

Prüfbericht-Nr.: <i>Test report no.:</i>	CN22Z1VA 001	Auftrags-Nr.: <i>Order no.:</i>	168367205	Seite 1 von 20 <i>Page 1 of 20</i>
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	2021-11-16	
Auftraggeber: <i>Client:</i>	BALYO 74 Avenue Vladimir Ilitch Lenine, ARCUEIL, 94110, France			
Prüfgegenstand: <i>Test item:</i>	Combox			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	Combox Gen 2 (Trademark: BALYO)			
Auftrags-Inhalt: <i>Order content:</i>	FCC and IC approval			
Prüfgrundlage: <i>Test specification:</i>	CFR47 FCC Part 15: Subpart C Section 15.249 CFR47 FCC Part 15: Subpart C Section 15.209 CFR47 FCC Part 15: Subpart C Section 15.207 CFR47 FCC Part 15: Subpart B Section 15.107 CFR47 FCC Part 15: Subpart B Section 15.109 RSS-210 Issue 10 December 2019 RSS-Gen Issue 5 February 2021 ICES-003 Issue 7 October 2020			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2021-07-29	Please refer to photo documents		
Prüfmuster-Nr.: <i>Test sample no.:</i>	A003099328			
Prüfzeitraum: <i>Testing period:</i>	2022-07-27 - 2023-04-28			
Ort der Prüfung: <i>Place of testing:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von: <i>tested by:</i>	genehmigt von: <i>authorized by:</i>			
Datum: <i>Date:</i> 2023-06-28	X  Signed by: Harry W. C. Wu		X  Signed by: Alex Lan	
Stellung / Position:	Project Manager	Ausstellungsdatum: <i>Issue date:</i> 2023-06-28	Reviewer	
Sonstiges / Other:	FCC ID: 2A63ACBXG2 IC: 28604-CBXG2 HVIN: COMBOX Gen2			
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>	Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>			
* Legende:	P(ass) = entspricht o.g. Prüfgrundlage(n)	F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht
* Legend:	P(ass) = passed a.m. test specification(s)	F(ail) = failed a.m. test specification(s)	N/A = not applicable	N/T = not tested
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

V05

Anmerkungen

Remarks

- | | |
|----------|--|
| 1 | <p>The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system.</p> <p>Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.</p> <p><i>Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben.</i></p> <p><i>Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden.</i></p> |
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| 3 | <p>Test clauses with remark of * are subcontracted to qualified subcontractors and described under the respective test clause in the report. Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.</p> <p><i>Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben. Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt.</i></p> |
| 4 | <p>The decision rule for statements of conformity, based on numerical measurement results, in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance with ILAC G8:2019 and IEC Guide 115:2021, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report. For additional information to the resulting risk based of this decision rule please refer to ILAC G8:2019.</p> <p><i>Die Entscheidungsregel für Konformitätserklärungen basierend auf numerischen Messergebnissen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2021, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. Zu weiteren Informationen bezüglich des Risikos durch diese Entscheidungsregel siehe ILAC G8:2019.</i></p> |

Test Summary

5.1.1 ANTENNA REQUIREMENT

RESULT: Pass

5.1.2 FUNDAMENTAL & HARMONICS RADIATED EMISSION

RESULT: Pass

5.1.3 20dB BANDWIDTH

RESULT: Pass

5.1.4 99% BANDWIDTH

RESULT: Pass

5.1.5 RADIATED SPURIOUS EMISSION

RESULT: Pass

5.1.6 CONDUCTED EMISSION ON AC MAINS

RESULT: Pass

5.1.7 RADIATED EMISSION

RESULT: Pass

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1 General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix A: Photographs of the Test Set-up

Appendix B: Test Results

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 Accreditation Designation No.: CN1260

ISED wireless device testing laboratory: 25069

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

TÜV Rheinland (Shenzhen) Co., Ltd.

Unwanted Emission Testing (TS9975)				
Equipment	Manufacturer	Model	Serial No.	Cal. until
EMI Test Receiver	R&S	ESR 7	102021	2024-08-02
Signal Analyzer	R&S	FSV 40	101439	2024-08-01
System Controller Interface	R&S	SCI-100	S10010038	N/A
Filterbank	R&S	Wlan	100759	2024-08-01
OSP	R&S	OSP 120	102040	N/A
Pre-amplifier	R&S	SCU08F1	08320031	2024-08-02
Amplifier	R&S	SCU-18F	180070	2024-08-02
Amplifier	R&S	SCU40A	100475	2024-08-02
Trilog Broadband Antenna (30 MHz - 7 GHz)	Schwarzbeck	VULB 9162	193	2024-08-06
Double-Ridged Antenna (1 -18 GHz)	ETS-LINDGREN	3117	00218717	2024-08-06
Wideband Ridged Horn Antenna (18-40 GHz)	Steatite	QMS-00880	19067	2024-08-07
Active Loop Antenna	Schwarzbeck	FMZB 1513	302	2024-08-06
Test software	R&S	EMC32 (V10.60.10)	N/A	N/A
Control PC	Dell	OptiPlex 7050	36NV9P2	N/A
3m Semi-Anechoic Chamber	Albatross	SAC-3m	APC17151-SAC	2024-06-22

Conducted Emission				
Equipment	Manufacturer	Model No.	Serial No.	Cal. Until
EMI Test Receiver	R&S	ESR3	102428	2023-07-31
Artificial Mains Network	R&S	ENV216	102333	2023-08-01
EMC32 test software	R&S	EMC32(Ver.10.50.00)	N/A	N/A
Radiated Emission				
Equipment	Manufacturer	Model No.	Serial No.	Cal. Until
3m SAC	ETS-Lindgren	SAC3	CT001632-Q1362	2024-04-26
EMI Test Receiver	R&S	ESR7	102111	2023-12-01
Horn Antenna	R&S	HF907	102706	2023-08-08
Preamplifier (1-18GHz)	FIT	SCU-18F	180077	2023-08-01
Active magnetic loop antenna	SCHWARZBECK	FMZB1519B	00080	2023-08-08
Trilog-Broadband	SCHWARZBECK	VULB9168	0945	2023-08-08

antenna				
EMC32 test software	R&S	EMC32(Ver.10.50.00)	N/A	N/A

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 basis 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.

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-7}$
RF Power (conducted)	± 2.5 dB
Radiated Emission of Transmitter, valid up to 26.5 GHz	± 6 dB
Radiated Emission of Receiver, valid up to 26.5 GHz	± 6 dB
Conducted Emission, (9kHz to 150kHz)/(150kHz to 30MHz)	± 3.70 dB / ± 3.30 dB
Radiated Emission (3m SAC), 30MHz to 1000MHz	± 4.52 dB
Radiated Emission (3m SAC), above 1000MHz	± 4.37 dB
Temperature	± 1 °C
Humidity	± 5 %
Voltage (DC)	± 1 %
Voltage (AC, <10kHz)	± 2 %

2.6 Location of Original Data

The original copies of all test data taken during actual testing were attached at Appendix A & B of 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 a Combox which supports LoRa technology, and it used for industrial environment.

This product has four different versions, the details specifications for these versions as below:

Version Option	Standard	Ext-I/O	Touch screen	Button without battery
Front Cover	Standard	Standard	Display	Button
Display	Not available	Not available	Available	Not available
Backlit button	Not available	Not available	Not available	3
AAA battery	Not available	Not available	Not available	Not available
Connectivity	LoRa	LoRa	LoRa	LoRa
Ethernet & POE	Available	Available	Available	Available
AC Power	Available	Available	Available	Available
I/O number	2	2	2	2
Additional I/O	Not available	+6	Not available	Not available

The radio part (include schematic & PCB layout) for all models are identical, others differences between different versions are for different markets.

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

3.2 Ratings and System Details

Table 2: Technical Specification of EUT

General Information of EUT	Value
Kind of Equipment	Combox
Type Designation	Combox Gen 2
Trademark	BALYO
FCC ID	2A63ACBXG2
IC	28604-CBXG2
HVIN	COMBOX Gen2
Operating Voltage	AC 110-240V, 50/60Hz or DC 48V via Ethernet port or DC 5V via Micro-USB interface
Technical Specification of Lora	
Frequency Range	902-928 MHz
Channel Number	1 channels
Frequency list	915MHz
Type of Modulation	Lora
Occupied Bandwidth	125KHz, 250KHz, 500KHz
Data Rate	SF5-SF12
Antenna Type	Integral antenna
Antenna gain	2.05 dBi

3.3 Independent Operation Modes

The basic operation modes are:

- A. On, transmitting mode
- B. On, operation mode
- C. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

3.5 Submitted Documents

- Rating Label

- User Manual

4 Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

Radio Spectrum: The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

Emission: 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.

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5. All tests were performed according to the procedures in ANSI C63.10: 2013 and ANSI C63.4: 2014.

According to clause 3.1, all tests of Radio Spectrum were performed on model Combox Gen 2 with touch screen version and all tests of EMC were applied on model Combox Gen 2 with touch screen & Ext-I/O versions.

4.3 Special Accessories and Auxiliary Equipment

Table 3: Auxiliary Equipment Used during Test

Description	Manufacturer	Model	S/N	Rating
Laptop	Lenovo	T480	PF-16A6N8	N/A
Keyboard	ZEN Factory Group (Asia) Limited	NS-XB1CHATPAD	N/A	DC 3.3V by battery

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 30MHz)

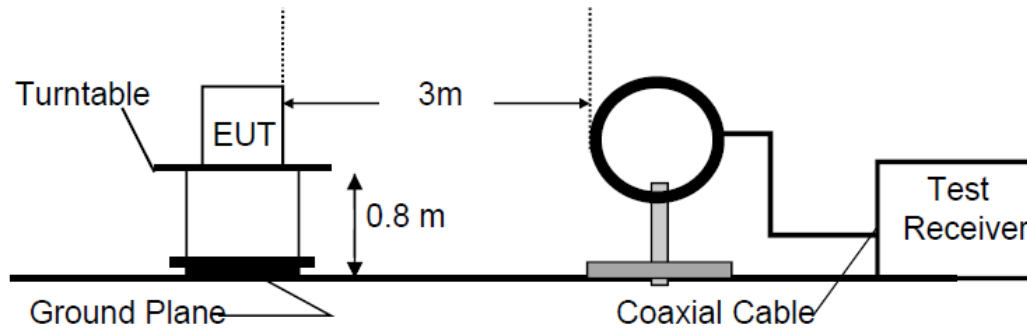


Diagram of Measurement Configuration for Radiation Test (Below 1GHz)

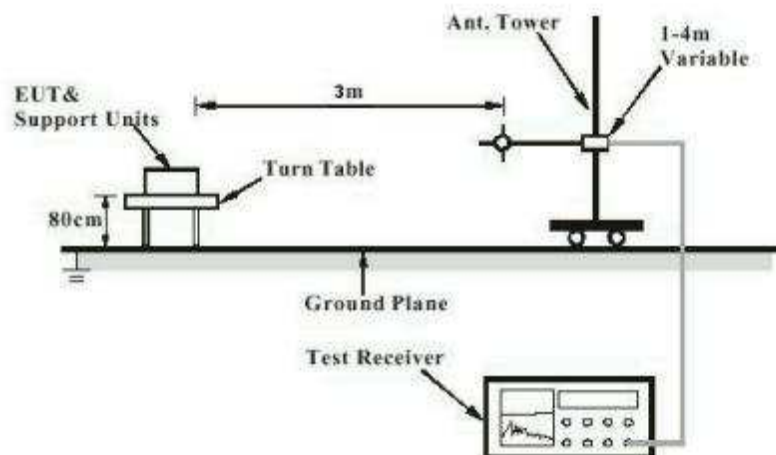


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

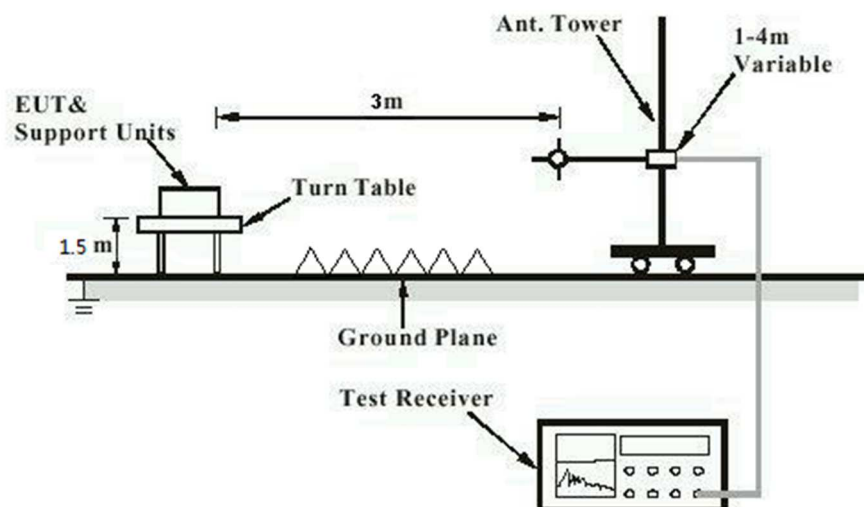
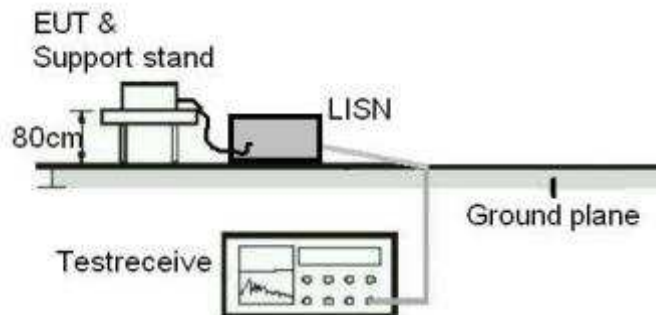


Diagram of Measurement Equipment Configuration for Mains Conduction Measurement



5 Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Pass****Test Specification**

Test standard : FCC Part 15.247(b)(4) and Part 15.203
RSS-Gen Clause 6.8

According to the manufacturer declared, the EUT has an internal antenna, the directional gain of antenna is 2.05 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Therefore the EUT is considered sufficient to comply with the provision.

Refer to EUT Photo for further details.

5.1.2 Fundamental & Harmonics Radiated Emission

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.249(a) RSS-210 Issue 10 B.10
Basic standard	: ANSI C63.10: 2013 RSS-210 Issue 10 B.10(a) & Table A2
Limits	: Refer to FCC Part 15.249(a) & 15.209(a)
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: 2022-07-27 to 2022-08-29
Input voltage	: AC 120V, 60Hz
Operation mode	: A
Ambient temperature	: 23 °C
Relative humidity	: 53 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B.

5.1.3 20dB Bandwidth

RESULT:**Pass****Test Specification**

Test standard : FCC Part 15.215
RSS-Gen clause 6.7
Basic standard : ANSI C63.10: 2013
Kind of test site : Shielded Room

Test Setup

Date of testing : 2022-07-02
Input voltage : AC 120V, 60Hz
Operation mode : A
Ambient temperature : 23 °C
Relative humidity : 53 %
Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix B.

Table 4: Test Result of 20dB Bandwidth

Test Channel Frequency (MHz)	20dB Bandwidth (kHz)	Verdict
915 with OCW 125KHz	138.21	PASS
915 with OCW 250KHz	273.20	PASS
915 with OCW 500KHz	549.20	PASS

5.1.4 99% Bandwidth

RESULT:**Pass****Test Specification**

Test standard : RSS-Gen clause 6.7
Basic standard : ANSI C63.10: 2013
Kind of test site : Shielded Room

Test Setup

Date of testing : 2022-07-27
Input voltage : AC 120V, 60Hz
Operation mode : A
Ambient temperature : 23 °C
Relative humidity : 53 %
Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix B.

Table 5: Test Result of 99% Bandwidth

Test Channel Frequency (MHz)	99% Bandwidth (kHz))	Verdict
915 with OCW 125KHz	127.35	PASS
915 with OCW 250KHz	266.28	PASS
915 with OCW 500KHz	503.62	PASS

5.1.5 Radiated Spurious Emission

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.249(a) RSS-210 Issue 10 B.10
Basic standard	: ANSI C63.10: 2013
Limits	: Refer to FCC Part 15.249(a) & 15.209(a) RSS-210 Issue 10 B.10(a) & Table A2
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: 2022-07-27 to 2023-03-09
Input voltage	: AC 120V, 60Hz
Operation mode	: A
Ambient temperature	: 25 °C
Relative humidity	: 56 %
Atmospheric pressure	: 101 kPa

Testing was carried out within frequency range 9kHz to the tenth harmonics with three OCW (125kHz, 250kHz, 500kHz). Only the worst case spurious emissions configuration of the each mode were reported.

For the measurement records, refer to the appendix B.

5.1.6 Conducted Emission on AC Mains

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.207(a) & FCC Part 15.107(a) RSS-Gen clause 8.8 & ICES-003 Issue 6
Basic standard	: ANSI C63.10: 2013 & ANSI C63.4: 2014
Frequency range	: 0.15 – 30MHz
Classification	: Class A
Limits	: FCC Part 15.207(a) & FCC Part 15.107(a) RSS-Gen clause 8.8 & ICES-003 Issue 6 Table 2
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2022-03-28 to 2023-04-28
Input voltage	: AC 120V, 60Hz
Operation mode	: B, C
Ambient temperature	: 22 °C
Relative humidity	: 54 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B.

5.1.7 Radiated Emission

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.109(a) ICES-003 Issue 6
Basic standard	: ANSI C63.4: 2014
Frequency range	: 30 - 6000MHz
Classification	: Class A
Limits	: FCC Part 15.109(a) ICES-003 Issue 6 Table 5 & Table 7
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: 2022-03-28 to 2023-04-28
Input voltage	: AC 120V, 60Hz or DC 48V
Operation mode	: C
Ambient temperature	: 22 °C
Relative humidity	: 54 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B.

6 Photographs of the Test Set-Up

For photographs of the test set-up, refer to the appendix A.

7 List of Tables

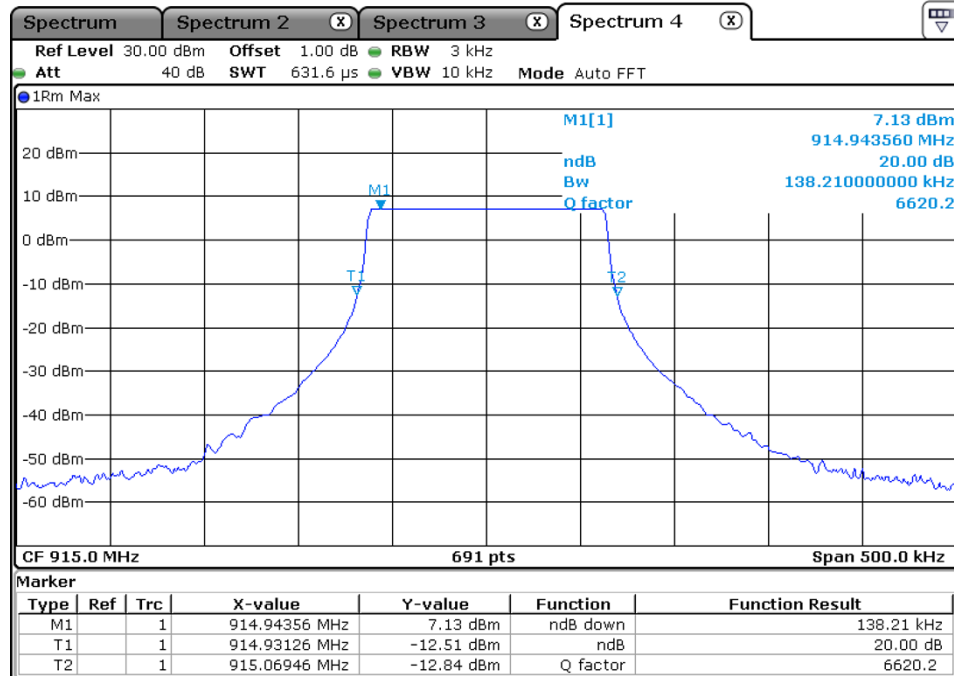
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Appendix B: Test Results

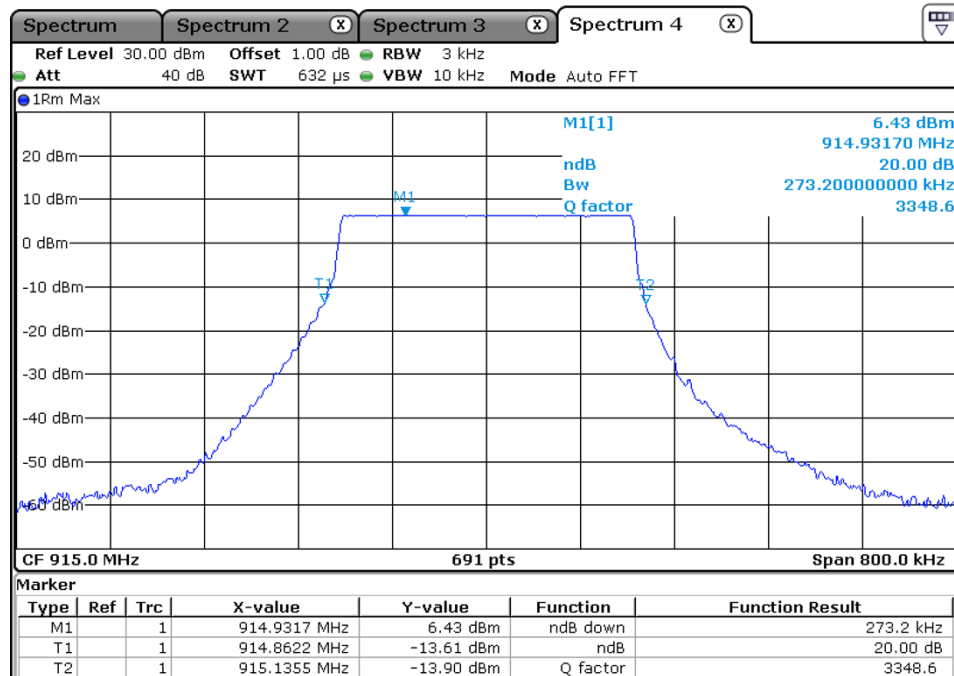
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Appendix B.1: Test Results of 20dB Bandwidth

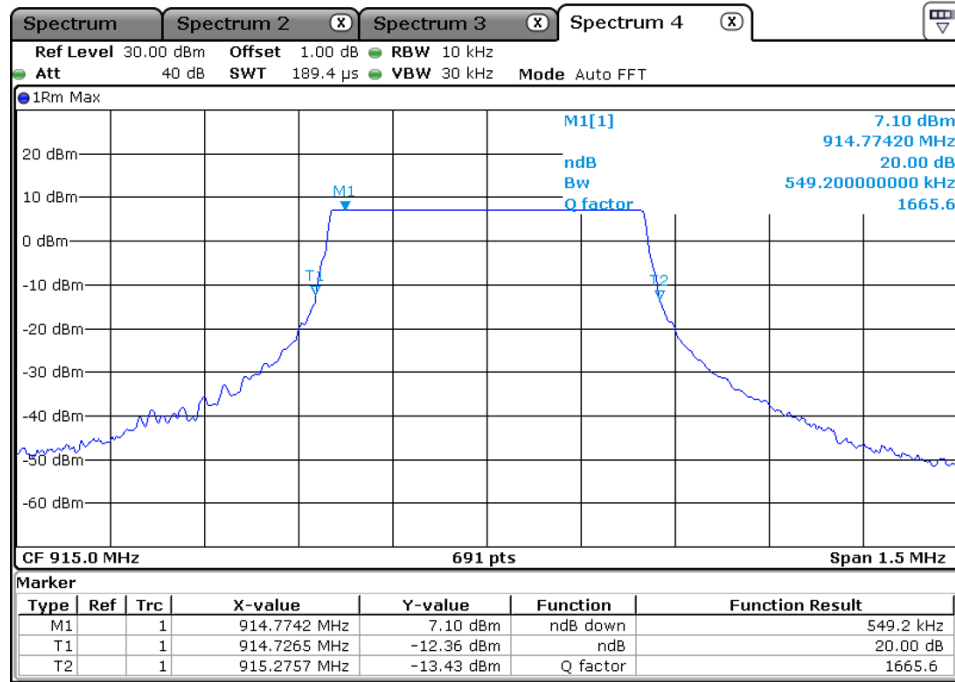
Lora 915MHz with OCW 125kHz



Lora 915MHz with OCW 250kHz

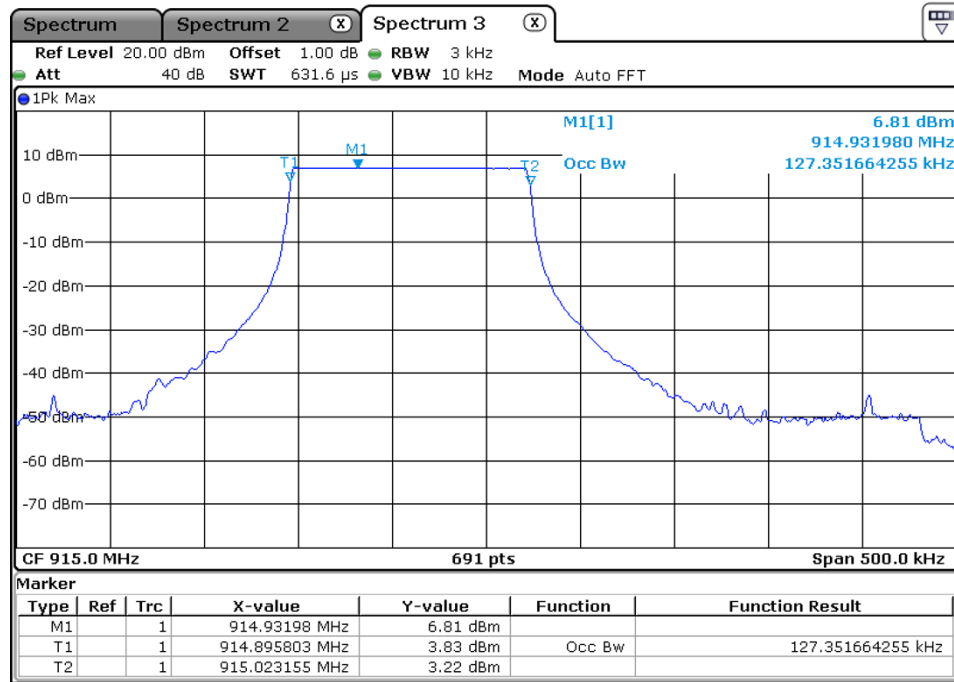


Lora 915MHz with OCW 500kHz

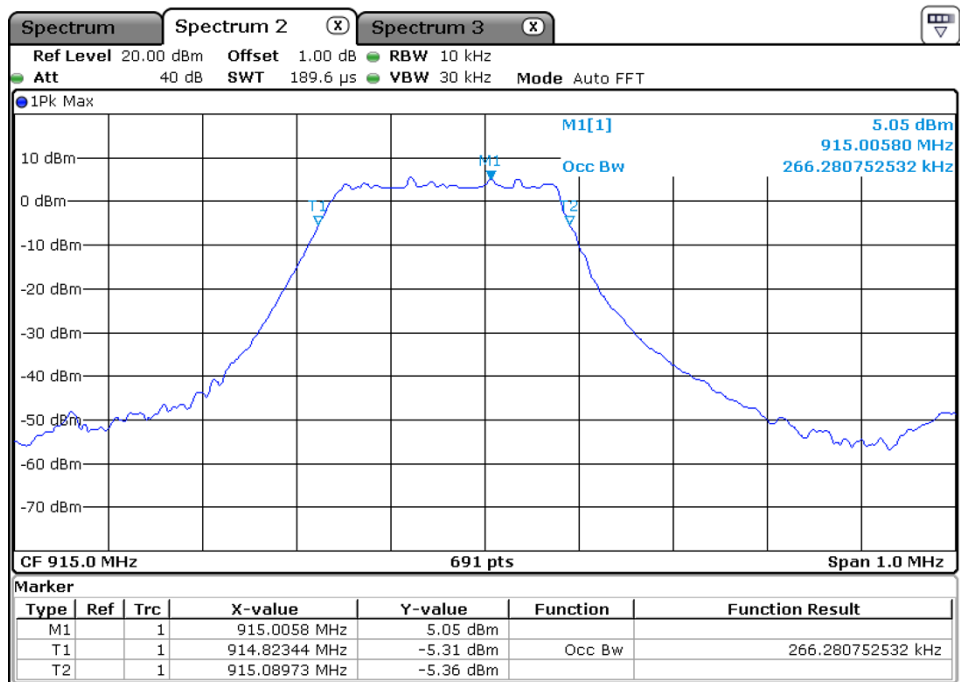


Appendix B.2: Test Results of 99% Bandwidth

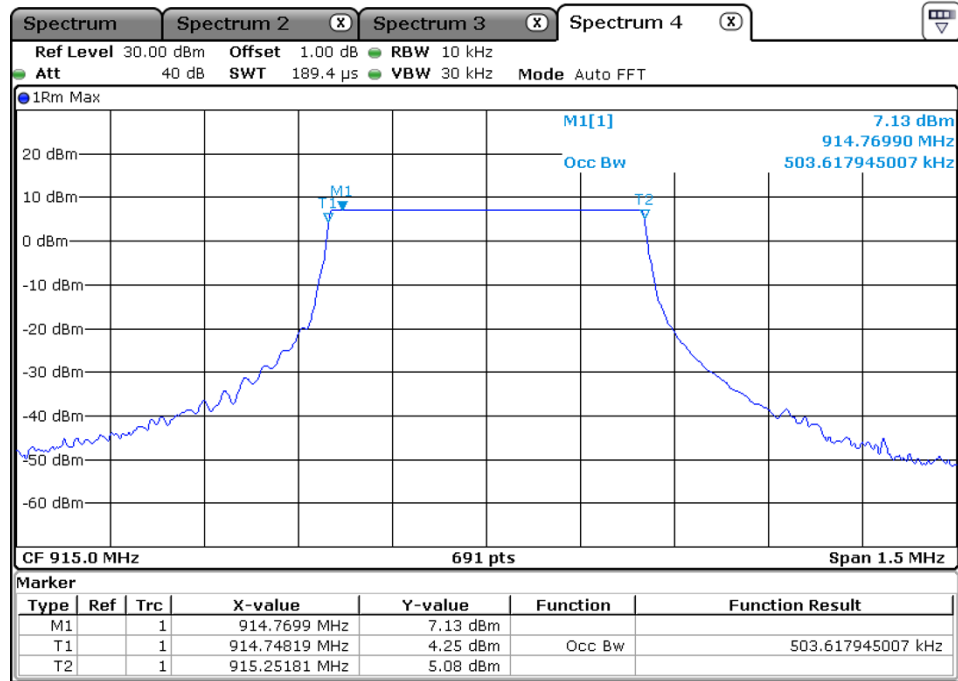
Lora 915MHz with OCW 125kHz



Lora 915MHz with OCW 250kHz



Lora 915MHz with OCW 500kHz

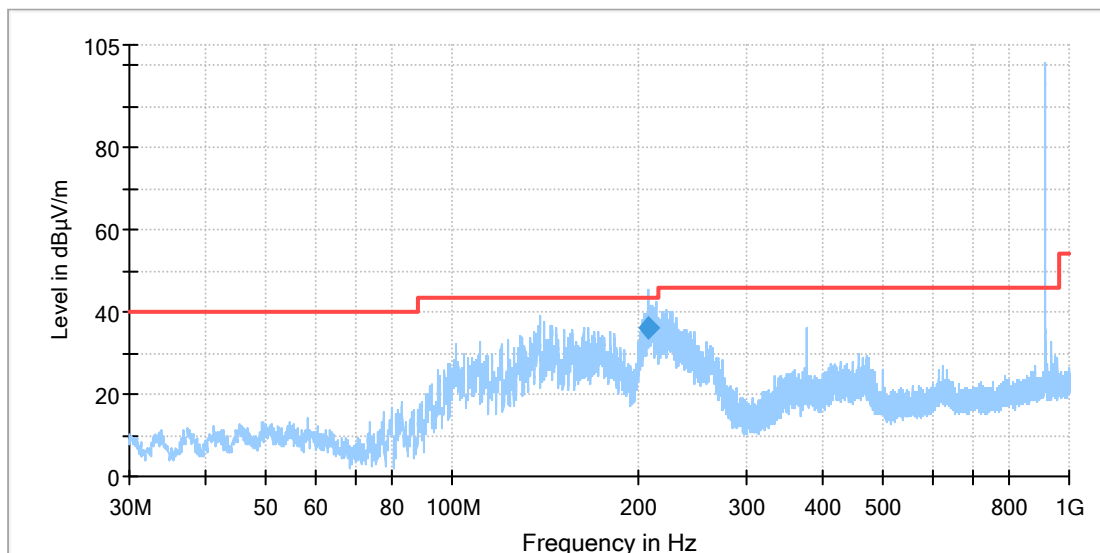


Note: Testing was carried out within frequency range 9kHz to the tenth harmonics. The measurement results below 30MHz and 18GHz -26.5GHz were greater than 20dB below the limit, so only the radiated spurious emissions from 30MHz to 18GHz were reported.

Appendix B.3: Fundamental & Harmonics Radiated Emission 30MHz - 1GHz

EUT Information

EUT Name:	Combox
Model:	Combox Gen 2
Test Mode:	Lora 250k_SF12_915MHz
Order No./Sample No:	168367205/A003243357-027
Test Voltage::	AC 120V, 60Hz
Remark:	Temp 23 Humi:53%
Test Standard:	FCC 15.249
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
83.051539	17.79	40.00	22.21	100.0	H	0.0	-23.1
138.528077	39.12	43.50	4.38	100.0	H	0.0	-22.5
208.454615	41.37	43.50	2.13	104.0	H	103.0	-19.2
374.984231	36.12	46.00	9.88	100.0	H	182.0	-14.7
936.427692	31.69	46.00	14.31	100.0	H	151.0	-5.0
915.00	101.32	114.00	12.68	100.0	H	132.0	-4.8

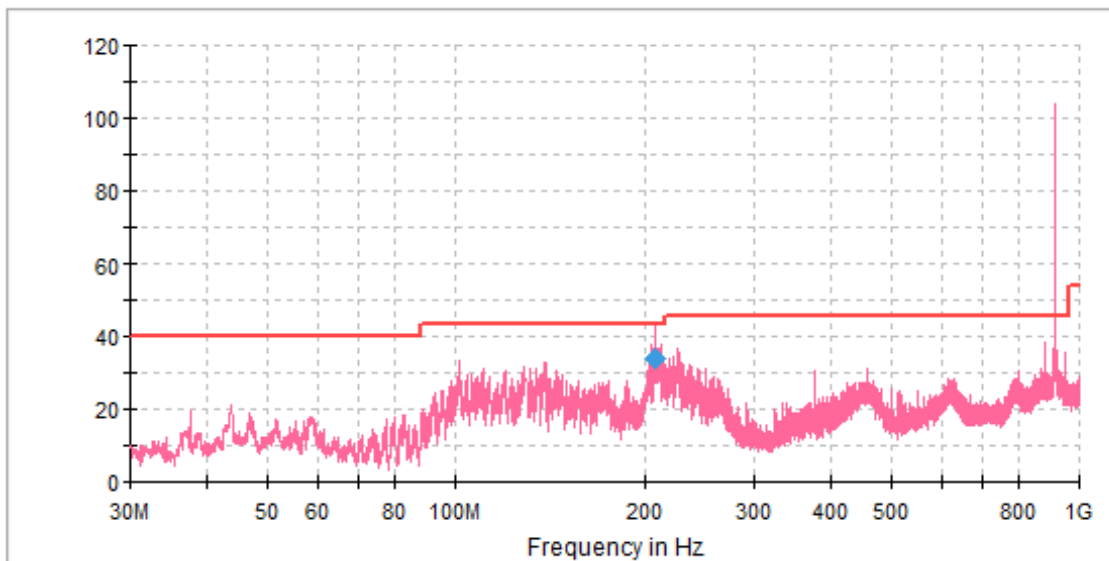
Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
208.454615	36.17	43.50	7.33	105.0	H	103.0	-19.2
915.00	91.54	94.00	2.46	100.0	H	132.0	-4.8

EUT Information

EUT Name: Combox
Model: Combox Gen 2
Test Mode: Lora 250k_SF12_915MHz
Order No/Sample No: 168367205/A003243357-027
Test Voltage:: AC 120V, 60Hz
Remark: Temp 23 Humi:53%
Test Standard: FCC 15.249
Tested By: Kei Zhang
Reviewed By: Terry Yin

Level in dBµV/m



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
43.617308	21.00	40.00	19.00	100.0	V	7.0	-19.4
101.593462	33.70	43.50	9.80	100.0	V	333.0	-19.2
208.447884	35.37	43.50	8.13	103.0	V	204.0	-19.2
374.984231	30.95	46.00	15.05	100.0	V	192.0	-14.7
882.965769	38.24	46.00	7.76	100.0	V	0.0	-5.5
915.00	104.43	114.00	9.57	100.0	V	231.0	-4.8

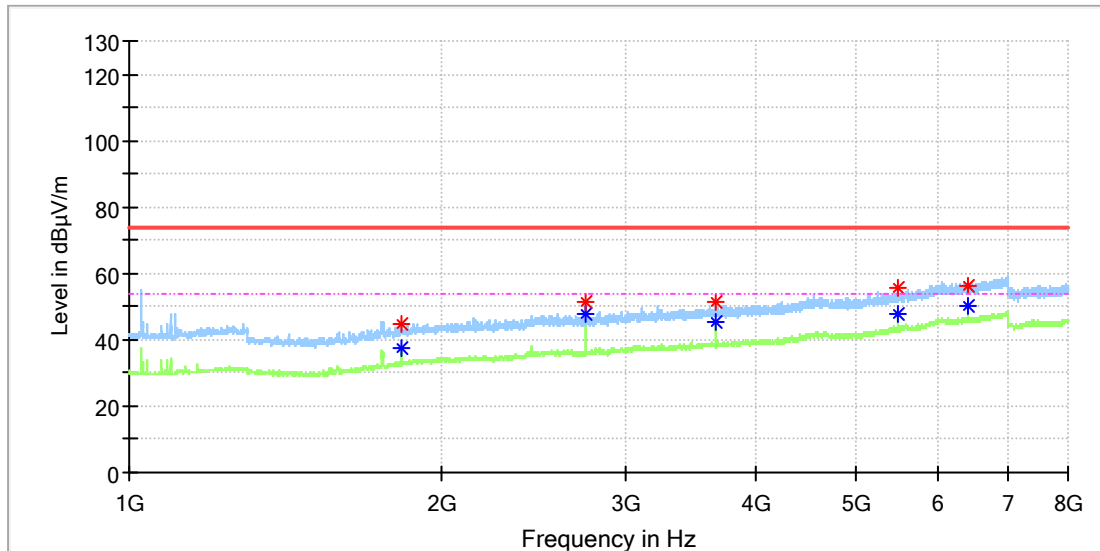
Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
208.447884	33.98	43.50	9.52	105.0	V	204.0	-19.2
915.00	93.34	94.00	0.66	100.0	V	231.0	-4.8

1GHz - 8GHz

EUT Information

EUT Name:	Combox
Model:	Combox Gen 2
Test Mode:	Lora with OCW 125kHz_SF12_915MHz
Order No/Sample No:	168367205/A003243357-027
Test Voltage::	AC 120V, 60Hz
Remark:	Temp 23 Humi:53%
Test Standard:	FCC 15.249
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

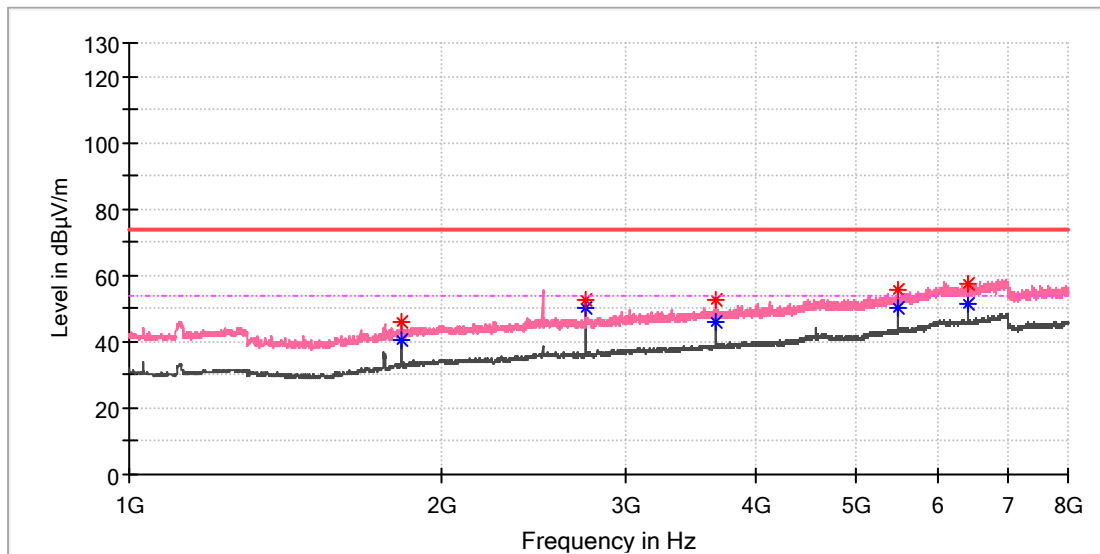


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1829.300000	45.03	---	74.00	28.97	100.0	H	334.0	4.9
1830.137500	---	37.35	54.00	16.65	100.0	H	73.0	4.9
2744.687500	51.47	---	74.00	22.53	100.0	H	316.0	7.8
2744.687500	---	47.97	54.00	6.03	100.0	H	316.0	7.8
3659.237500	51.40	---	74.00	22.60	100.0	H	287.0	9.4
3660.075000	---	45.48	54.00	8.52	100.0	H	11.0	9.4
5490.012500	55.55	---	74.00	18.45	100.0	H	11.0	13.7
5490.012500	---	47.48	54.00	6.52	100.0	H	11.0	13.7
6405.400000	56.26	---	74.00	17.75	100.0	H	334.0	16.1
6405.400000	---	50.32	54.00	3.68	100.0	H	334.0	16.1

EUT Information

EUT Name: Combox
Model: Combox Gen 2
Test Mode: Lora with OCW 125kHz_SF12_915MHz
Order No/Sample No: 168367205/A003243357-027
Test Voltage:: AC 120V, 60Hz
Remark: Temp 23 Humi:53%
Test Standard: FCC 15.249
Tested By: Kei Zhang
Reviewed By: Terry Yin

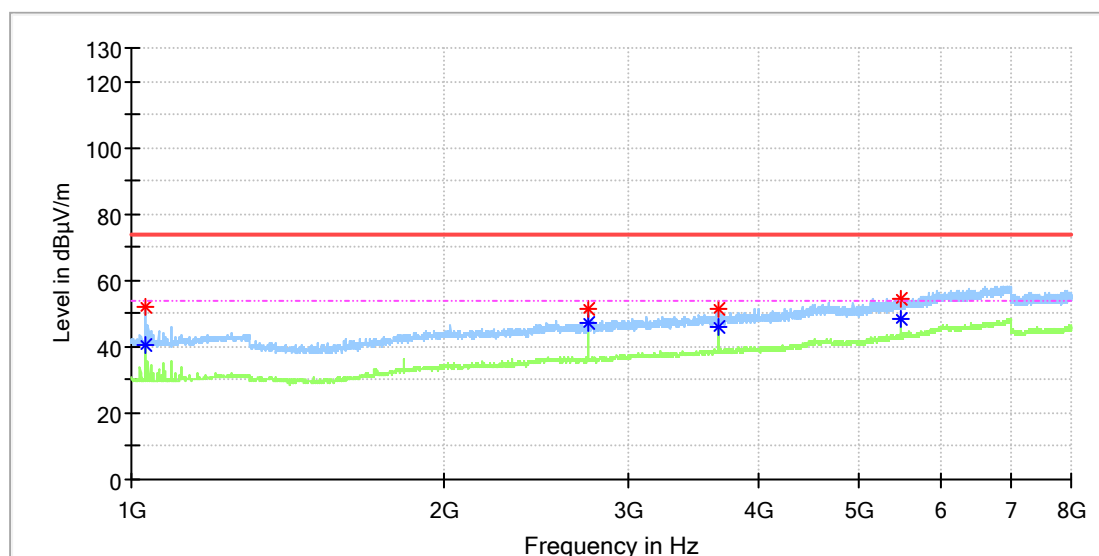


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1829.300000	45.88	---	74.00	28.12	100.0	V	219.0	4.9
1829.300000	---	40.25	54.00	13.75	100.0	V	219.0	4.9
2744.687500	52.72	---	74.00	21.28	100.0	V	356.0	7.8
2744.687500	---	49.91	54.00	4.09	100.0	V	356.0	7.8
3660.075000	52.71	---	74.00	21.29	100.0	V	266.0	9.4
3660.075000	---	46.25	54.00	7.75	100.0	V	266.0	9.4
5490.012500	55.58	---	74.00	18.42	100.0	V	147.0	13.7
5490.012500	---	50.09	54.00	3.91	100.0	V	147.0	13.7
6405.400000	57.50	---	74.00	16.50	100.0	V	56.0	16.1
6405.400000	---	51.70	54.00	2.30	100.0	V	56.0	16.1

EUT Information

EUT Name:	Combox
Model:	Combox Gen 2
Test Mode:	Lora with OCW 250kHz_SF12_915MHz
Order No/Sample No:	168367205/A003243357-027
Test Voltage::	AC 120V, 60Hz
Remark:	Temp 23 Humi:53%
Test Standard:	FCC 15.249
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

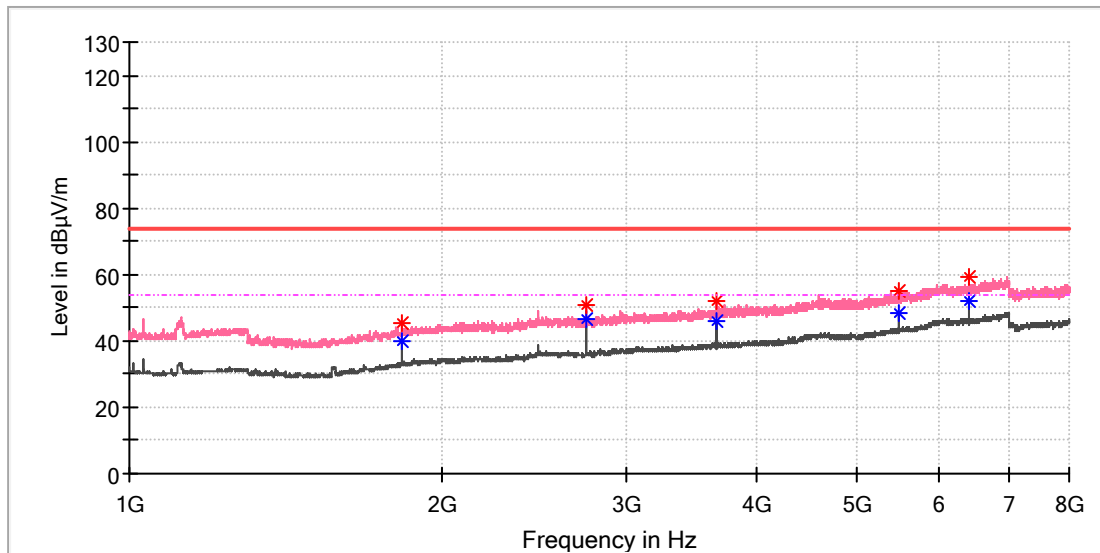


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1030.500000	51.71	---	74.00	22.29	100.0	H	225.0	-0.2
1030.500000	---	40.32	54.00	13.68	100.0	H	225.0	-0.2
2744.687500	51.49	---	74.00	22.51	100.0	H	281.0	7.8
2744.687500	---	47.36	54.00	6.64	100.0	H	281.0	7.8
3659.237500	51.58	---	74.00	22.42	100.0	H	298.0	9.4
3659.237500	---	46.15	54.00	7.85	100.0	H	298.0	9.4
5490.012500	54.56	---	74.00	19.44	100.0	H	281.0	13.7
5490.012500	---	48.12	54.00	5.88	100.0	H	281.0	13.7

EUT Information

EUT Name: Combox
Model: Combox Gen 2
Test Mode: Lora with OCW 250kHz_SF12_915MHz
Order No/Sample No: 168367205/A003243357-027
Test Voltage:: AC 120V, 60Hz
Remark: Temp 23 Humi:53%
Test Standard: FCC 15.249
Tested By: Kei Zhang
Reviewed By: Terry Yin



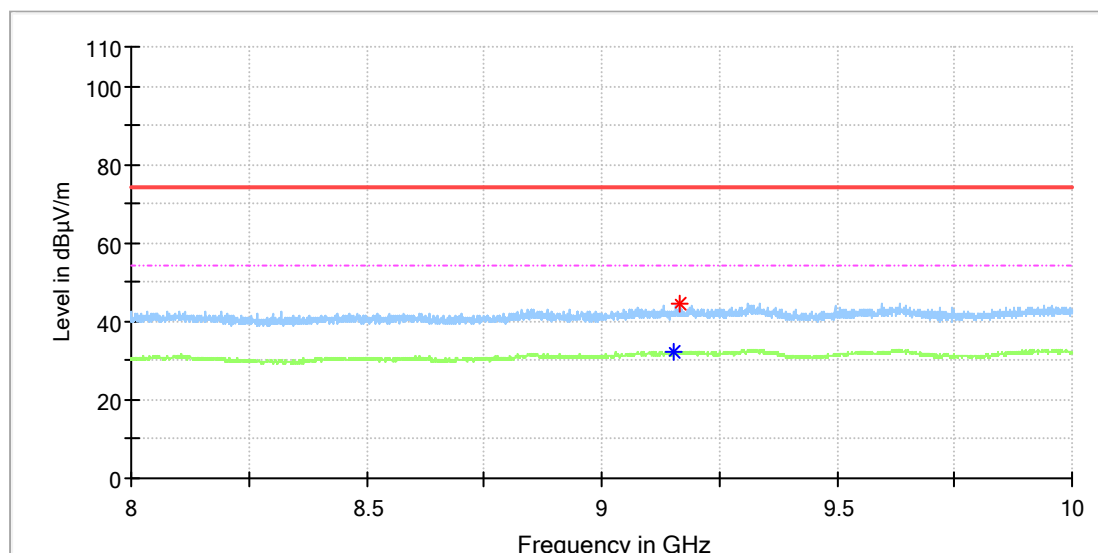
Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1829.300000	45.62	---	74.00	28.38	100.0	V	215.0	4.9
1829.300000	---	40.10	54.00	13.90	100.0	V	215.0	4.9
2743.850000	50.85	---	74.00	23.15	100.0	V	304.0	7.8
2744.687500	---	46.55	54.00	7.45	100.0	V	304.0	7.8
3659.237500	52.27	---	74.00	21.73	100.0	V	304.0	9.4
3659.237500	---	45.95	54.00	8.05	100.0	V	304.0	9.4
5489.175000	---	48.36	54.00	5.64	100.0	V	104.0	13.7
5490.012500	55.28	---	74.00	18.72	100.0	V	224.0	13.7
6404.562500	---	51.74	54.00	2.26	100.0	V	69.0	16.1
6405.400000	59.01	---	74.00	14.99	100.0	V	69.0	16.1

8-10GHz

EUT Information

EUT Name:	Combox
Model:	Combox Gen 2
Test Mode:	Lora 125k_SF12_915MHz
Order No/Sample No:	168367205/A003243357-027
Test Voltage::	AC 120V, 60Hz
Remark:	Temp 23 Humi:53%
Test Standard:	FCC 15.249
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

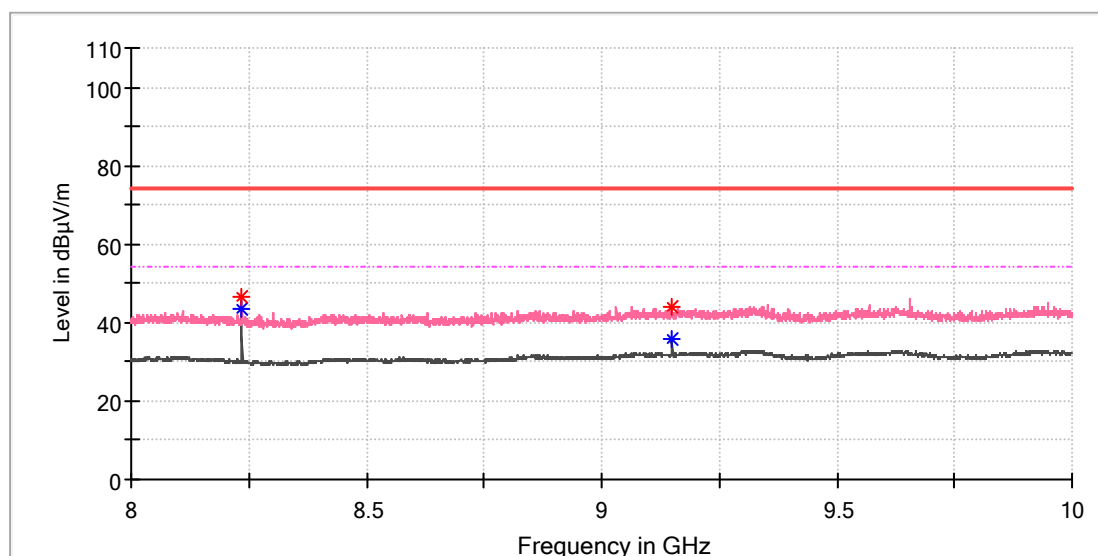


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
9155.000000	---	32.01	54.00	21.99	100.0	H	291.0	10.1
9168.000000	44.42	---	74.00	29.58	100.0	H	344.0	10.2

EUT Information

EUT Name:	Combox
Model:	Combox Gen 2
Test Mode:	Lora 125k_SF12_915MHz
Order No/Sample No:	168367205/A003243357-027
Test Voltage::	AC 120V, 60Hz
Remark:	Temp 23 Humi:53%
Test Standard:	FCC 15.249
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

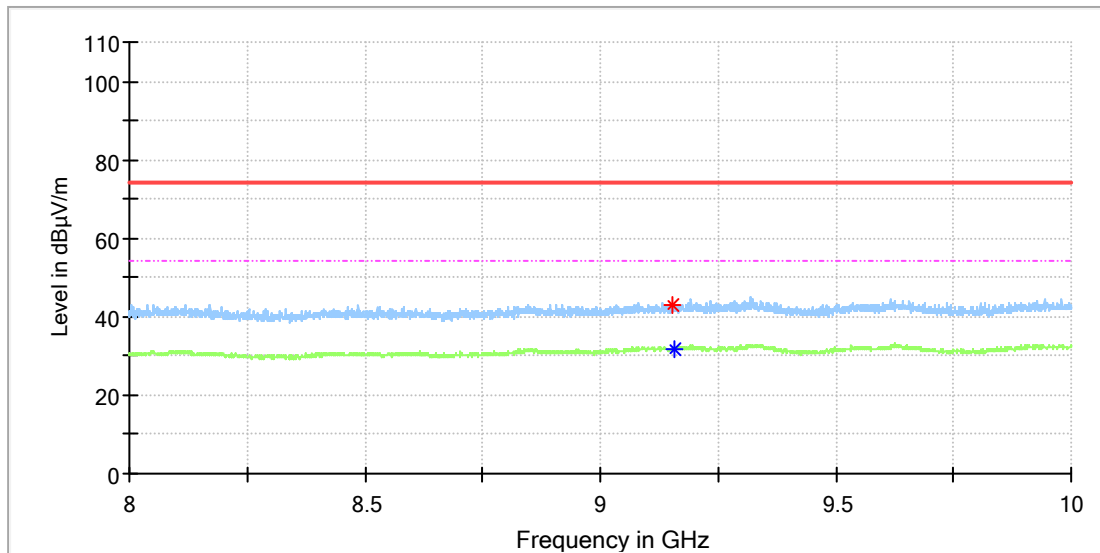


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
8235.000000	46.80	---	74.00	27.20	100.0	V	87.0	8.4
8235.000000	---	43.60	54.00	10.40	100.0	V	87.0	8.4
9150.500000	44.00	---	74.00	30.00	100.0	V	116.0	10.1
9150.500000	---	35.83	54.00	18.17	100.0	V	116.0	10.1

EUT Information

EUT Name:	Combox
Model:	Combox Gen 2
Test Mode:	Lora with OCW 250kHz_SF12_915MHz
Order No/Sample No:	168367205/A003243357-027
Test Voltage::	AC 120V, 60Hz
Remark:	Temp 23 Humi:53%
Test Standard:	FCC 15.249
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

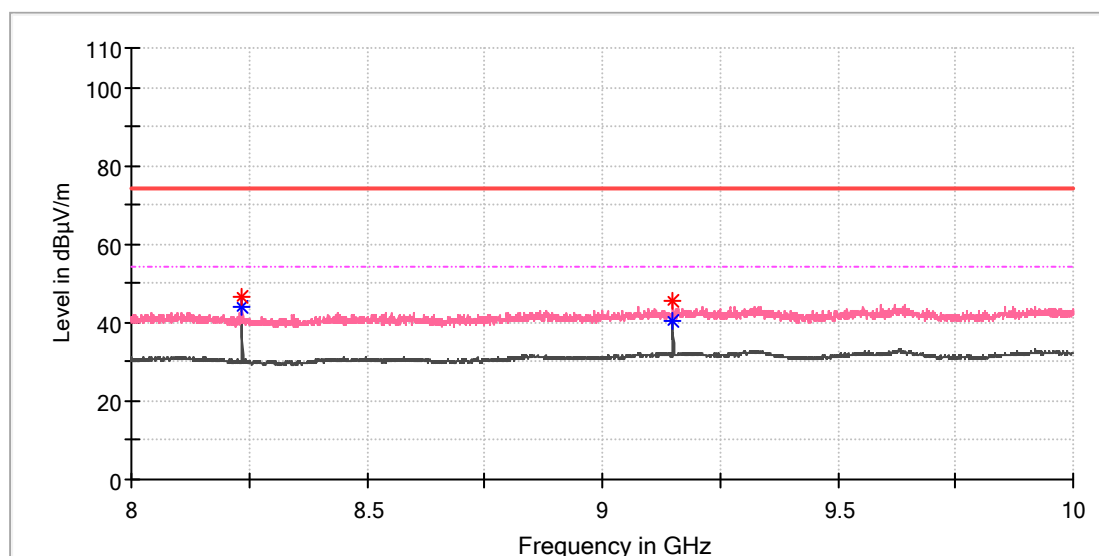


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
9152.000000	43.03	---	74.00	30.97	100.0	H	153.0	10.1
9155.500000	---	31.96	54.00	22.04	100.0	H	33.0	10.1

EUT Information

EUT Name:	Combox
Model:	Combox Gen 2
Test Mode:	Lora with OCW 250kHz_SF12_915MHz
Order No/Sample No:	168367205/A003243357-027
Test Voltage::	AC 120V, 60Hz
Remark:	Temp 23 Humi:53%
Test Standard:	FCC 15.249
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



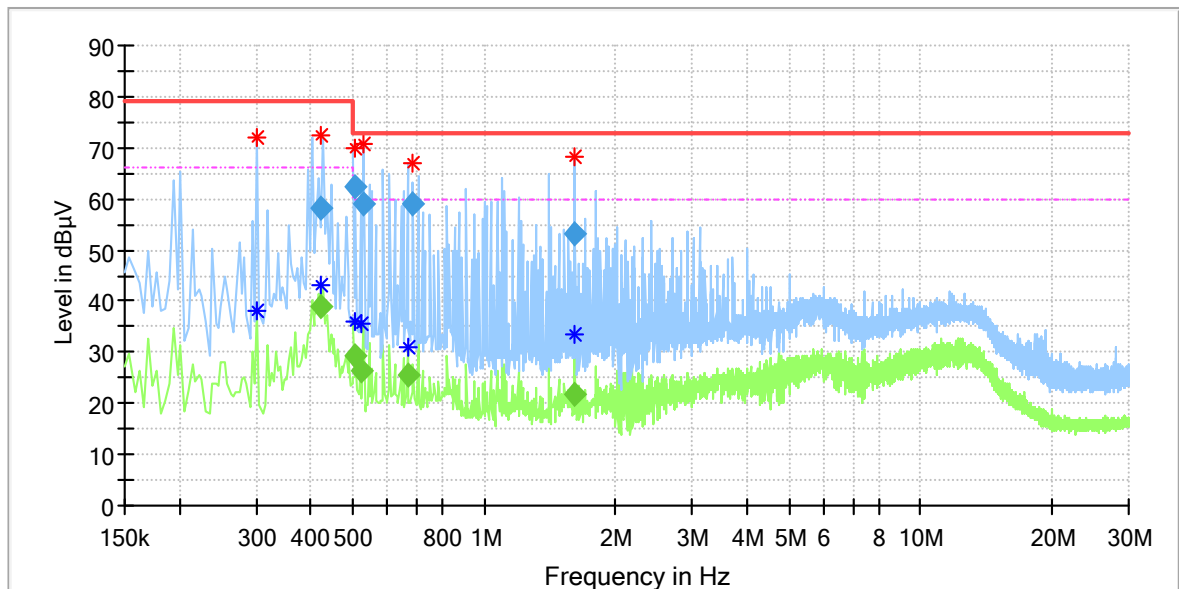
Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
8234.000000	46.75	---	74.00	27.25	100.0	V	76.0	8.4
8234.000000	---	43.90	54.00	10.10	100.0	V	76.0	8.4
9150.000000	45.71	---	74.00	28.29	100.0	V	143.0	10.1
9150.500000	---	40.52	54.00	13.48	100.0	V	143.0	10.1

Appendix B.4: Test Results of Conducted Emissions

EUT Information

EUT Name: Combox
Model: Combox Gen 2
Test Mode: Operating, AC input
Test Voltage: AC 120V/60Hz
Test By./Review By: Guangshen cen/Gary Chen
Standard: FCC Part 15B
Tem./Hum./Pressure: 23.2°C/50.8%/101kPa
Remark: SR1

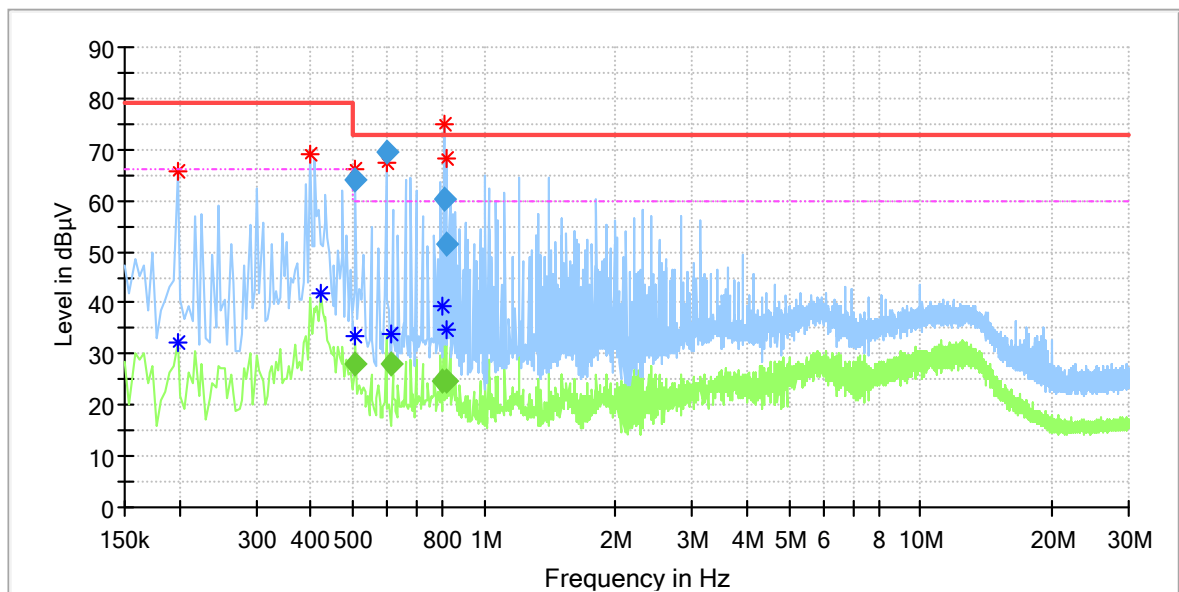


Final Result

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.424500	---	39.03	66.00	26.97	1000.0	9.000	L1	10.0
0.424500	58.03	---	79.00	20.97	1000.0	9.000	L1	10.0
0.508000	---	29.48	60.00	30.52	1000.0	9.000	L1	10.0
0.508000	62.51	---	73.00	10.49	1000.0	9.000	L1	10.0
0.522500	---	26.22	60.00	33.78	1000.0	9.000	L1	10.0
0.526500	59.15	---	73.00	13.85	1000.0	9.000	L1	10.0
0.666500	---	25.40	60.00	34.60	1000.0	9.000	L1	9.9
0.681500	59.21	---	73.00	13.79	1000.0	9.000	L1	9.9
1.602500	---	21.61	60.00	38.39	1000.0	9.000	L1	9.9
1.606500	53.28	---	73.00	19.72	1000.0	9.000	L1	9.9

EUT Information

EUT Name: Combox
Model: Combox Gen 2
Test Mode: Operating, AC input
Test Voltage: AC 120V/60Hz
Test By./Review By: Guangshen cen/Gary Chen
Standard: FCC Part 15B
Tem./Hum./Pressure: 23.2°C/50.8%/101kPa
Remark: SR1



Final Result

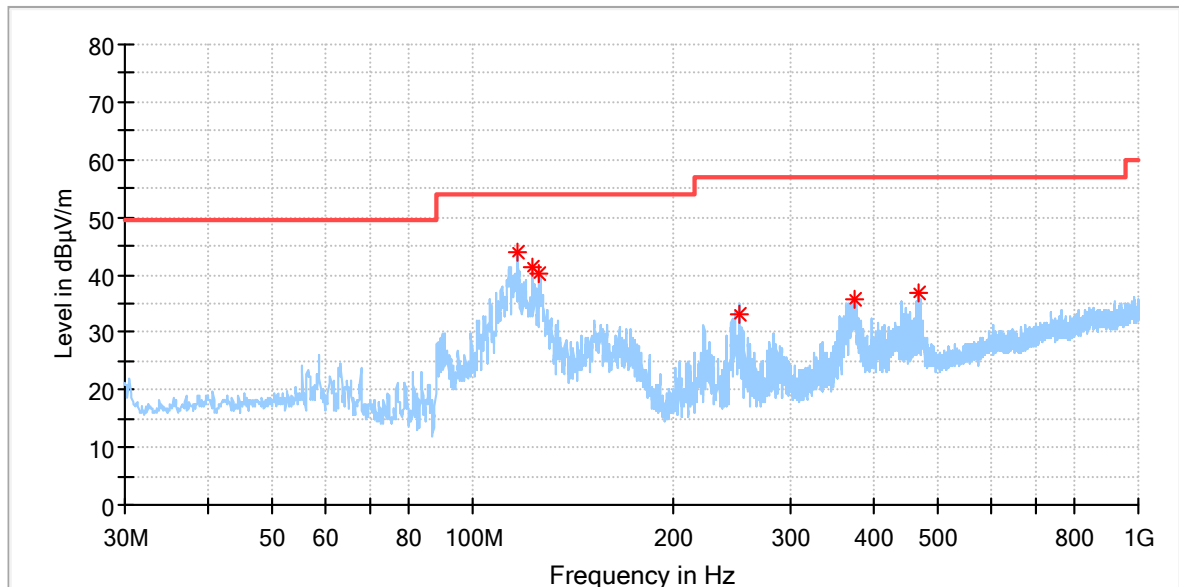
Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.508000	---	28.13	60.00	31.87	1000.0	9.000	N	9.8
0.508000	63.94	---	73.00	9.06	1000.0	9.000	N	9.8
0.598500	69.56	---	73.00	3.44	1000.0	9.000	N	9.9
0.609500	---	27.88	60.00	32.12	1000.0	9.000	N	9.9
0.798500	---	24.80	60.00	35.20	1000.0	9.000	N	9.8
0.810500	60.24	---	73.00	12.76	1000.0	9.000	N	9.8
0.818500	---	24.83	60.00	35.17	1000.0	9.000	N	9.8
0.818500	51.58	---	73.00	21.42	1000.0	9.000	N	9.8

Appendix B.5: Test Results of Radiated Emissions

Ext-I/O version:

EUT Information

EUT Name:	Combox
Model:	Combox Gen 2
Test Mode:	Operating,
Test Voltage	AC 120V60Hz
Test Standard:	FCC Part 15B
Test By:/Review By:	Guangshen / Gary Chen
Tem./Hum./Pressure:	24.3°C/51.6%/101kPa
Remark:	3m chamber

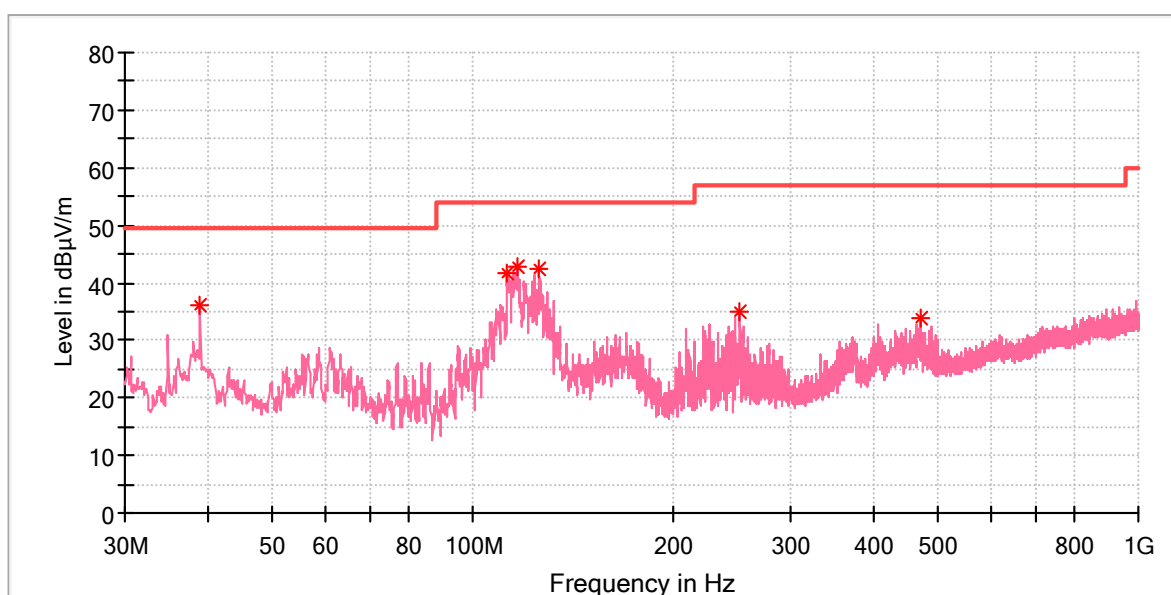


Critical Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
116.815000	44.09	54.00	9.91	300.0	H	17.0	18.1
123.023000	41.21	54.00	12.79	300.0	H	50.0	18.6
126.030000	40.07	54.00	13.93	300.0	H	50.0	18.9
251.548000	33.00	56.90	23.90	100.0	H	1.0	19.7
375.514000	35.85	56.90	21.05	100.0	H	1.0	23.6
467.567000	36.87	56.90	20.03	200.0	H	20.0	26.0

EUT Information

EUT Name: Combox
Model: Combox Gen 2
Test Mode: Operating,
Test Voltage: AC 120V60Hz
Test Standard: FCC Part 15B
Test By./Review By: Guangshen / Gary Chen
Tem./Hum./Pressure: 24.3°C/51.6%/101kPa
Remark: 3m chamber



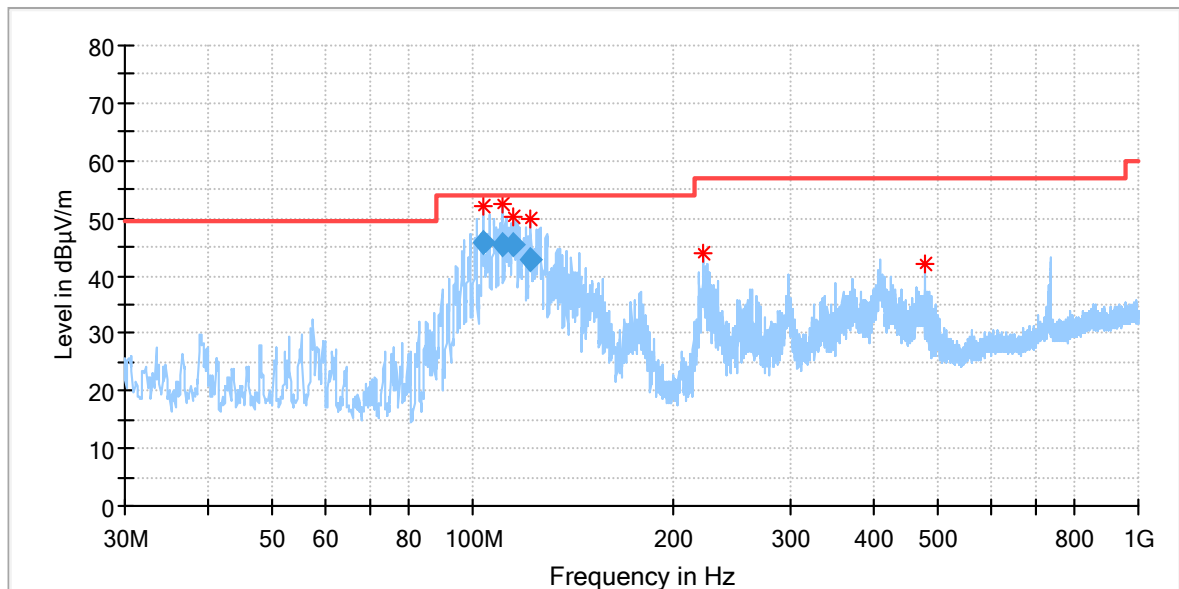
Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
38.827000	36.27	49.50	13.23	100.0	V	359.0	20.0
112.547000	41.86	54.00	12.14	100.0	V	119.0	17.7
116.718000	42.97	54.00	11.03	100.0	V	336.0	18.1
125.933000	42.46	54.00	11.54	100.0	V	336.0	18.9
252.130000	34.95	56.90	21.95	100.0	V	95.0	19.7
470.380000	33.94	56.90	22.96	100.0	V	76.0	26.1

Touch screen version:

EUT Information

EUT Name: Combox
Model: Combox Gen 2
Test Mode: Operating,
Test Voltage: AC 120V60Hz
Test Standard: FCC Part 15B
Test By:/Review By: Guangshen / Gary Chen
Tem./Hum./Pressure: 24.3°C/51.6%/101kPa
Remark: 3m chamber



Critical_Freqs

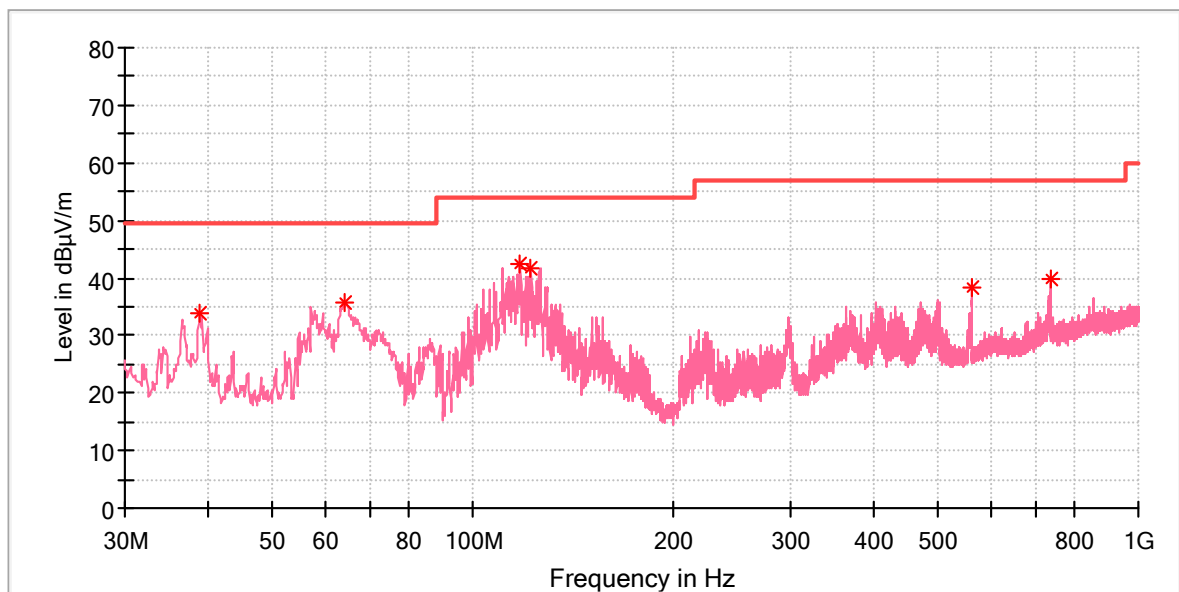
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
103.760000	52.03	54.00	1.97	200.0	H	182.0	16.7
110.681000	52.40	54.00	1.60	200.0	H	197.0	17.5
115.303000	50.18	54.00	3.82	200.0	H	229.0	18.0
122.247000	49.90	54.00	4.10	200.0	H	229.0	18.6
221.575000	43.85	56.90	13.05	200.0	H	124.0	17.8
476.394000	42.01	56.90	14.89	100.0	H	72.0	26.2

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
103.760000	45.83	54.00	8.17	1000.0	113.000	120.0	H	182.0	16.7
110.681000	45.47	54.00	8.53	1000.0	120.000	230.0	H	197.0	17.5
115.303000	45.29	54.00	8.71	1000.0	170.000	210.0	H	229.0	18.0
122.247000	42.62	54.00	11.38	1000.0	120.000	200.0	H	229.0	18.6

EUT Information

EUT Name: Combox
Model: Combox Gen 2
Test Mode: Operating,
Test Voltage: AC 120V60Hz
Test Standard: FCC Part 15B
Test By:/Review By: Guangshen / Gary Chen
Tem./Hum./Pressure: 24.3°C/51.6%/101kPa
Remark: 3m chamber

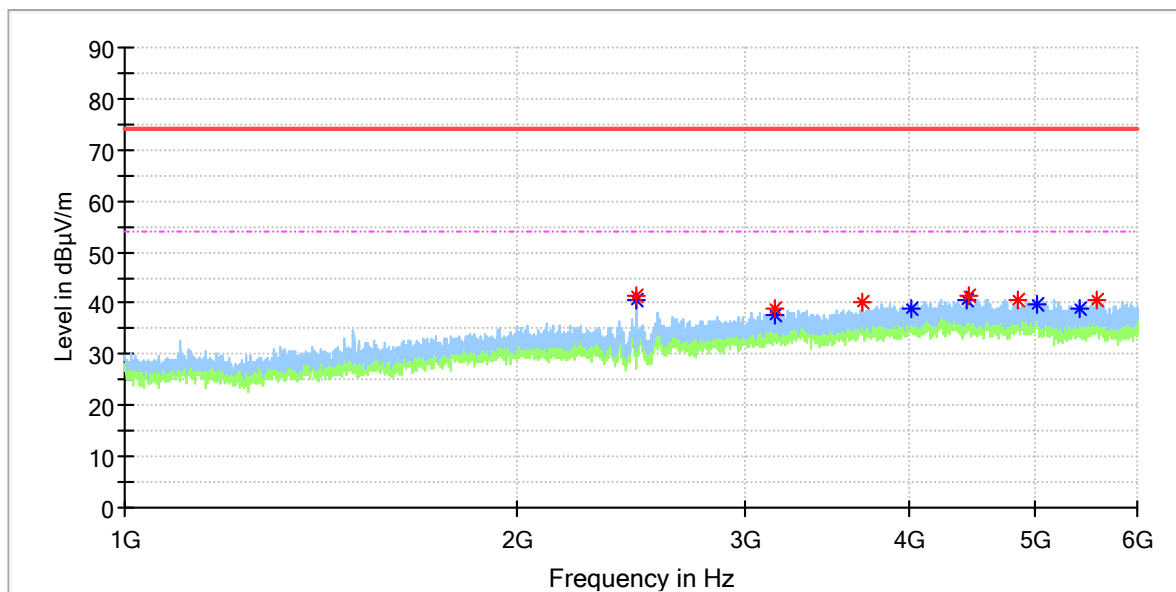


Critical Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
38.827000	33.96	49.50	15.54	100.0	V	324.0	20.0
64.338000	35.81	49.50	13.69	100.0	V	276.0	19.4
117.979000	42.42	54.00	11.58	100.0	V	99.0	18.2
122.247000	41.80	54.00	12.20	100.0	V	26.0	18.6
560.978000	38.19	56.90	18.71	100.0	V	132.0	27.8
738.003000	39.80	56.90	17.10	300.0	V	151.0	31.6

EUT Information

EUT Name: Combox
Model: Combox Gen 2
Test Mode: Operating,
Test Voltage: AC 120V/60Hz
Test Standard: FCC Part 15B
Test By./Review By: Guangshen / Gary Chen
Tem./Hum./Pressure: 23.3°C/50.6%/101kPa
Remark: 3m chamber

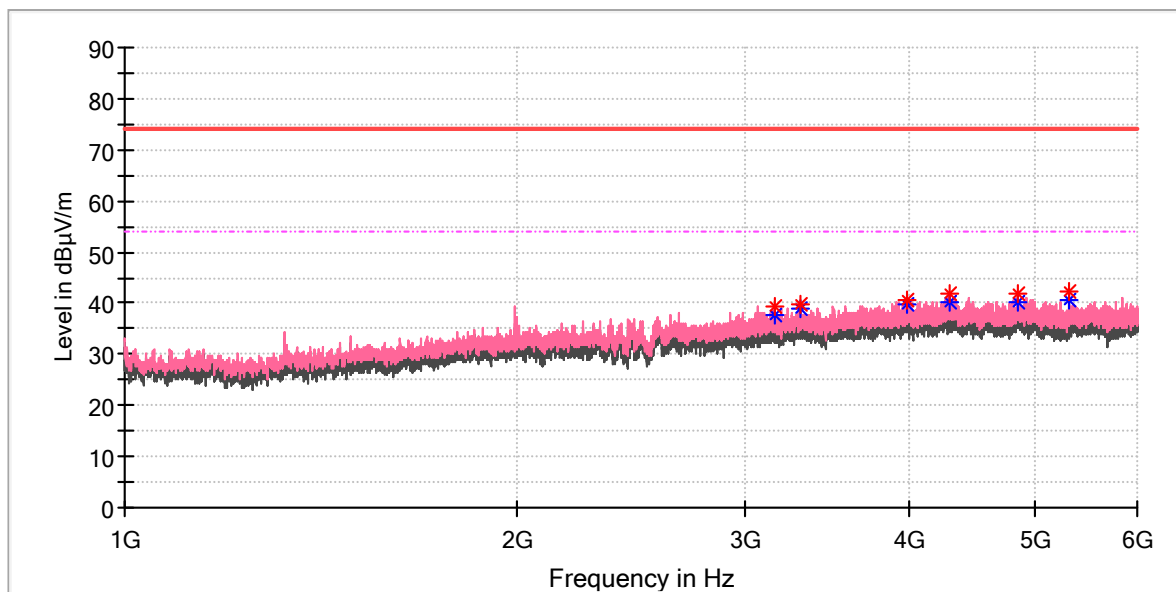


Critical_Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4017.500000	---	39.14	54.00	14.86	100.0	H	6.0	0.0
2470.000000	41.31	---	74.00	32.69	100.0	H	65.0	-5.6
2470.000000	---	40.69	54.00	13.31	100.0	H	65.0	-5.6
5586.000000	40.42	---	74.00	33.58	100.0	H	74.0	2.1
3691.000000	40.16	---	74.00	33.84	100.0	H	134.0	-0.8
4865.000000	40.67	---	74.00	33.33	100.0	H	166.0	1.8
5412.000000	---	39.06	54.00	14.94	100.0	H	240.0	2.0
3156.000000	---	37.83	54.00	16.17	100.0	H	249.0	-2.6
3156.000000	38.99	---	74.00	35.01	100.0	H	249.0	-2.6
4450.000000	41.40	---	74.00	32.60	100.0	H	277.0	1.1
5032.000000	---	39.67	54.00	14.33	100.0	H	277.0	1.6
4437.500000	---	40.74	54.00	13.27	100.0	H	346.0	0.8

EUT Information

EUT Name: Combox
Model: Combox Gen 2
Test Mode: Operating,
Test Voltage: AC 120V/60Hz
Test Standard: FCC Part 15B
Test By:/Review By: Guangshen / Gary Chen
Tem./Hum./Pressure: 23.3°C/50.6%/101kPa
Remark: 3m chamber



Critical_Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3304.500000	39.77	---	74.00	34.23	100.0	V	14.0	-1.9
3304.500000	---	39.07	54.00	14.93	100.0	V	14.0	-1.9
5323.000000	---	40.62	54.00	13.38	100.0	V	113.0	1.6
5323.000000	42.09	---	74.00	31.91	100.0	V	113.0	1.6
3991.000000	---	39.62	54.00	14.38	100.0	V	150.0	0.0
3991.000000	40.49	---	74.00	33.51	100.0	V	150.0	0.0
4299.000000	41.65	---	74.00	32.35	100.0	V	196.0	1.2
4299.000000	---	40.16	54.00	13.84	100.0	V	196.0	1.2
3162.000000	---	37.59	54.00	16.41	100.0	V	233.0	-2.6
3162.000000	39.46	---	74.00	34.54	100.0	V	233.0	-2.6
4858.000000	41.91	---	74.00	32.09	100.0	V	322.0	1.8
4864.500000	---	39.98	54.00	14.02	100.0	V	346.0	1.8