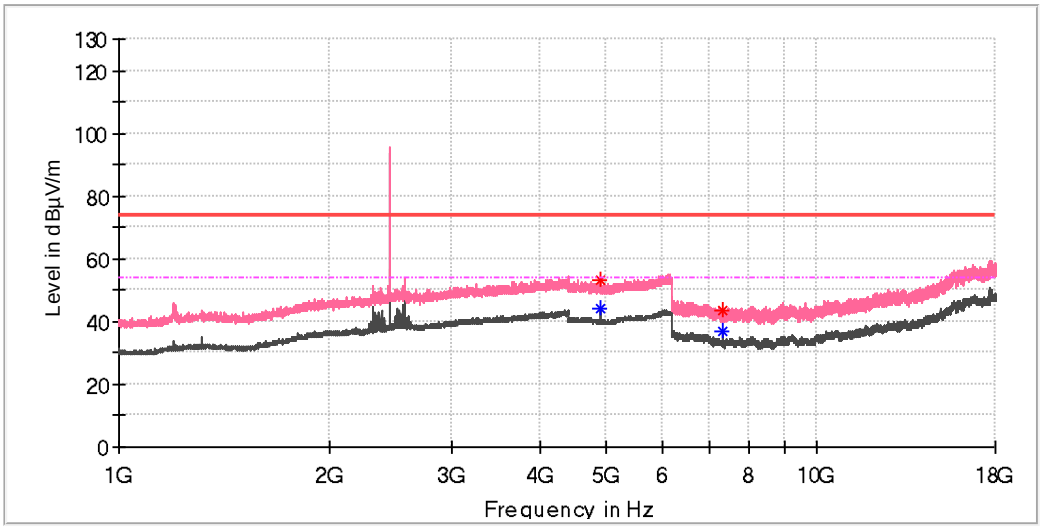
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
23802.125000	---	39.80	54.00	14.20	100.0	V	266.0	-10.0
23802.125000	48.06	---	74.00	25.94	100.0	V	266.0	-10.0

Mode A.2
Horizontal



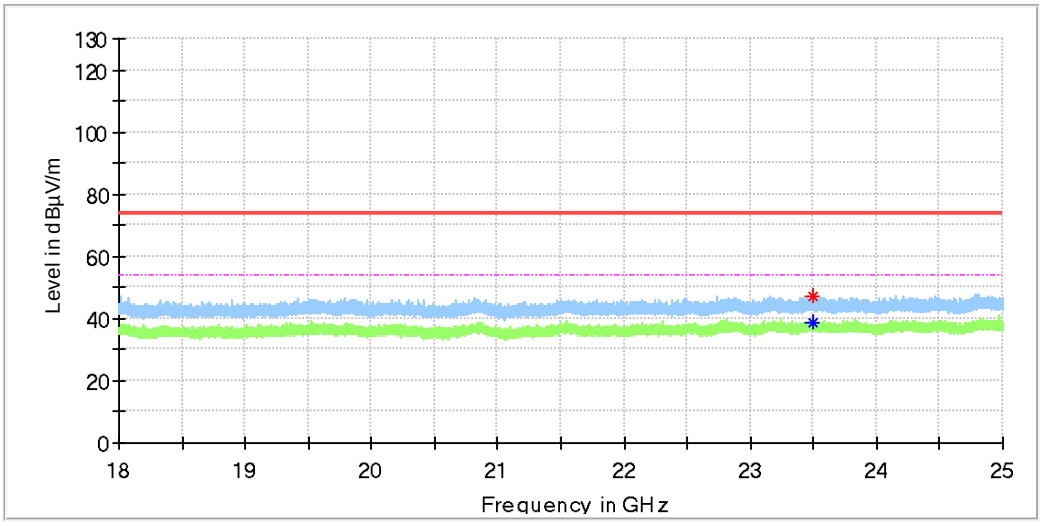
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4879.000000	53.41	---	74.00	20.59	100.0	H	311.0	13.4
4879.500000	---	43.48	54.00	10.52	100.0	H	311.0	13.4

Vertical



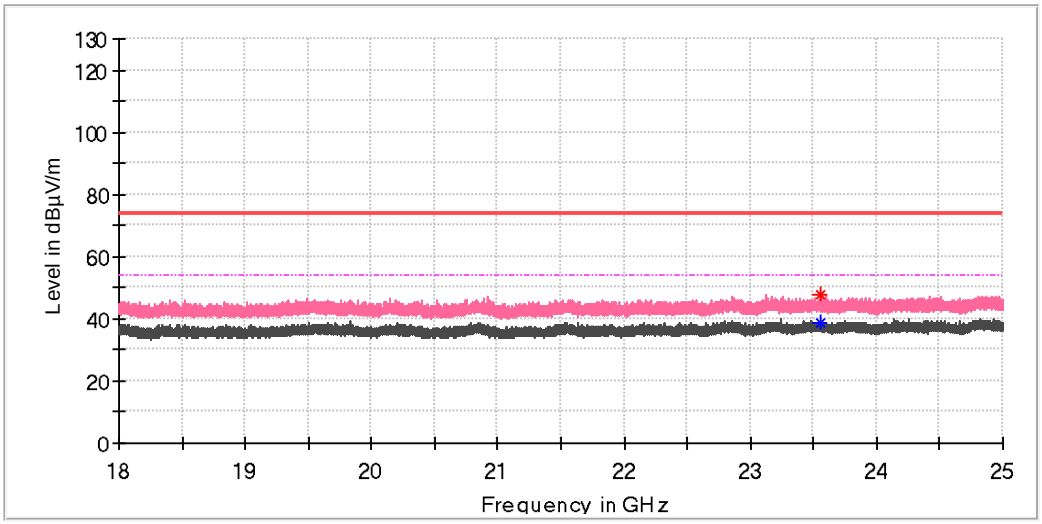
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4879.500000	53.47	---	74.00	20.53	100.0	V	263.0	13.4
4880.000000	---	44.43	54.00	9.57	100.0	V	274.0	13.4
7320.016667	---	36.84	54.00	17.16	100.0	V	300.0	8.2
7320.508333	43.70	---	74.00	30.30	100.0	V	300.0	8.2

Horizontal



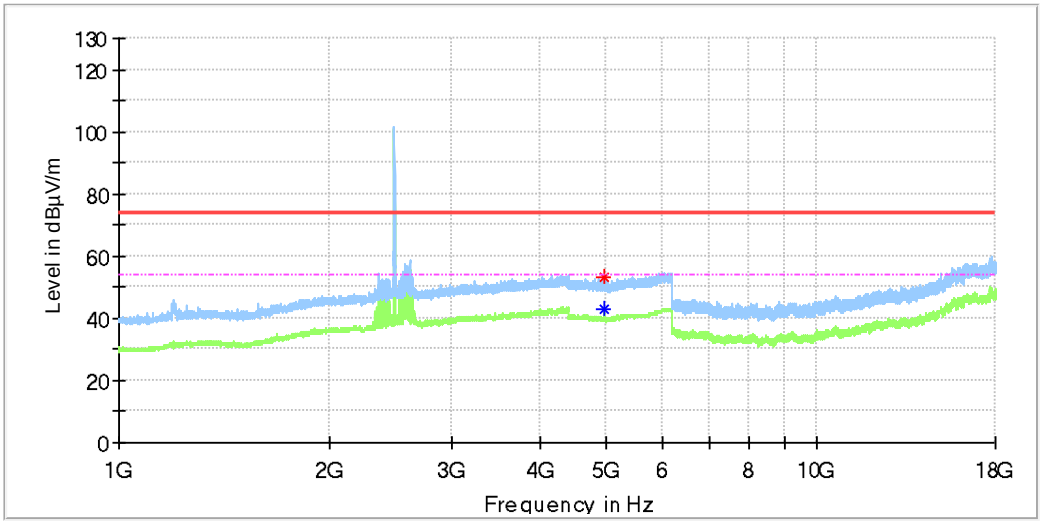
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
23489.312500	47.36	---	74.00	26.64	100.0	H	130.0	-10.5
23496.093750	---	38.60	54.00	15.40	100.0	H	178.0	-10.5

Vertical



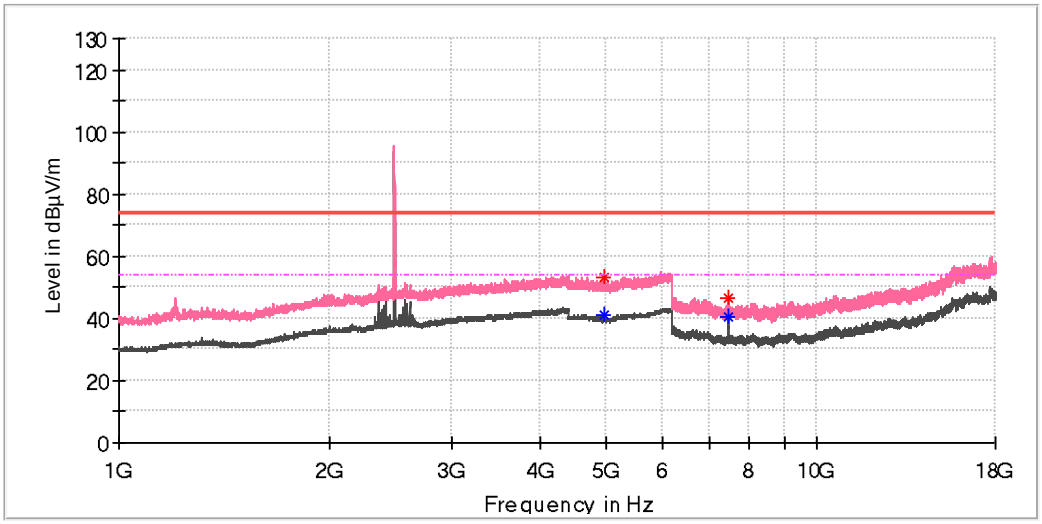
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
23552.093750	47.73	---	74.00	26.27	100.0	V	0.0	-10.5
23552.312500	---	38.80	54.00	15.20	100.0	V	48.0	-10.5

Mode A.3
Horizontal



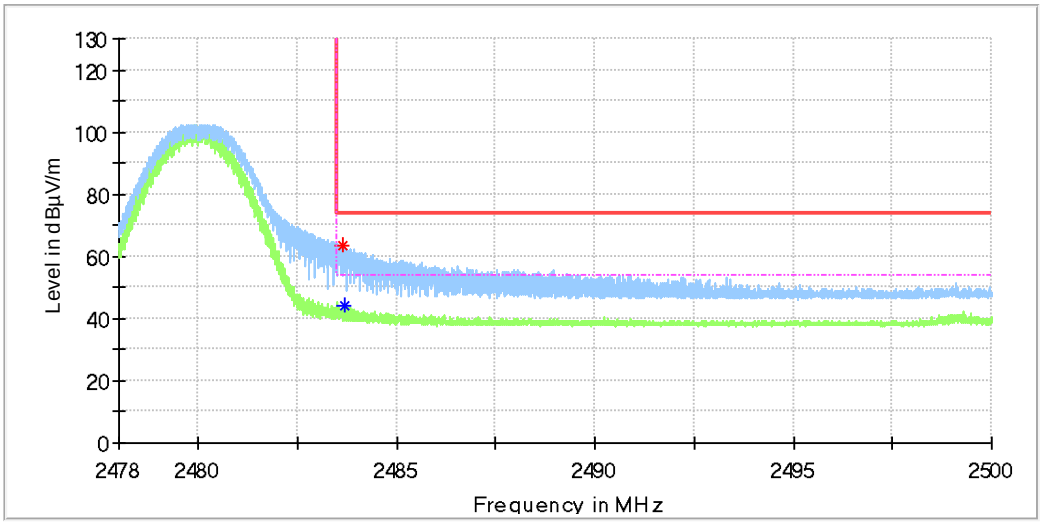
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4959.500000	53.49	---	74.00	20.51	100.0	H	305.0	13.2
4960.000000	---	43.02	54.00	10.98	100.0	H	41.0	13.2

Vertical



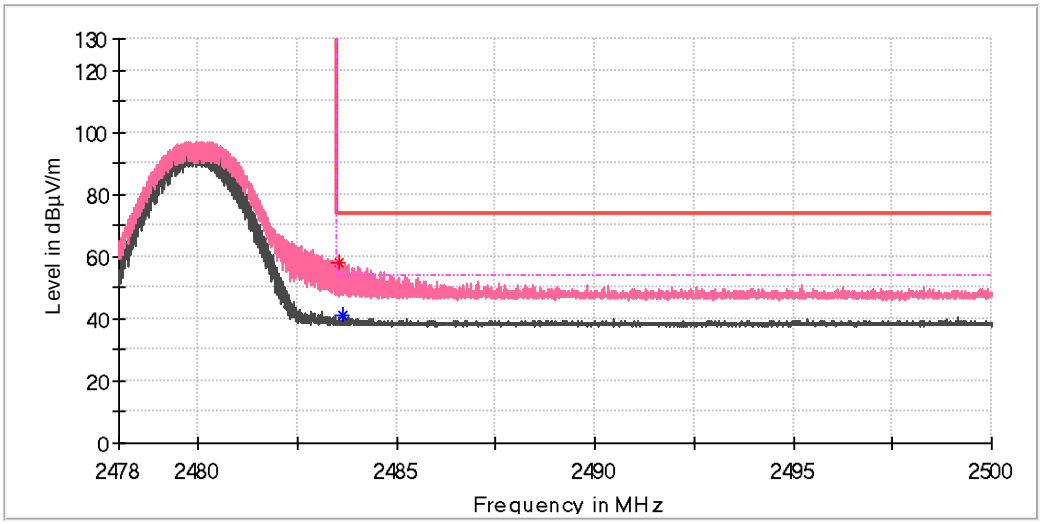
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4959.500000	---	41.03	54.00	12.97	100.0	V	219.0	13.2
4960.000000	52.97	---	74.00	21.04	100.0	V	265.0	13.2
7439.983333	46.34	---	74.00	27.66	100.0	V	0.0	8.4
7439.983333	---	40.74	54.00	13.26	100.0	V	0.0	8.4

Horizontal



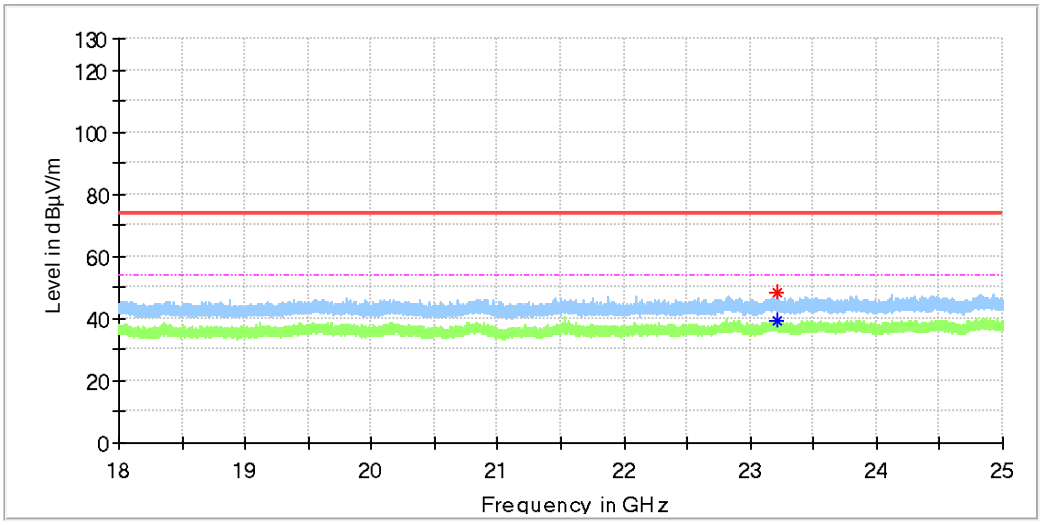
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.645588	63.53	---	74.00	10.47	100.0	H	204.0	7.4
2483.681177	---	43.86	54.00	10.14	100.0	H	212.0	7.4

Vertical



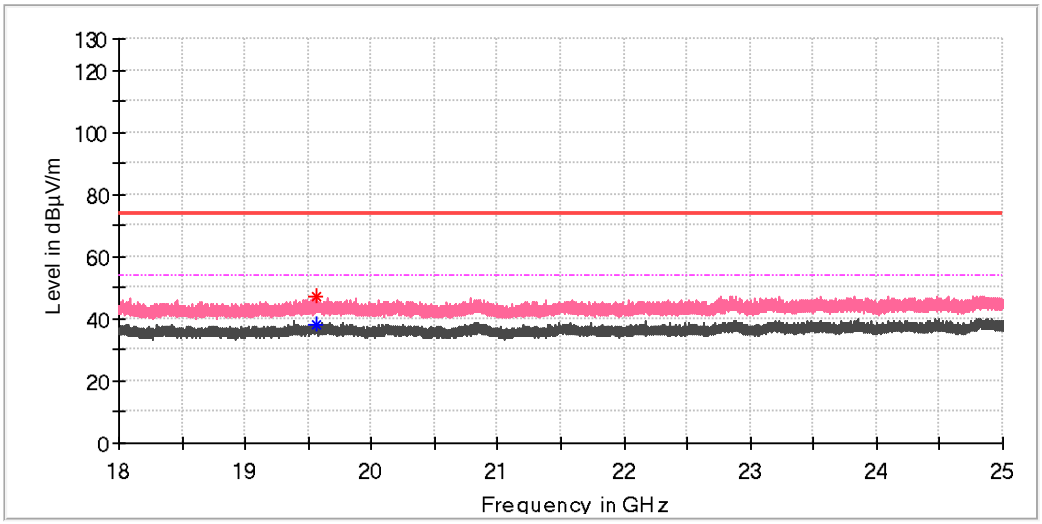
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.538824	58.30	---	74.00	15.70	100.0	V	230.0	7.4
2483.629412	---	41.16	54.00	12.84	100.0	V	221.0	7.4

Horizontal



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
23206.031250	---	39.10	54.00	14.90	100.0	H	267.0	-10.6
23208.218750	48.64	---	74.00	25.36	100.0	H	112.0	-10.6

Vertical



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
19559.031250	47.29	---	74.00	26.71	100.0	V	241.0	-13.1
19562.968750	---	38.17	54.00	15.83	100.0	V	241.0	-13.1