Prüfbericht-Nr.: *Test report No.:*	**50325316 001**	**Auftrags-Nr.:** *Order No.:*	168142797	Seite 1 von 22 *Page 1 of 22*
Kunden-Referenz-Nr.: *Client reference No.:*	N/A	**Auftragsdatum:** *Order date:*	02.12.2019	
Auftraggeber: *Client:*	**Ring LLC** 1523 26th St, Santa Monica, CA 90404, USA			
Prüfgegenstand: *Test item:*	Smart Lightbulb			
Bezeichnung / Typ-Nr.: *Identification / Type No.:*	5AT1S3, 5AT3S4			
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:*	02.12.2019	Refer to photos
Prüfmuster-Nr.: *Test sample No.:*	A001034554-002	
Prüfzeitraum: *Testing period:*	02.12.2019 - 12.12.2019	
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:*			**kontrolliert von /** *reviewed by:*		
Jackson Yang			Winnie Hou		
06.01.2020	Jackson Yang / Project Engineer		06.01.2020	Winnie Hou / Technical Certifier	
Datum *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*

Sonstiges / *Other:*

FCC ID: 2AEUPRB19001

IC: 20271-RB19001

Note: The BLE Radiated Spurious Emission above 1GHz of this product are evaluated in this report which was additional tests as test report 50321015 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.
1F East & 2-4F, Cybio Technology Building No.1, No.16 Kejibei 2nd Road, Nanshan District, Shenzhen, 518057, 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

Radiated Spurious Emission				
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Until**
EMI Test Receiver	Rohde & Schwarz	ESR 7	102021	19.08.2020
Signal Analyzer	Rohde & Schwarz	FSV 40	101439	21.08.2020
System Controller Interface	Rohde & Schwarz	SCI-100	S10010038	N/A
Filterbank	Rohde & Schwarz	Wlan	100759	21.08.2020
OSP	Rohde & Schwarz	OSP 120	102040	N/A
Pre-amplifier	Rohde & Schwarz	SCU08F1	08320031	20.08.2020
Amplifier	Rohde & Schwarz	SCU-18F	180070	20.08.2020
Amplifier	Rohde & Schwarz	SCU40A	100475	20.09.2020
Trilog Broadband Antenna (30 MHz - 1 GHz)	Schwarzbeck	VULB9162	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

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 1F East & 2-4F, Cybio Technology Building No.1, No.16 Kejibei 2nd Road, Nanshan District, Shenzhen, 518057, 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 Smart Lightbulb which support Bluetooth, LoRa DTS, LoRa FHSS and FSK HFSS function operated at 2400-2483.5MHz and 902-928MHz respectively.

In electrical characteristics, all models are the same except color temperature aspects.

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	Smart Lightbulb
Type Designation	5AT1S3, 5AT3S4
Operating Voltage	AC 120V/60Hz
Testing Voltage	AC 120V/60Hz
Rated current	75mA
Rated power	8.5W

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℃ ~ 40℃
Modulation	GFSK
Antenna Type	Monopole Antenna
Antenna Gain(dBi)	2.44
Channel	0~39

Technical Specification of LoRa DTS

Technical Specification	LoRa DTS 500KHz 902.5-926.5MHz	LoRa DTS 500KHz 903-914.2MHz	LoRa DTS 500KHz 923.3-926.9MHz
Operating Frequency band	902 – 928 MHz		
Extreme Temperature Range	-20℃ ~ 40℃		
Bandwidth(KHz)	500		
Modulation	LoRa DTS		
Antenna Type	Monopole Antenna		
Antenna Gain(dBi)	-1.69		
Channel Separation (KHz)	800	1600	600
Channel Number	31	8	7
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,	903, 904.6, 906.2, 907.8, 909.4, 911, 912.6, 914.2	923.3, 923.9, 924.5, 925.1, 925.7, 926.3, 926.9

	924.1, 924.9, 925.7, 926.5		

Technical Specification of LoRa FHSS

Technical Specification	LoRa 250KHz FHSS 902.3-926.7MHz	LoRa 125KHz FHSS 902.3-914.9MHz	LoRa 125KHz FHSS 902.2-927.8MHz
Operating Frequency band	902 – 928 MHz		
Extreme Temperature Range	-20℃ ~ 40℃		
Modulation	LoRa FHSS		
Antenna Type	Monopole Antenna		
Antenna Gain(dBi)	-1.69		
Channel Separation (KHz)	400	200	200
Channel Number	62	64	129
Bandwidth (KHz)	250	125	125
Hopping channel(MHz)	902.3~926.7	902.3~914.9	902.2-927.8

Technical Specification of FSK FHSS

Technical Specification	FSK150Kbps FHSS	FSK 50Kbps FHSS	FSK 5Kbps FHSS	FSK 250Kbps FHSS
Operating Frequency band	902 – 928 MHz			
Extreme Temperature Range	-20℃ ~ 40℃			
Modulation	FSK FHSS			
Antenna Type	Monopole Antenna			
Antenna Gain(dBi)	-1.69			
Channel Separation (KHz)	400	200	200	500
Channel Number	64	129	129	51
Data Rate (Kbps)	150	50	5	250
Hopping Channel(MHz)	902.4~927.6	902.2~927.8	902.2~927.8	902.5~927.5

3.3 Independent Operation Modes

The basic operation modes are:

A. On, BLE transmitting 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 5AT3S4.

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)

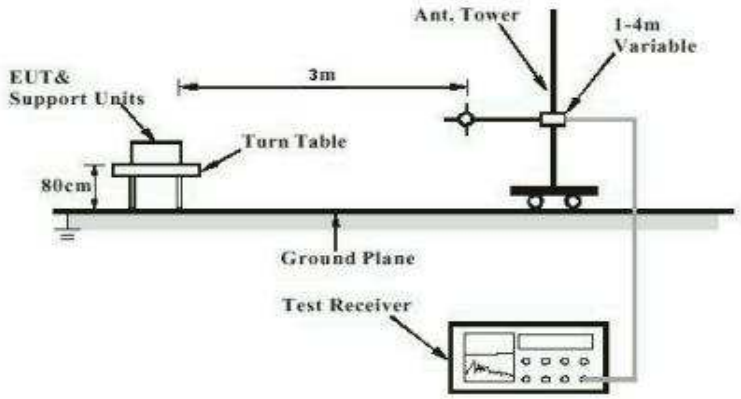
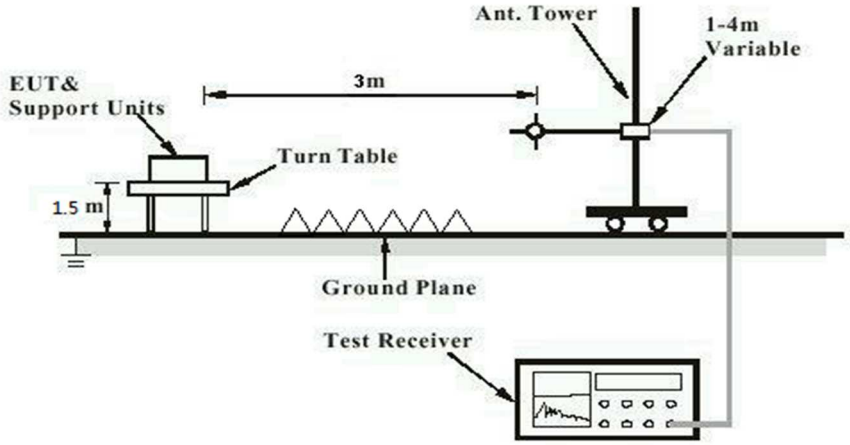


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)



5 Test Results

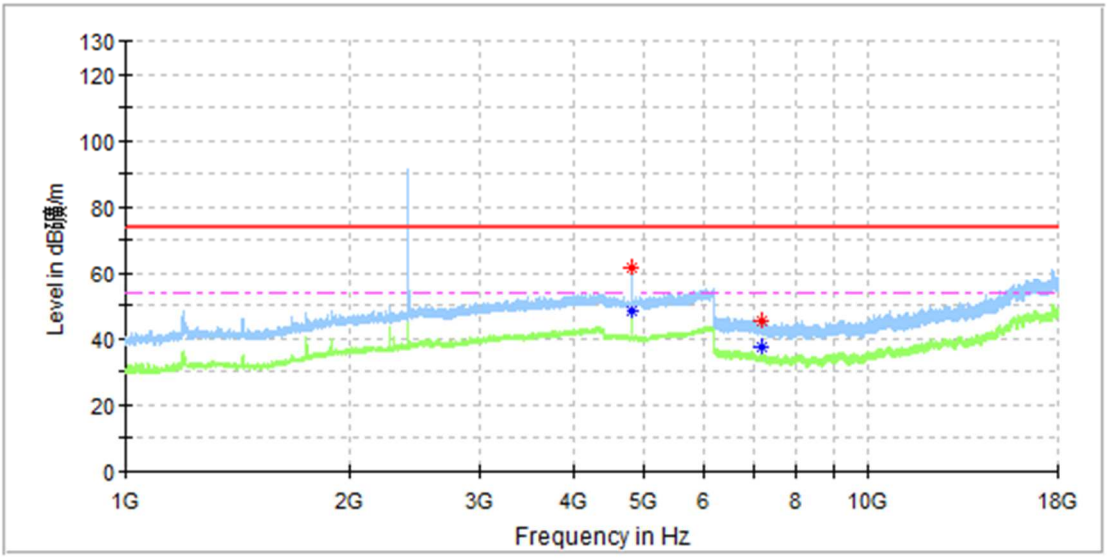
5.1 Transmitter Requirement & Test Suites

5.1.1 Radiated Spurious Emissions

RESULT: **Pass**

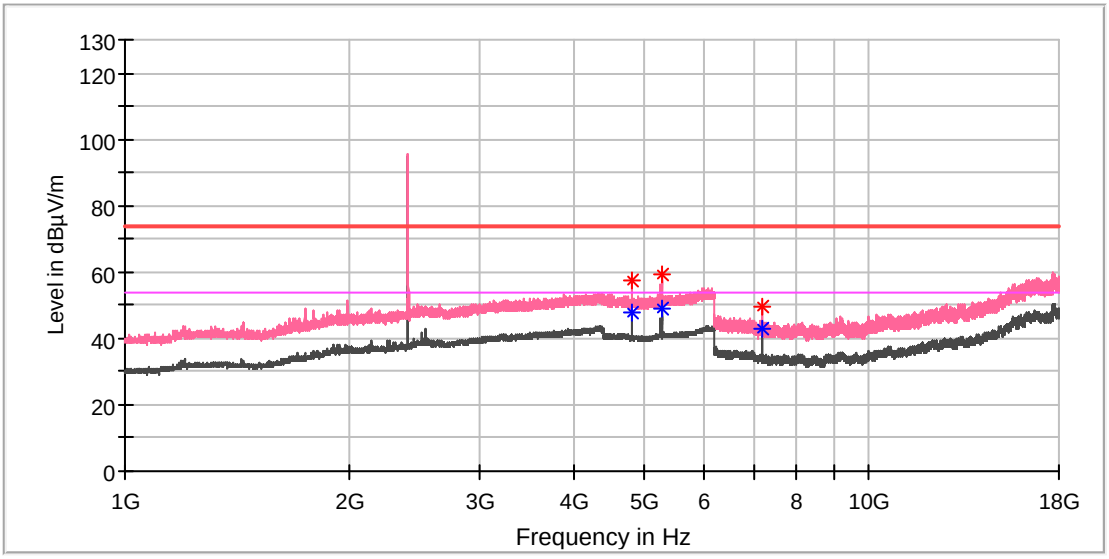
Test Specification		
Test standard	:	FCC Part 15.247 (d) & FCC Part 15.205 RSS-GEN Clause 8.9 & RSS-247 Clause 3.3
Basic standard	:	ANSI C63.10: 2013
Limits	:	Refer to 15.209(a) of FCC part 15.247(d) RSS-Gen Table 5
Kind of test site	:	3m Semi-anechoic Chamber
Test Setup		
Date of testing	:	04.12.2019
Input voltage	:	AC 120V/60Hz
Operation mode	:	A.1, A.2, A.3
Earthing	:	Not Connected
Ambient temperature	:	23 ℃
Relative humidity	:	47 %
Atmospheric pressure	:	101 kPa

Mode A.1
Horizontal



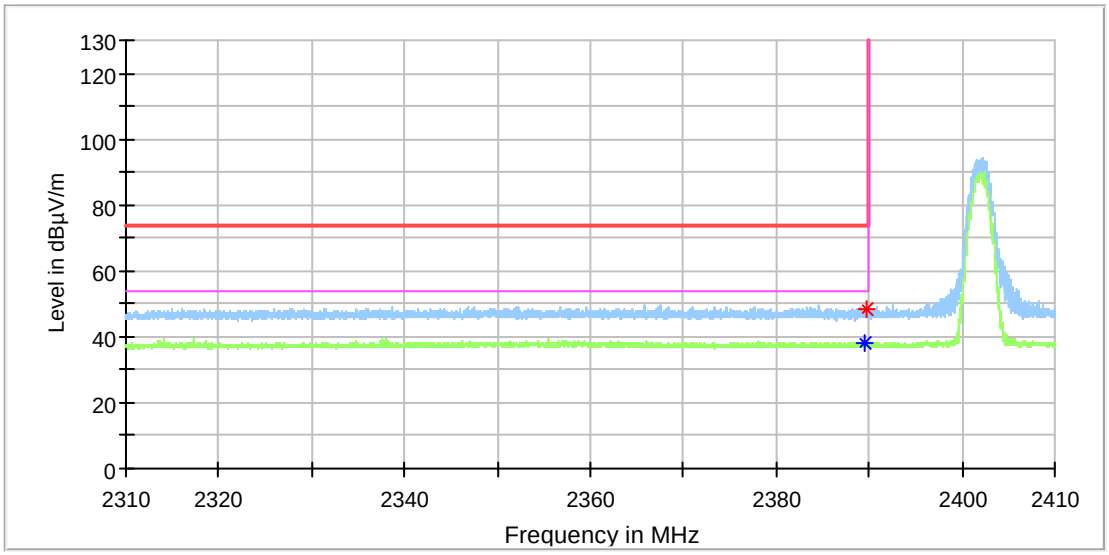
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4804.000000	---	46.25	54.00	7.75	100.0	H	134.0	13.6
4804.000000	61.41	---	74.00	12.59	100.0	H	134.0	13.6
7205.458333	---	37.22	54.00	16.78	100.0	H	106.0	8.8
7205.950000	45.44	---	74.00	28.56	100.0	H	106.0	8.8

Vertical



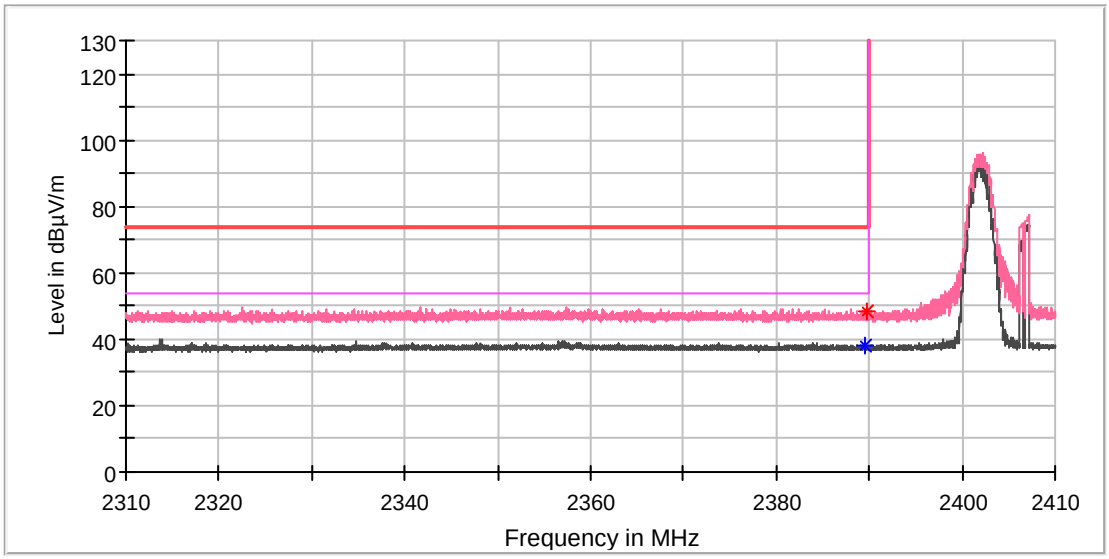
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4803.500000	---	47.87	54.00	6.13	100.0	V	123.0	13.6
4804.000000	57.26	---	74.00	16.74	100.0	V	123.0	13.6
5257.000000	---	49.27	54.00	4.73	100.0	V	80.0	14.0
5259.500000	59.54	---	74.00	14.46	100.0	V	43.0	14.0
7204.475000	49.41	---	74.00	24.59	100.0	V	82.0	8.8
7205.950000	---	42.85	54.00	11.15	100.0	V	0.0	8.8

Horizontal



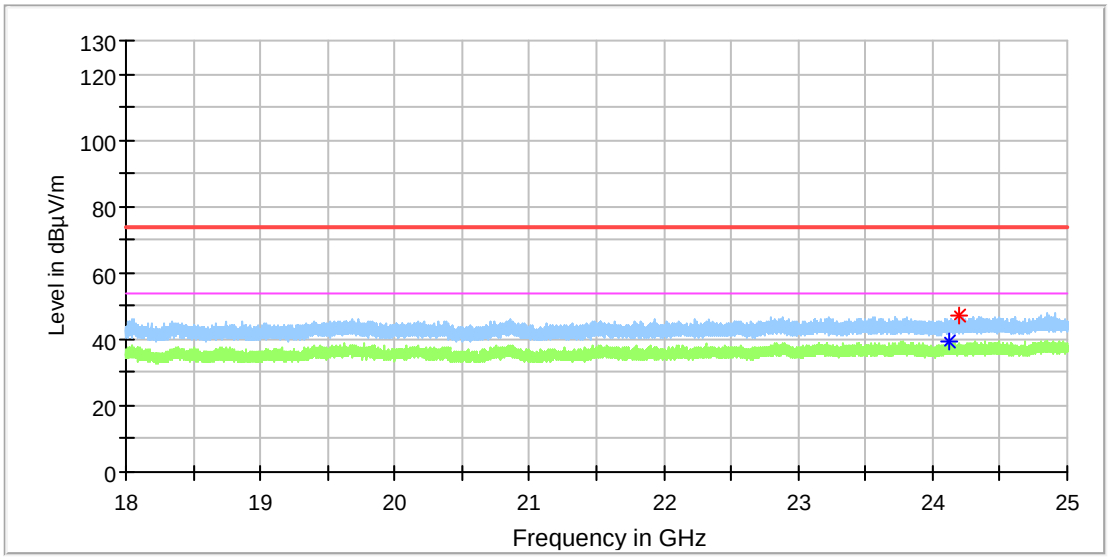
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2389.602941	---	37.94	54.00	16.06	100.0	H	127.0	7.0
2389.750000	48.27	---	74.00	25.73	100.0	H	287.0	7.0

Vertical



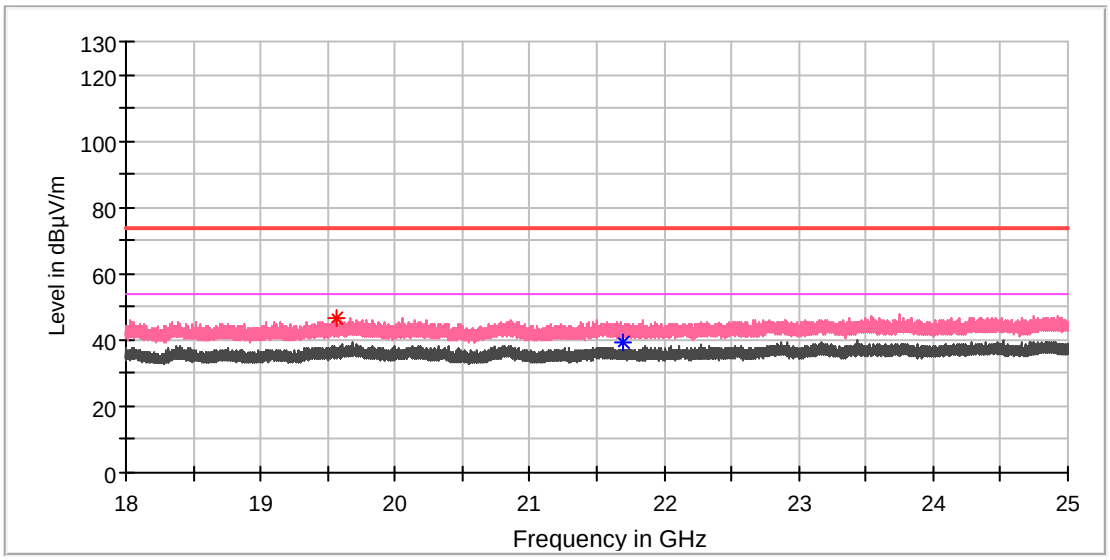
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2389.470588	---	37.88	54.00	16.12	100.0	V	281.0	7.0
2389.691177	48.41	---	74.00	25.59	100.0	V	267.0	7.0

Horizontal



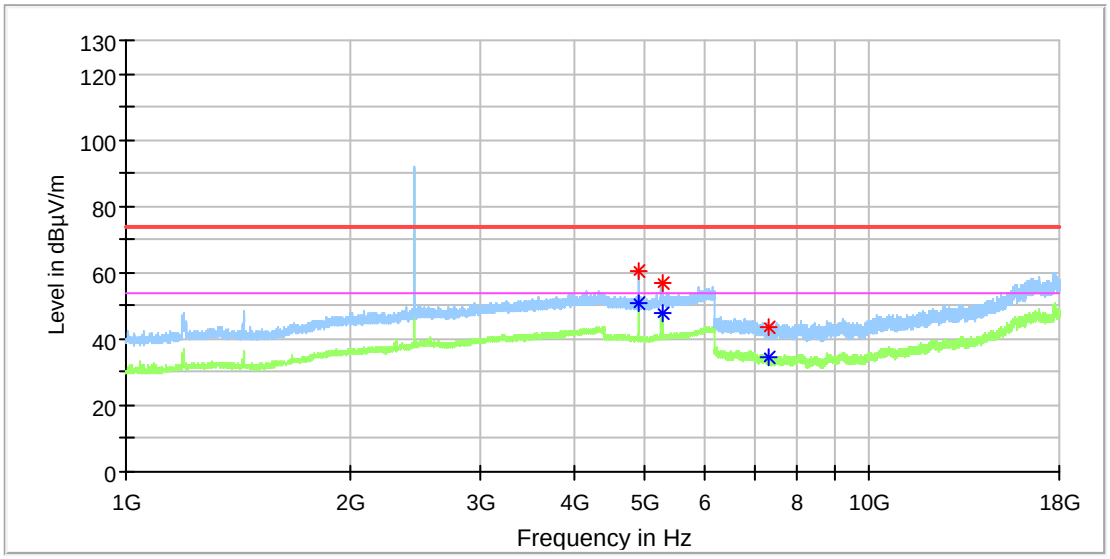
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
24114.937500	---	39.42	54.00	14.58	100.0	H	130.0	-10.1
24199.375000	47.33	---	74.00	26.67	100.0	H	130.0	-10.1

Vertical



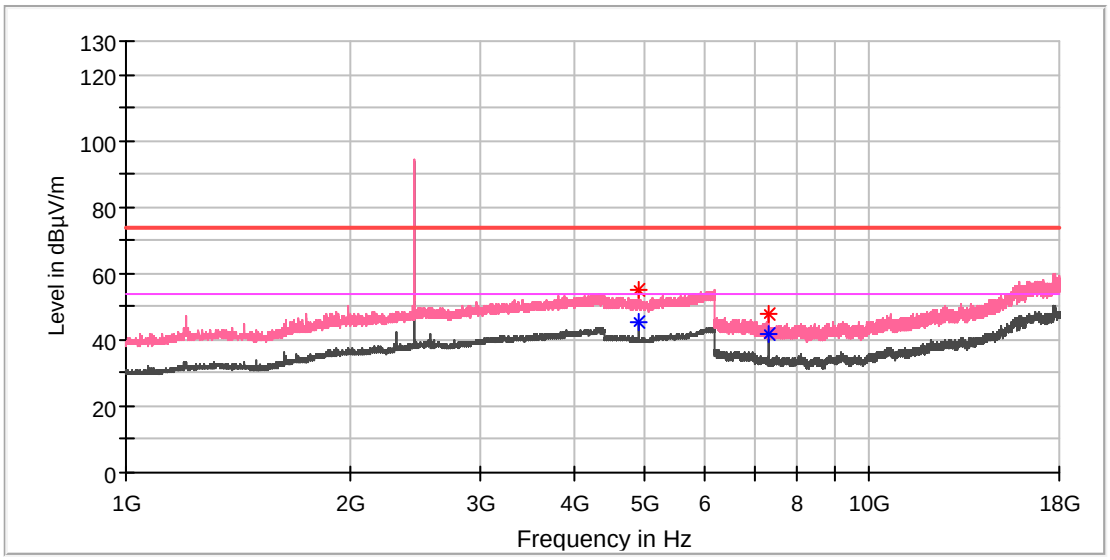
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
19560.125000	46.85	---	74.00	27.15	100.0	V	303.0	-13.1
21698.406250	---	39.15	54.00	14.85	100.0	V	288.0	-11.6

Mode A.2
Horizontal



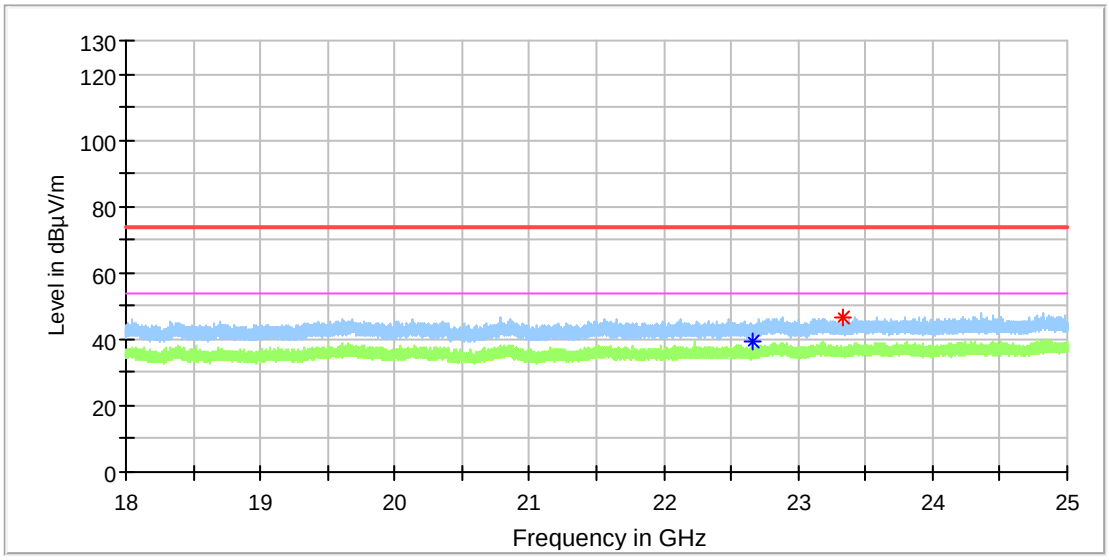
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4879.500000	60.29	---	74.00	13.71	100.0	H	129.0	13.4
4880.000000	---	50.53	54.00	3.47	100.0	H	129.0	13.4
5262.000000	56.77	---	74.00	17.23	100.0	H	291.0	14.0
5264.000000	---	47.50	54.00	6.50	100.0	H	291.0	14.0
7313.133333	---	34.48	54.00	19.52	100.0	H	31.0	8.2
7321.491667	43.72	---	74.00	30.28	100.0	H	108.0	8.2

Vertical



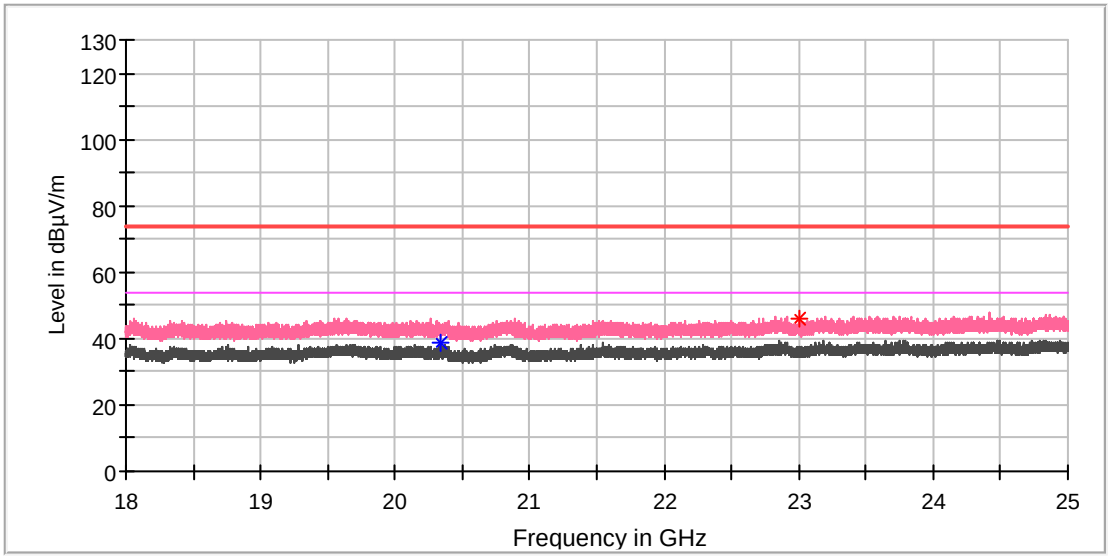
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4879.500000	---	45.46	54.00	8.54	100.0	V	0.0	13.4
4880.000000	54.75	---	74.00	19.25	100.0	V	0.0	13.4
7319.033333	---	41.81	54.00	12.19	100.0	V	98.0	8.2
7319.033333	47.77	---	74.00	26.23	100.0	V	98.0	8.2

Horizontal



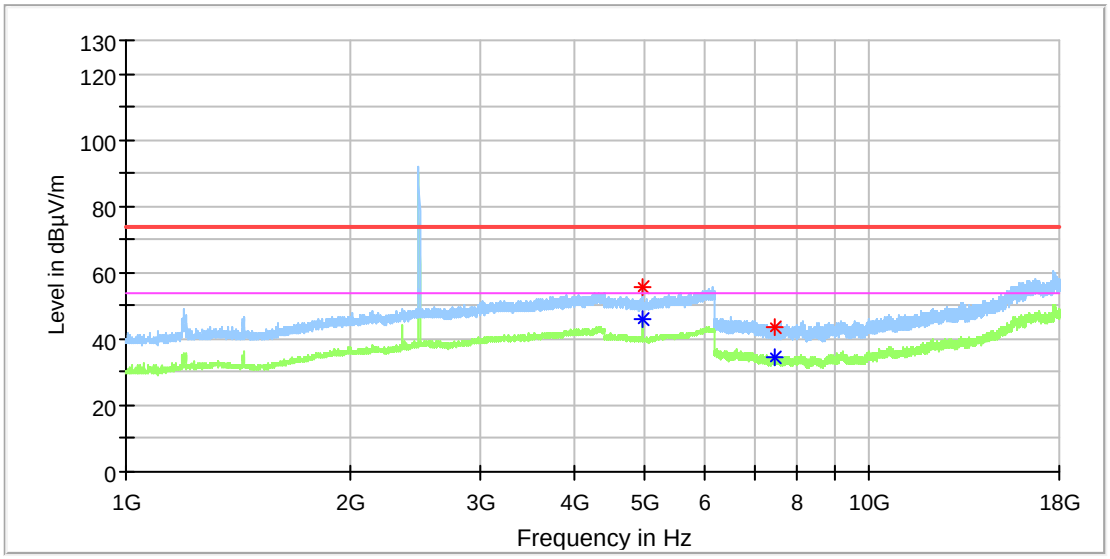
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
22665.718750	---	39.11	54.00	14.89	100.0	H	322.0	-11.0
23327.875000	46.61	---	74.00	27.39	100.0	H	64.0	-10.4

Vertical



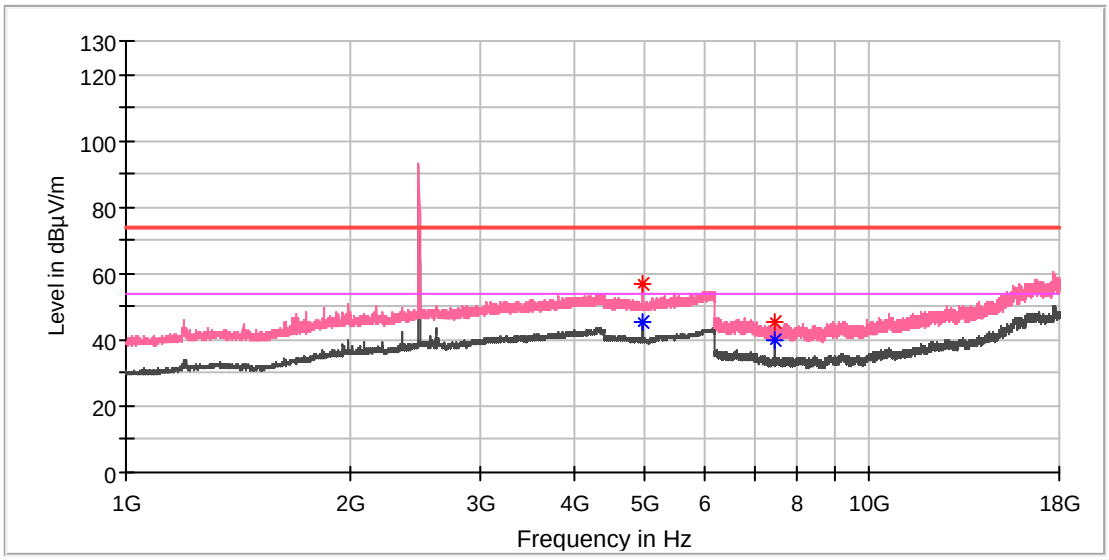
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
20342.375000	---	38.97	54.00	15.03	100.0	V	89.0	-12.7
22998.656250	46.22	---	74.00	27.78	100.0	V	203.0	-10.8

Mode A.3
Horizontal



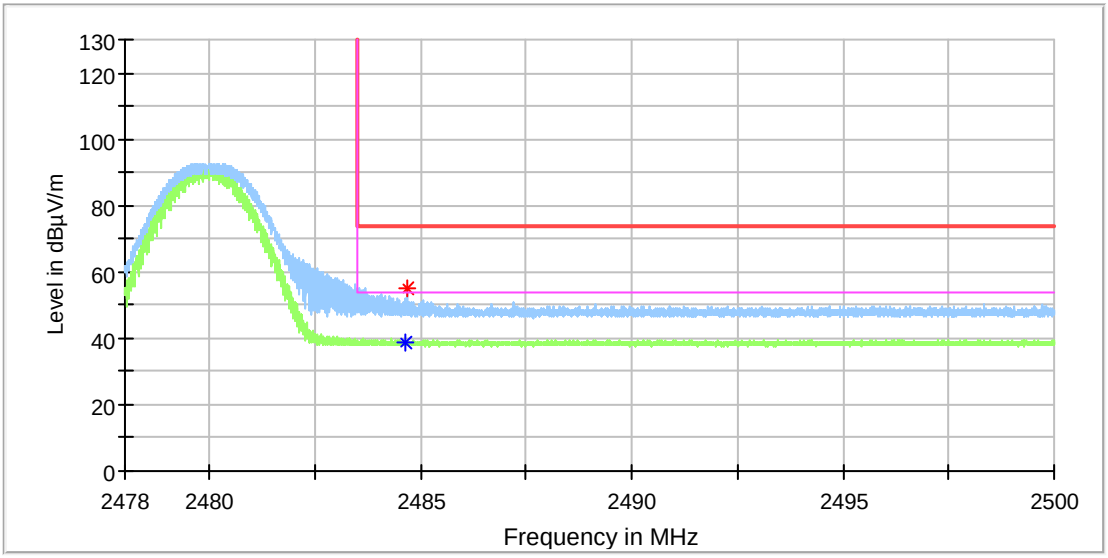
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4959.500000	---	45.91	54.00	8.09	100.0	H	123.0	13.2
4960.000000	55.66	---	74.00	18.34	100.0	H	80.0	13.2
7437.525000	43.45	---	74.00	30.55	100.0	H	351.0	8.4
7439.983333	---	34.20	54.00	19.80	100.0	H	165.0	8.4

Vertical



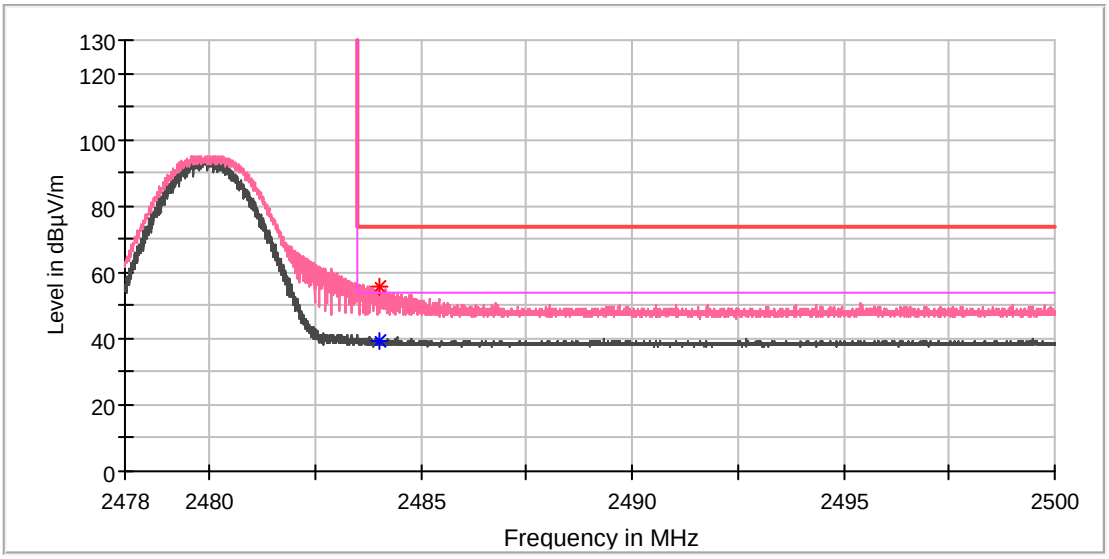
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4959.500000	---	45.49	54.00	8.51	100.0	V	119.0	13.2
4960.000000	56.79	---	74.00	17.21	100.0	V	129.0	13.2
7439.491667	---	39.97	54.00	14.03	100.0	V	16.0	8.4
7439.491667	45.23	---	74.00	28.77	100.0	V	16.0	8.4

Horizontal



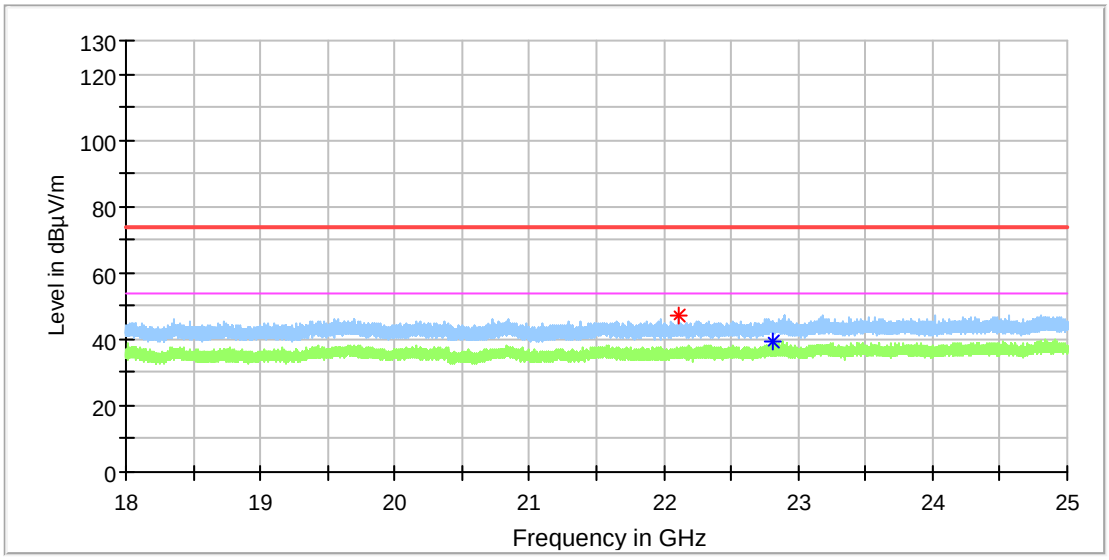
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2484.661471	---	38.59	54.00	15.41	100.0	H	336.0	7.4
2484.703530	54.75	---	74.00	19.25	100.0	H	315.0	7.4

Vertical



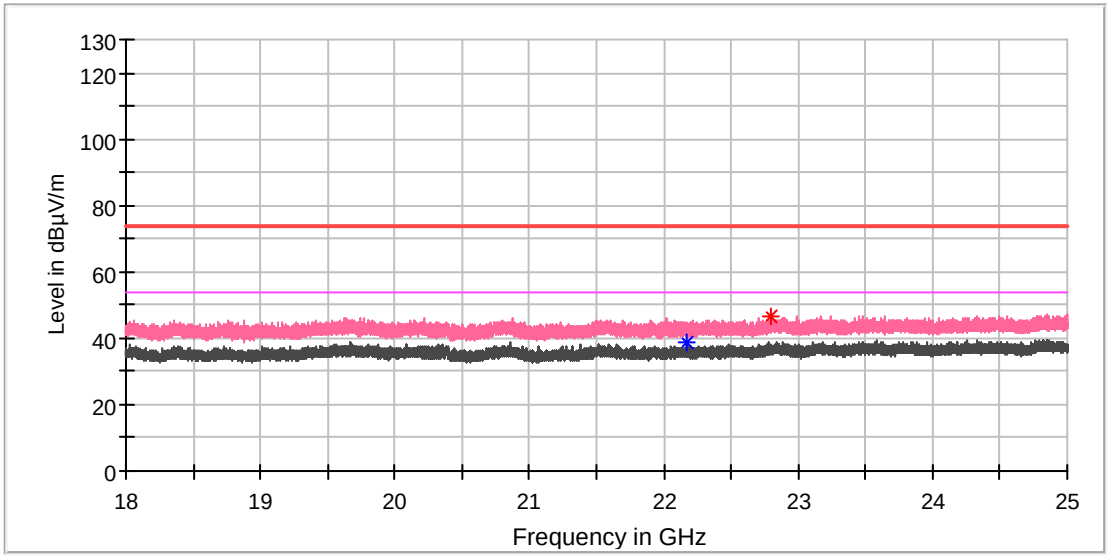
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.998235	55.89	---	74.00	18.11	100.0	V	169.0	7.4
2484.017647	---	39.22	54.00	14.78	100.0	V	203.0	7.4

Horizontal



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
22105.062500	46.95	---	74.00	27.05	100.0	H	301.0	-11.3
22806.593750	---	39.14	54.00	14.86	100.0	H	194.0	-10.9

Vertical



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
22163.687500	---	38.66	54.00	15.34	100.0	V	356.0	-11.3
22794.781250	46.76	---	74.00	27.24	100.0	V	38.0	-10.9