

Prüfbericht-Nr.: <i>Test report no.:</i>	CN21EWDY(P15C-THREAD) 001	Auftrags-Nr.: <i>Order no.:</i>	238515036	Seite 1 von 27 Page 1 of 27
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	2021-06-28	
Auftraggeber: <i>Client:</i>	Eve Systems LLC 100 Pine St., Suite 1250, San Francisco CA 94111 United States Of America (Excluding The States Of Alaska)			
Prüfgegenstand: <i>Test item:</i>	Eve Room			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	20EBX9901			
Auftrags-Inhalt: <i>Order content:</i>	FCC Part 15C Test report (THREAD)			
Prüfgrundlage: <i>Test specification:</i>	FCC 47CFR Part 15: Subpart C Section 15.247			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2021-08-23			
Prüfmuster-Nr.: <i>Test sample no.:</i>	A003115240-002 A003115240-005			
Prüfzeitraum: <i>Testing period:</i>	2021-08-30 - 2021-09-10			
Ort der Prüfung: <i>Place of testing:</i>	EMC/RF Taipei Testing Site			
Prüflaboratorium: <i>Testing laboratory:</i>	Taipei Testing Laboratories			
Prüfergebnis*: <i>Test result*:</i>	Pass			
überprüft von: <i>reviewed by:</i>	genehmigt von: <i>authorized by:</i>			
Datum: <i>Date:</i> 2021-10-07	 Ryan Chen		 Brenda Chen	
Stellung / Position:	Senior Project Manager		Senior Project Manager	
Sonstiges / Other:	There is an alternative material of touch function which IC has been evaluated in this report, and the function are all the same.			
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:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	4 = ausreichend N/A = nicht anwendbar
* Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory F(ail) = failed a.m. test specification(s)	4 = sufficient N/A = not applicable
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>				

TEST SUMMARY

Report Section	FCC Clause	Test Item	Result
5.1.1	15.247(b) & 15.203	Antenna Requirement	Pass
5.1.2	15.247(b)(3)	Peak Output Power	Pass
5.1.3	15.247(a)(2)	6 dB Bandwidth	Pass
5.1.3	2.1049	99% Occupied Bandwidth	Pass
5.1.4	15.247(e)	Power Spectral Density	Pass
5.1.5	15.247(d)	Conducted Spurious Emissions and Band Edges	Pass
5.1.6	15.247(d) & 15.205 & 15.209	Radiated Spurious Emissions and Band Edges	Pass
5.2.1	15.207	Mains Conducted Emission	Pass

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

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APPENDIX B - TEST RESULT OF RADIATED EMISSIONS & MAINS CONDUCTED EMISSION

APPENDIX SP - PHOTOGRAPHS OF TEST SETUP

APPENDIX EP - PHOTOGRAPHS OF EUT

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HISTORY OF THIS TEST REPORT

Report No.	Description	Date Issued
CN21EWDY(P15C-THREAD) 001	Original Release	2021-10-07

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 - Test Result of Conducted

Appendix B - Test Result of Radiated Emissions & Mains Conducted Emission

Appendix SP - Photographs of Test Setup

Appendix EP - Photographs of EUT

Applied Standard and Test Levels

Radio
FCC 47CFR Part 15: Subpart C Section 15.247
FCC 47CFR Part 2: Subpart J Section 2.1049
ANSI C63.10:2013
KDB 558074 D01 15.247 Meas Guidance v05r02
KDB 447498 D01 General RF Exposure Guidance v06

1.2 Decision Rule of Conformity

The decision rule of conformity of this test report is following the requirements of the requested standard in the quotation, and agreed among testing laboratory and manufacturer (applicant) to exclude the consideration of Measurement Uncertainty, unless it is required by the specific standard.

2. Test Sites

2.1 Test Laboratory

Taipei Testing Laboratories

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

2.2 Test Facility

Taipei Testing Laboratories

No.458-18, Sec. 2, Fenliao Rd., Linkou Dist.,
New Taipei City 244
Taiwan (R.O.C.)
FCC Registration No.: 226631
ISED Registration No.: 25563

2.3 Traceability

All measurement equipment calibrations are traceable to NML(Taiwan)/NIST(USA) or where calibration is performed outside Taiwan, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically in a suitably accredited Calibration Lab. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

All measurement uncertainty values are shown with a coverage factor of $k=2$ to indicate a 95% level of confidence.

Emission Measurement Uncertainty

Parameter	Uncertainty
Radiated Emission (9 kHz ~ 30 MHz)	± 1.15 dB
Radiated Emission (30 MHz ~ 200 MHz)	± 1.32 dB
Radiated Emission (200 MHz ~ 1 GHz)	± 1.31 dB
Radiated Emission (1 GHz ~ 18 GHz)	± 1.53 dB
Radiated Emission (18 GHz ~ 40 GHz)	± 2.50 dB
Mains Conducted Emission	± 1.65 dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT is an Eve Room. It contains a Thread compatible module enabling the user to communicate data through a Wireless interface.

For details refer to the User Guide, Data Sheet and Circuit Diagram.

3.2 System Details and Ratings

Basic Information of EUT

Item	EUT information
Kind of Equipment/Test Item	Eve Room
Type Identification	20EBX9901
FCC	SNE-ROOM-003

Technical Specification of EUT

Item	EUT information
Operating Frequency	2405 MHz ~ 2480 MHz
Channel Spacing	5 MHz
Channel number	16
Data Rate	250kbps
Operation Voltage	3.7Vdc (battery); Tested at 5Vdc (USB)
Modulation	GFSK
Maximum Output Power (mW)	4.9
Antenna Information	Refer to 5.1.1
Accessory Device	Refer to 4.4

3.3 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.4 Submitted Documents

- Circuit Diagram
- Instruction Manual
- Rating Label
- Technical Description

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The test modes were adapted accordingly in reference to the instructions for use.

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output expected by the customer and is going to be fixed on the firmware of the final end product.

Table for Parameters of Test Software Setting

Frequency (MHz)	Power Setting
2405	8
2440	8
2480	8

4.2 Carrier Frequency and Channel

Channel	Freq. (MHz)	Channel	Freq. (MHz)
11	2405	19	2445
12	2410	20	2450
13	2415	21	2455
14	2420	22	2460
15	2425	23	2465
16	2430	24	2470
17	2435	25	2475
18	2440	26	2480

4.3 Test Operation and Test Software

Setup for testing: The Eve Room is provided with an USB interface which makes it possible to control the module through the test software installed on a notebook computer.

This software was running on the laptop computer connected to the EUT.

It was used to enable the operation modes listed as below.

Test Software	Tera Term
---------------	-----------

The samples were used as follows:

A003115240-002 for radiated test

A003115240-005 for conducted test

Full test was applied on all test modes, but only worst case was shown.

EUT Configure Mode	Applicable To				Description
	Antenna Port Conducted Measurement	Radiated Spurious Emissions above 1 GHz	Radiated Spurious Emissions below 1 GHz	Mains Conducted Emission	
-	√	√	√	√	-
Alternative materials	-	√	√	-	-

Note:

1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when position on Y-plane.
2. "-" means no effect.

Antenna Port Conducted Measurement

☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Frequency (MHz)	Tested Frequency (MHz)	Date Rate (Mbps)
-	2405 to 2480	2405, 2440, 2480	0.25

Radiated Spurious Emissions (Above 1 GHz)

☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Frequency (MHz)	Tested Frequency (MHz)	Date Rate (Mbps)
-	2405 to 2480	2405, 2440, 2480	0.25
Alternative materials	2405 to 2480	2440	0.25

Radiated Spurious Emissions (Below 1 GHz)

☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Frequency (MHz)	Tested Frequency (MHz)	Date Rate (Mbps)
-	2405 to 2480	2405	0.25
Alternative materials	2405 to 2480	2440	0.25

Mains Conducted Emission

☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Frequency (MHz)	Tested Frequency (MHz)	Date Rate (Mbps)
-	2405 to 2480	2480	0.25

Test Condition

Test Item	Ambient Temperature	Relative Humidity	Tested by
Conducted Measurement	24-24.2 °C	47-58 %	Stanislas Charles
Radiated Spurious Emissions above 1 GHz	21.2-23.2 °C	68-70 %	Simon Tsai
Radiated Spurious Emissions below 1 GHz	21.2-23.2 °C	68-70 %	Simon Tsai
Mains Conducted Emission	19 °C	61 %	Simon Tsai

4.4 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

Accessory of EUT

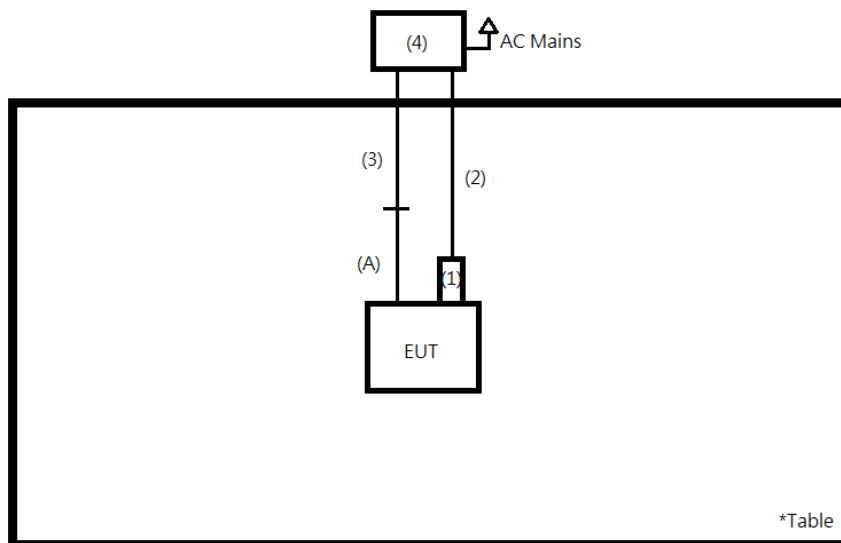
No.	Product	Brand	Model	Description
-	Li-Polymer Battery	YJ	372528	3.7 Vdc, 2400 mAh

Support Unit

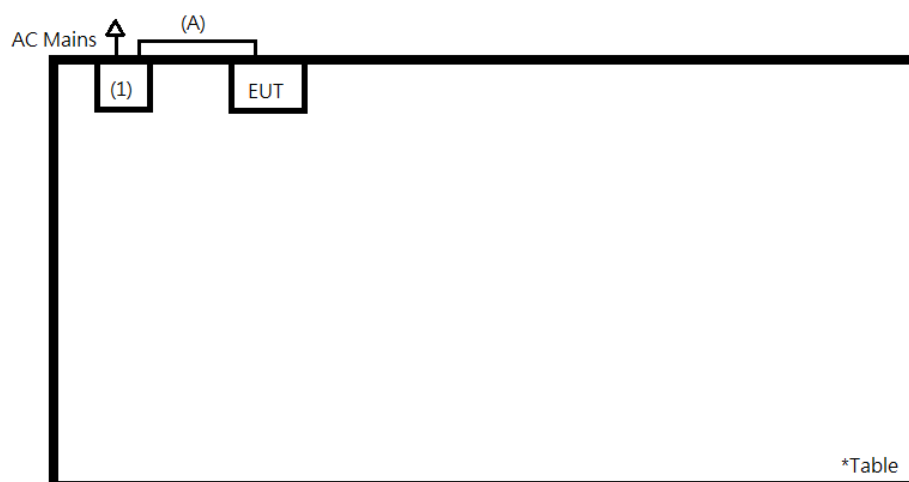
No.	Description	Brand	Model	S/N	Remark
Radiated Test					
A	USB Cable	Dexatek	E343712	-	100 cm shielded cable w/o core
1	UART	TUV	CP2102	-	-
2	USB Cable	Pro-Best	MK-USBMF-3M	-	300 cm shielded cable w/o core
3	USB Cable	Pro-Best	MK-USBMF-3M	-	300 cm shielded cable w/o core
4	Notebook	Lenovo	TP00094F	PF-1V4YV0	-
Mains Conducted Emission					
A	Micro USB Cable	Dexatek	E343712	-	100 cm shielded cable w/o core
1	Adapter	Dongguan Aohai	A18A-050100U-US2	-	-
-	UART	TUV	CP2102	-	-
-	Notebook	Lenovo	TP00094F	PF-1V4YV0	-

4.5 Test Setup Diagram

<Radiated Spurious Emissions mode>



<Mains Conducted Emission mode>



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

Requirement Use of approved antennas only

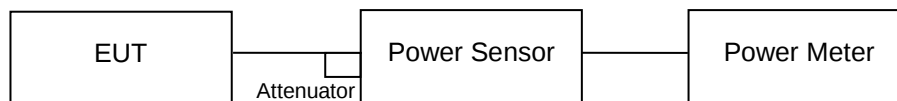
According to the manufacturer declaration, the EUT has an antenna with a directional gain of 1.9 dBi. The antenna is a PCB antenna with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision.
Refer to EUT photo for details.

5.1.2 Peak Output Power

Limit 1 watt (30 dBm) for Conducted Output Power

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Power Meter	Anritsu	ML2495A	1901008	2021/3/24	2022/3/23	2021/8/30	2021/8/30
Power Sensor	Anritsu	MA2411B	1725269	2021/3/24	2022/3/23	2021/8/30	2021/8/30

Test Procedures

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

Test Result**Peak Output Power**

Channel	Channel Frequency	Peak Output Power		Limit (dBm)
	(MHz)	(dBm)	(mW)	
Low Channel	2405	6.66	4.63	30
Middle Channel	2440	6.90	4.90	30
High Channel	2480	6.21	4.18	30

Average Power

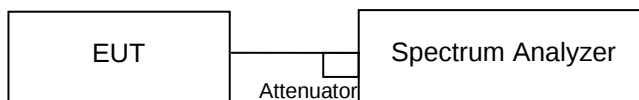
Channel	Channel Frequency	Average Power	
	(MHz)	(dBm)	(mW)
Low Channel	2405	6.62	4.59
Middle Channel	2440	6.87	4.86
High Channel	2480	6.17	4.14

5.1.3 6 dB Bandwidth and 99% Occupied Bandwidth

Limit The minimum 6 dB bandwidth shall be at least 500 kHz.

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2021/1/29	2022/1/28	2021/8/30	2021/9/6

Test Procedure

- Set resolution bandwidth (RBW) = 100 kHz
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.
- For 99% occupied bandwidth measurement, the transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to PEAK. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean power of a given emission.

Test Results

Please refer to Appendix A.

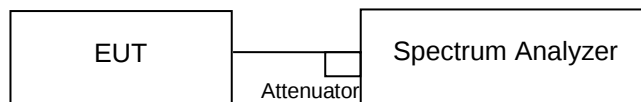
5.1.4 Power Spectral Density

Limit

The power spectral density shall not be greater than 8 dBm in any 3 kHz band.

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2021/1/29	2022/1/28	2021/8/30	2021/9/6

Test Procedure

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- Set the VBW $\geq 3 \times \text{RBW}$.
- 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 within the RBW.

Test Results

Please refer to Appendix A.

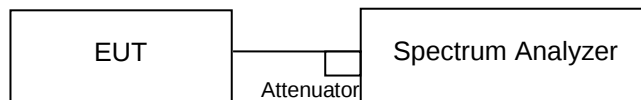
5.1.5 Conducted Spurious Emissions and Frequency Band Edges Measured in 100kHz Bandwidth

Limit

20dB (below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.)

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2021/1/29	2022/1/28	2021/8/30	2021/9/6

Test Procedure

Measurement procedure REF

1. Set the RBW = 100 kHz.
2. Set the VBW $\geq$ 300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

Measurement procedure OOB

1. Set RBW = 100 kHz.
2. Set VBW $\geq$ 300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

Test Results

Please refer to Appendix A.

5.1.6 Radiated Spurious Emissions and Band Edges

Limit

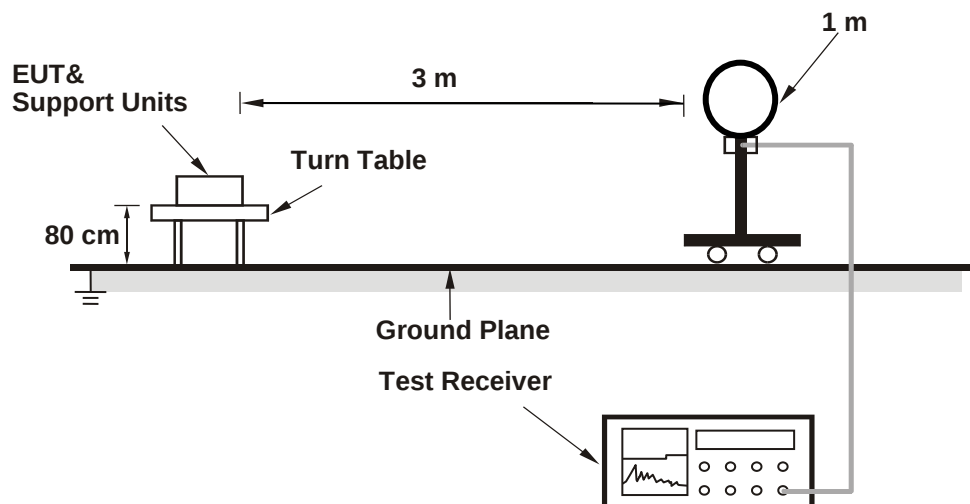
Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a).

Emissions radiated outside the restricted and authorized frequency bands must either comply with the radiated emission limits specified for the restricted bands or in §15.247(d).

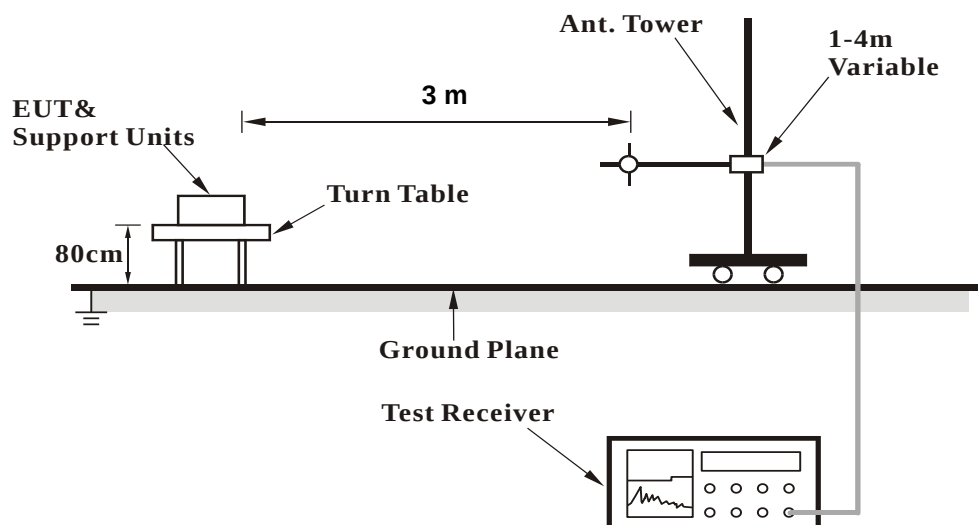
Kind of Test Site 3m Semi-Anechoic Chamber

Test Setup

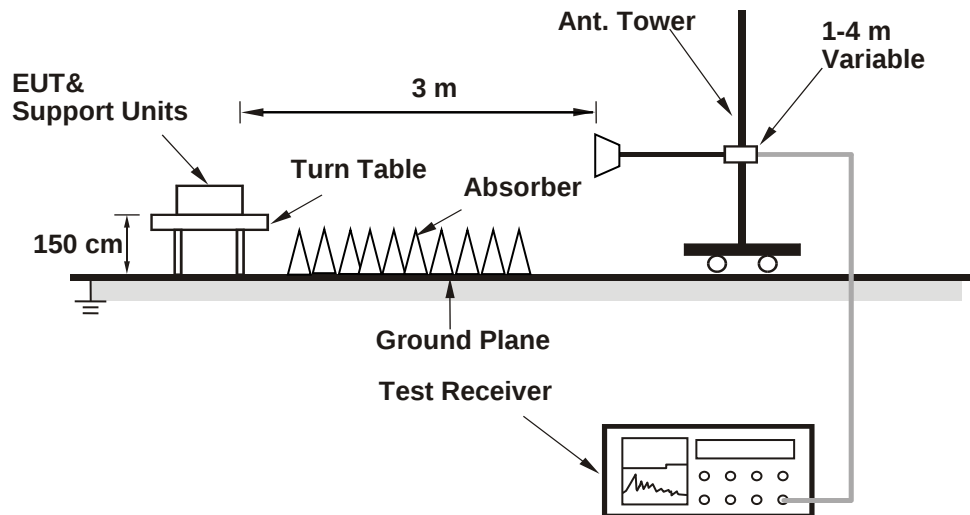
<Radiated Emissions below 30 MHz>



<Radiated Emissions 30 MHz to 1 GHz>



<Radiated Emissions above 1 GHz>



For the actual test configuration, please refer to the attached file (Test Setup Photo).

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Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
Signal Analyzer	R&S	FSV40	101509	2021/3/24	2022/3/23
Receiver	R&S	ESR7	102108	2021/3/17	2022/3/16
Bilog Antenna	SCHWARZBECK	VULB-9168	00950	2021/1/25	2022/1/24
Horn Antenna	ETS-Lindgren	3117	00218929	2020/11/6	2021/11/5
LF-AMP	Agilent	8447D	2727A05146	2021/2/1	2022/1/31
HF-AMP + AC source	EMCI	EMC051845SE	980635	2021/2/1	2022/1/31
HF-AMP + AC source	EMCI	EMC184045SE	980656	2021/2/9	2022/2/8
Horn Antenna	SCHWARZBECK	BBHA 9170	00890	2021/4/14	2022/4/13
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104EA	800057/4EA	2021/4/14	2022/4/13
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104	802244/4	2021/4/14	2022/4/13
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104	MY37203/4	2021/4/14	2022/4/13
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	800897/2EA	2021/3/11	2022/3/10
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	800902/2EA	2021/3/11	2022/3/10
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	801026/2EA	2021/3/11	2022/3/10
Loop Antenna	Chance Most	EMCILPA600 +calibration	287	2021/6/17	2022/6/16

Test Procedures**For Radiated Emissions below 30 MHz**

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel (OPEN), perpendicular (CLOSE), and ground-parallel (GROUND) orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz at frequency below 30 MHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

For Radiated Emissions above 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1 GHz) / 1.5 meters (for above 1 GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98 %) or 10 Hz (Duty cycle ≥ 98 %) for Average detection (AV) at frequency above 1 GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.
5. The Radiated Emissions testing was performed in the X(E1), Y(H) and Z(E2) axis orientation. The worst-case Axis orientation is recorded in this test report.

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Test Results

Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB)
Level (dBuV/m) = Reading (dBuV) + Factor (dB/m)

Please refer to Appendix B.

5.2 Mains Emission

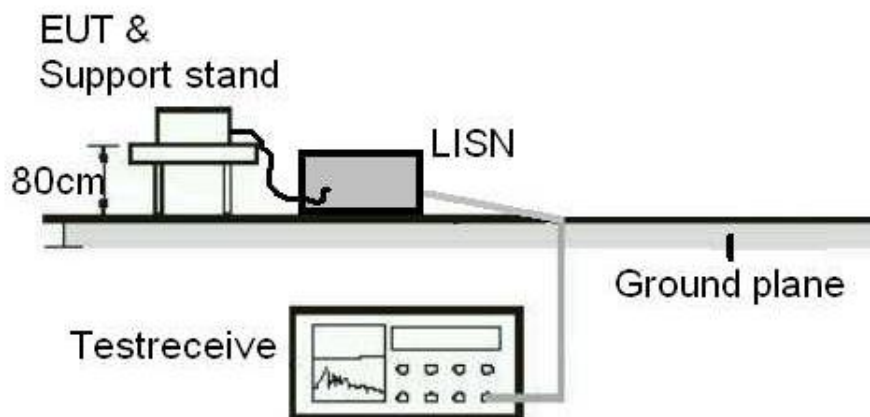
5.2.1 Mains Conducted Emission

Limit

Mains Conducted Emission as defined in §15.207 must comply with the mains conducted emission limits.

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
TWO-LINE V-NETWORK	R&S	ENV216	1816064	2020/9/10	2021/9/9
EMI Test Receiver	R&S	ESCI	1816063	2020/11/17	2021/11/16
RF Cable	N/A	N/A	EMC-003	2020/11/15	2021/11/14

Test Procedures

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50 uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

Note: The resolution bandwidth and video bandwidth of test receiver is 9 kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15 MHz – 30 MHz.

Test Results

Please refer to Appendix B.

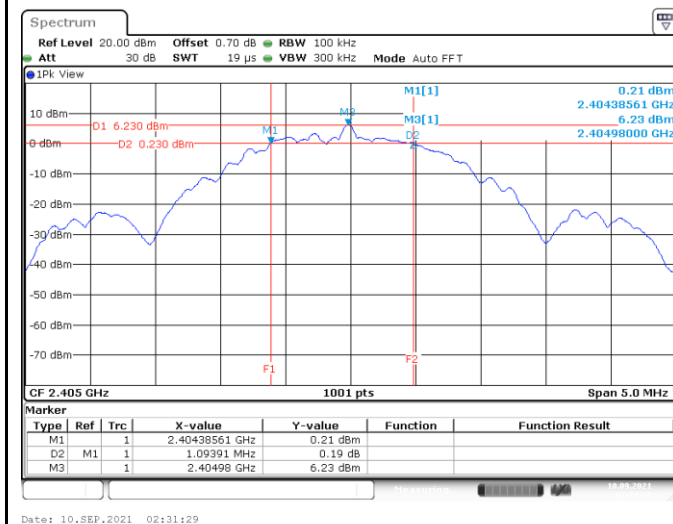
Appendix A: Test Results of Conducted Test

Test Result of 6 dB Bandwidth

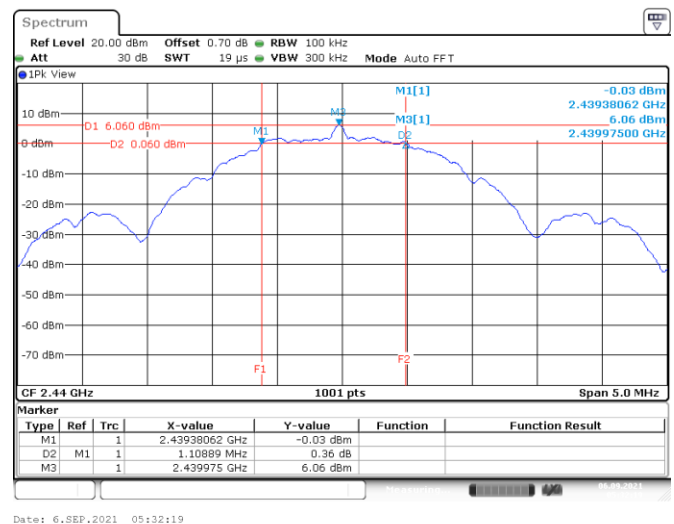
Thread

Channel	Channel Frequency (MHz)	6 dB Bandwidth (kHz)	Limit (kHz)	Result
Low Channel	2405	1093.91	> 500	Pass
Middle Channel	2440	1108.89	> 500	Pass
High Channel	2480	1128.87	> 500	Pass

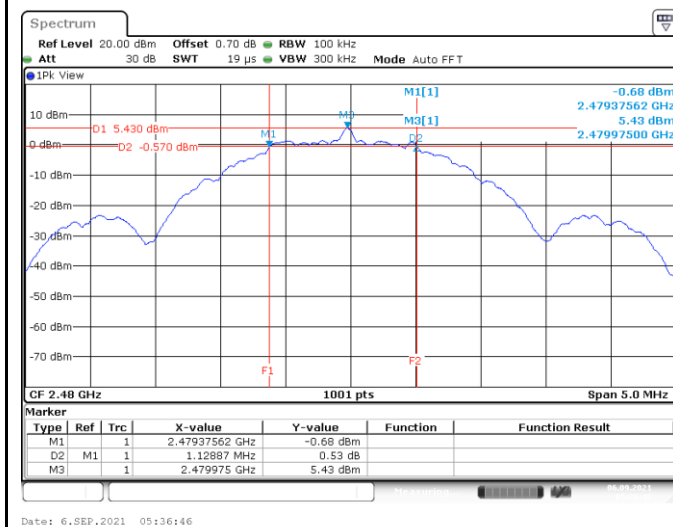
Low Channel



Middle Channel



High Channel

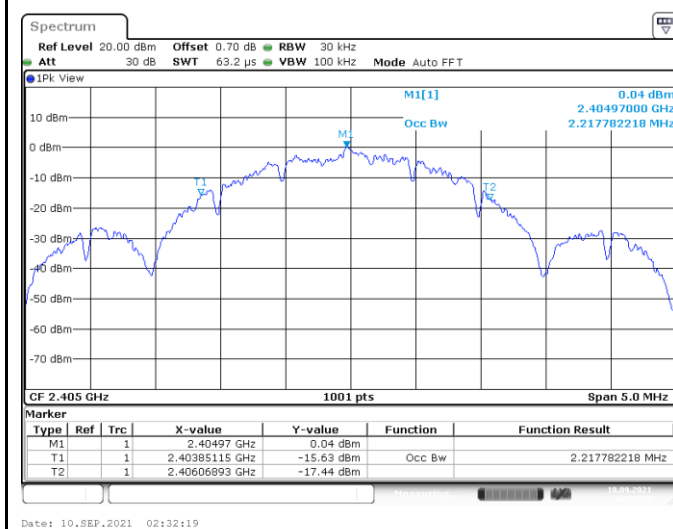


Test Result of 99% Occupied Bandwidth

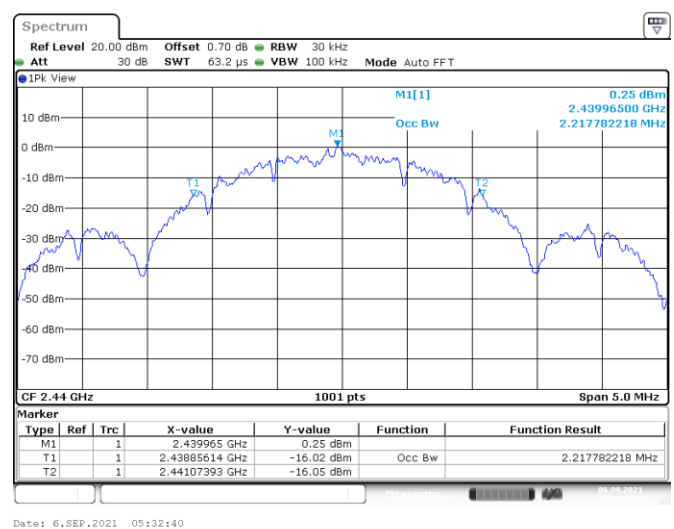
Thread

Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)
Low Channel	2405	2.22
Middle Channel	2440	2.22
High Channel	2480	2.23

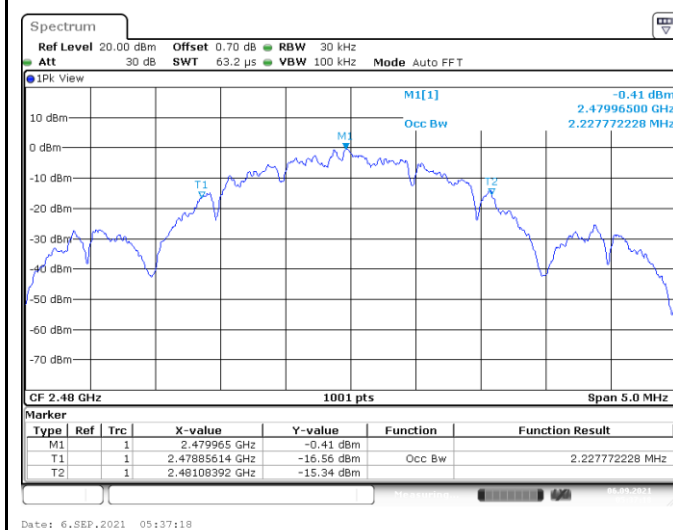
Low Channel



Middle Channel



High Channel

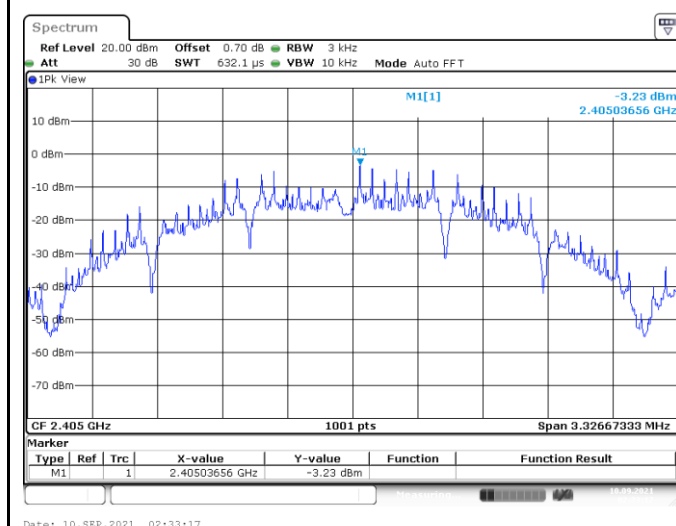


Test Result of Power Spectral Density

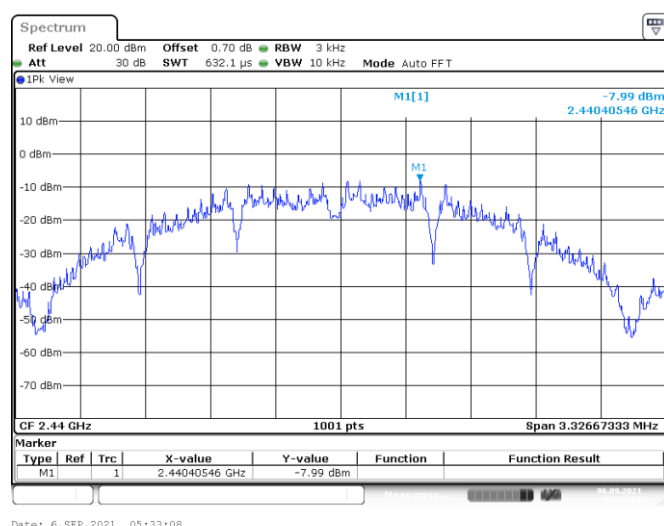
Thread

Channel	Channel Frequency (MHz)	Power Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
Low Channel	2405	-3.23	8	Pass
Middle Channel	2440	-7.99	8	Pass
High Channel	2480	-8.52	8	Pass

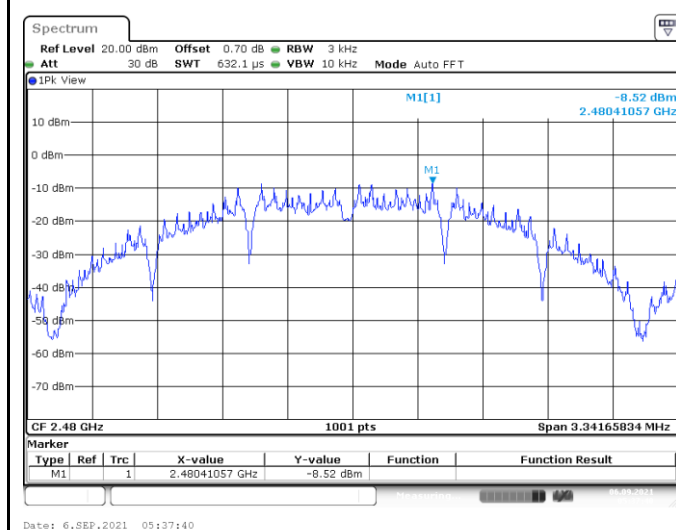
Low Channel



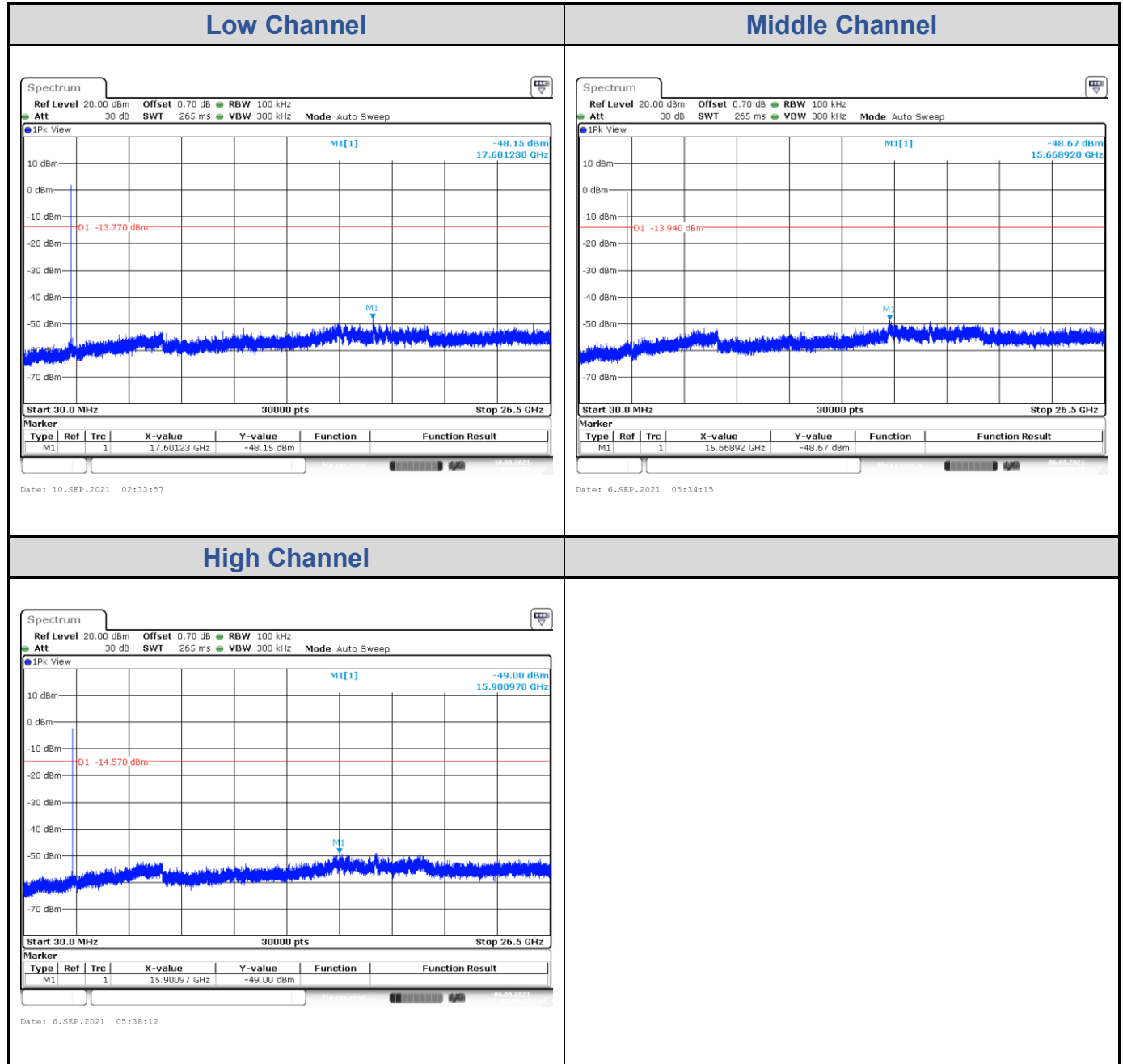
Middle Channel



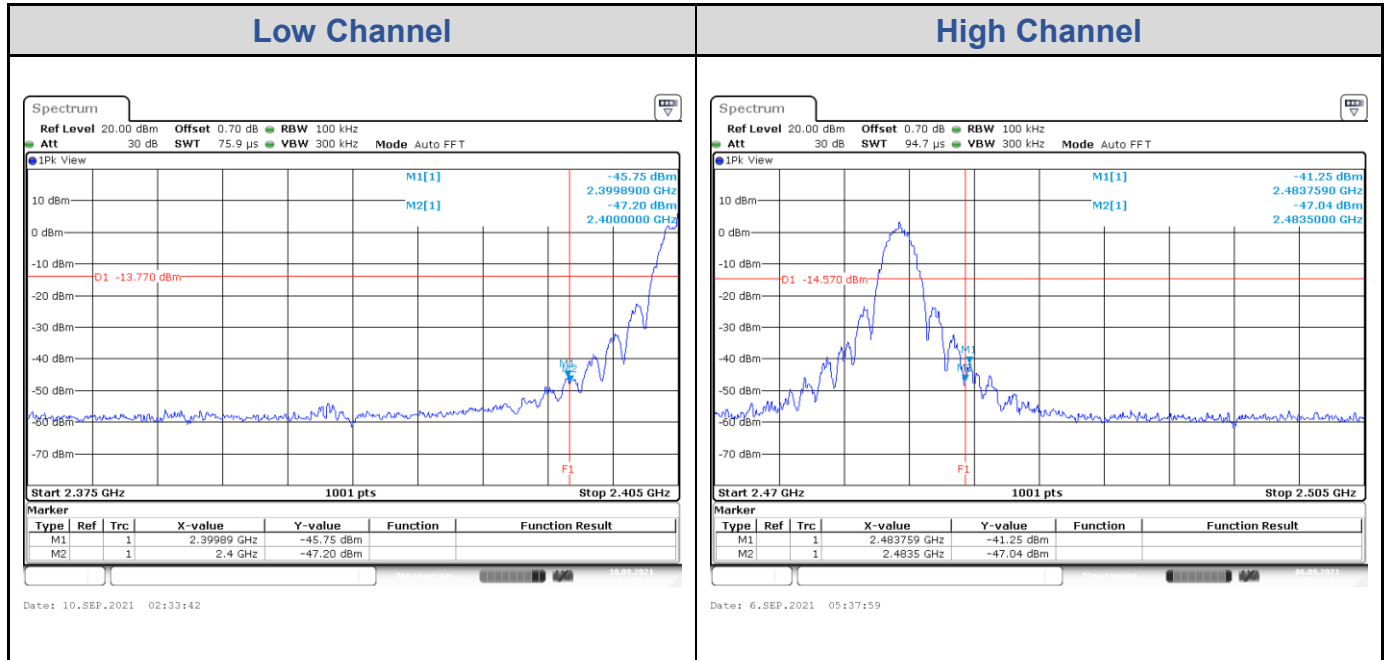
High Channel



Test Result of Conducted Spurious Emissions, Tx Mode Thread



Test Result of Conducted Band Edge, Tx Mode Thread



Appendix B: Test Results of Radiated Spurious Emissions & Mains

Conducted Emission Test

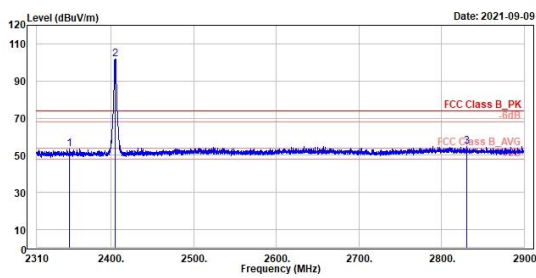
Band Edges, 2.31GHz ~ 2.9GHz

Thread

Low Channel (Horizontal) Peak



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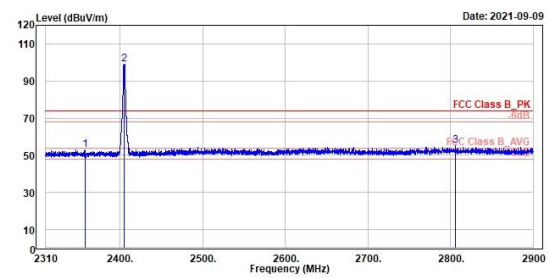


Peak	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	2349.46	53.45	16.19	37.26	74.00	-20.55	100	232	Peak	Horizontal		
2 *	2405.00	101.71	64.38	37.33	74.00	27.71	100	232	Peak	Horizontal		
3	2831.21	54.78	16.57	38.21	74.00	-19.22	100	232	Peak	Horizontal		

Low Channel (Vertical) Peak



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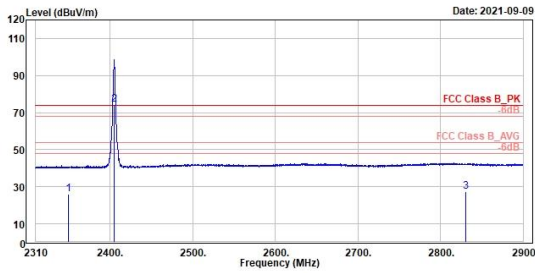
Peak	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	2357.35	53.03	15.77	37.26	74.00	-20.97	105	247	Peak	Vertical		
2 *	2405.00	99.12	61.79	37.33	74.00	25.12	105	247	Peak	Vertical		
3	2805.77	55.13	16.95	38.18	74.00	-18.87	105	247	Peak	Vertical		

Thread

Low Channel (Horizontal) Average



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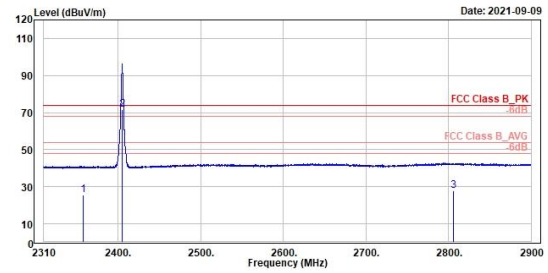


	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	dB	cm	deg			
1	2349.46	25.99	-11.27	37.26	54.00	-28.01	180	232	Average	Horizontal	CF	
2 *	2405.00	74.25	36.92	37.33	54.00	20.25	180	232	Average	Horizontal	CF	
3	2831.21	27.31	-10.90	38.21	54.00	-26.69	180	232	Average	Horizontal	CF	

Low Channel (Vertical) Average



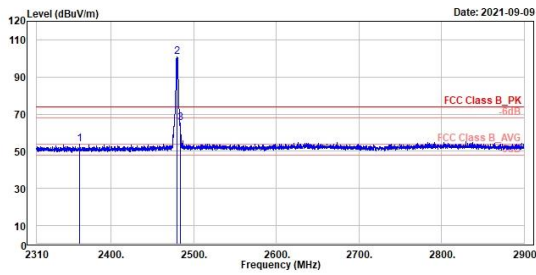
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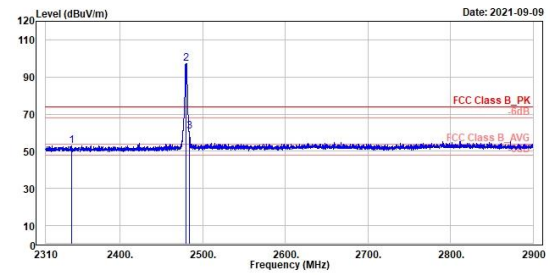
	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	dB	cm	deg			
1	2357.35	25.56	-11.70	37.26	54.00	-28.44	185	247	Average	Vertical	CF	
2 *	2405.00	71.65	34.32	37.33	54.00	17.65	185	247	Average	Vertical	CF	
3	2805.77	27.66	-10.52	38.18	54.00	-26.34	185	247	Average	Vertical	CF	

Thread

High Channel (Horizontal) Peak



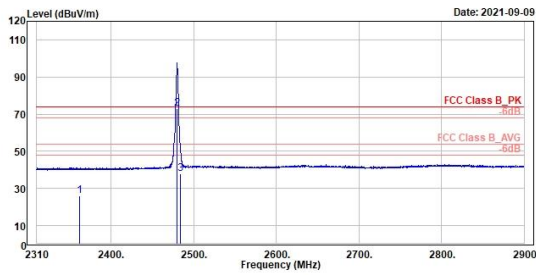
Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	2361.71	53.62	16.35	37.27	74.00	-20.38	109	232	Peak	Horizontal	
2 *	2480.00	100.62	62.93	37.69	74.00	26.62	109	232	Peak	Horizontal	
3	2483.50	65.15	27.44	37.71	74.00	-8.85	109	232	Peak	Horizontal	



Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	2341.69	53.09	15.09	37.20	74.00	-20.91	161	214	Peak	Vertical	
2 *	2480.00	97.37	59.68	37.69	74.00	23.37	161	214	Peak	Vertical	
3	2483.62	60.46	22.75	37.71	74.00	-13.54	161	214	Peak	Vertical	

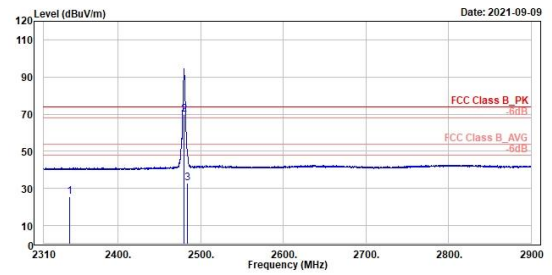
Thread

High Channel (Horizontal) Average



	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	2361.71	26.16	-11.11	37.27	54.00	-27.84	189	232	Average	Horizontal	CF	
2 *	2480.00	73.16	35.47	37.69	54.00	19.16	189	232	Average	Horizontal	CF	
3	2483.50	37.69	-0.02	37.71	54.00	-16.31	189	232	Average	Horizontal	CF	

High Channel (Vertical) Average



	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	2341.69	25.63	-11.57	37.20	54.00	-28.37	161	214	Average	Vertical	CF	
2 *	2480.00	69.90	32.21	37.69	54.00	15.90	161	214	Average	Vertical	CF	
3	2483.62	32.99	-4.72	37.71	54.00	-21.01	161	214	Average	Vertical	CF	

Spurious Emissions, Tx Mode, 9kHz ~ 30MHz

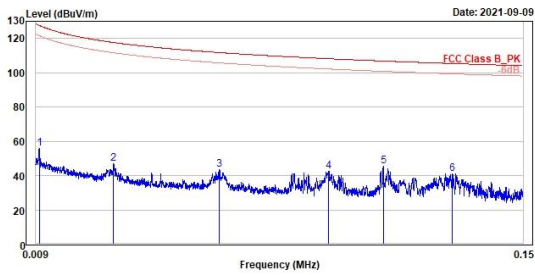
Thread

Low Channel (Open) 9kHz~150kHz

Low Channel (Open) 150kHz~30MHz



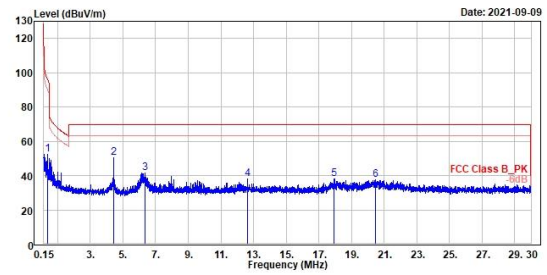
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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		cm	deg			
1	0.01	55.75	35.81	19.94	127.57	-71.82	100	108	QP	Open		
2	0.03	46.88	26.59	20.29	117.61	-70.73	100	143	QP	Open		
3	0.06	43.49	23.24	20.25	111.72	-68.23	100	166	QP	Open		
4	0.09	42.47	22.27	20.20	108.16	-65.69	100	176	QP	Open		
5	0.11	45.30	25.11	20.19	106.80	-61.50	100	193	QP	Open		
6	0.13	40.99	20.82	20.17	105.34	-64.35	100	195	QP	Open		



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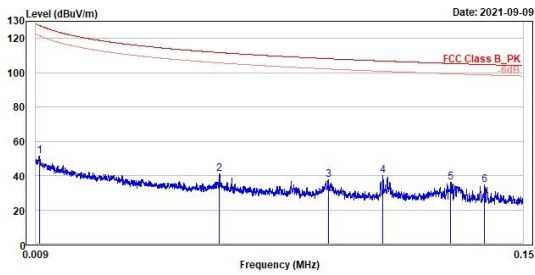
	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		cm	deg			
1	0.38	52.49	32.39	20.10	96.88	-43.59	100	181	QP	Open		
2	4.43	50.24	29.99	20.25	69.50	-19.26	100	306	QP	Open		
3	6.36	41.67	21.39	20.28	69.50	-27.83	100	0	QP	Open		
4	12.65	38.29	17.76	20.53	69.50	-31.21	100	5	QP	Open		
5	17.96	37.96	17.34	20.62	69.50	-31.54	100	201	QP	Open		
6	28.45	37.69	17.04	20.65	69.50	-31.81	100	349	QP	Open		

Thread

Low Channel (Close) 9kHz~150kHz



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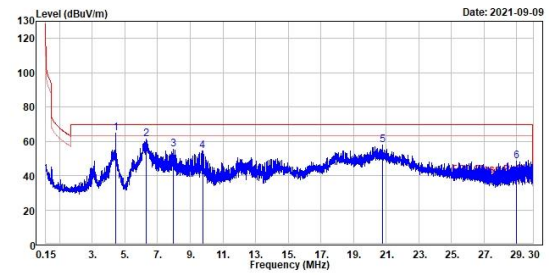


	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	0.01	51.19	31.25	19.94	127.58	-76.39	100	203	QP	Close		
2	0.06	40.99	20.74	20.25	111.72	-70.73	100	199	QP	Close		
3	0.09	37.50	17.30	20.20	108.17	-70.67	100	127	QP	Close		
4	0.11	39.94	19.75	20.19	106.81	-66.87	100	125	QP	Close		
5	0.13	36.19	16.02	20.17	105.38	-69.19	100	119	QP	Close		
6	0.14	34.51	14.35	20.16	104.75	-70.24	100	96	QP	Close		

Low Channel (Close) 150kHz~30MHz



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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	4.43	64.58	44.33	20.25	69.50	-4.92	100	69	QP	Close		
2	6.33	61.21	40.93	20.28	69.50	-8.29	100	67	QP	Close		
3	7.95	55.56	35.22	20.34	69.50	-13.94	100	52	QP	Close		
4	9.76	54.23	33.77	20.46	69.50	-15.27	100	324	QP	Close		
5	20.80	57.67	37.02	20.65	69.50	-11.83	100	18	QP	Close		
6	28.90	48.30	27.57	20.73	69.50	-21.20	100	2	QP	Close		

Spurious Emissions, Tx Mode, 30MHz ~ 1GHz

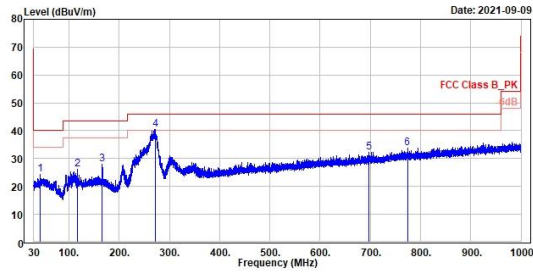
Thread

Low Channel (Horizontal)

Low Channel (Vertical)



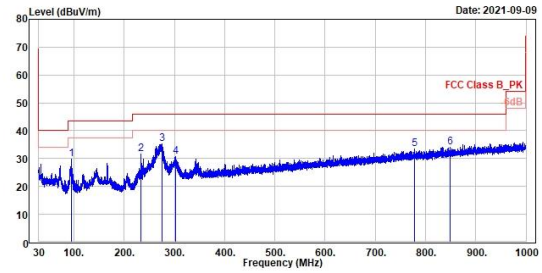
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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	42.51	24.31	30.06	-5.75	40.00	-15.69	300	0	QP	Horizontal		
2	117.40	26.00	34.65	-8.57	43.50	-17.42	200	144	QP	Horizontal		
3	166.58	27.99	33.77	-5.78	43.50	-15.51	200	148	QP	Horizontal		
4	272.50	40.38	45.93	-5.55	46.00	-5.62	300	167	QP	Horizontal		
5	697.75	32.31	30.53	1.78	46.00	-13.69	200	117	QP	Horizontal		
6	773.99	33.75	30.72	3.03	46.00	-12.25	400	360	QP	Horizontal		



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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	94.00	29.90	41.05	-12.05	43.50	-13.60	200	55	QP	Vertical		
2	232.63	31.73	38.61	-6.88	46.00	-14.27	100	352	QP	Vertical		
3	276.28	35.15	40.48	-5.33	46.00	-10.85	100	52	QP	Vertical		
4	302.18	30.75	35.30	-4.55	46.00	-15.25	200	33	QP	Vertical		
5	778.16	33.41	30.28	3.13	46.00	-12.59	300	352	QP	Vertical		
6	849.07	34.13	30.01	4.12	46.00	-11.87	400	352	QP	Vertical		

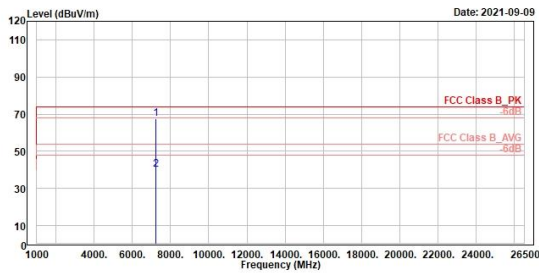
Spurious Emissions, Tx Mode, 1GHz ~ 26.5GHz

Thread

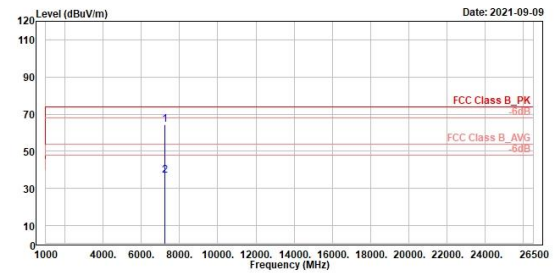
Low Channel (Horizontal)



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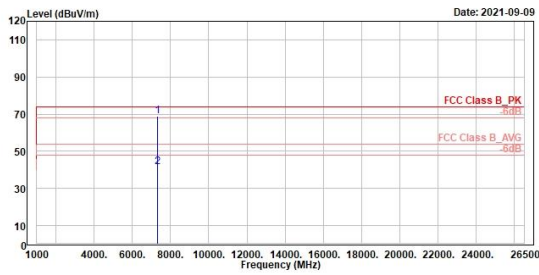


Thread

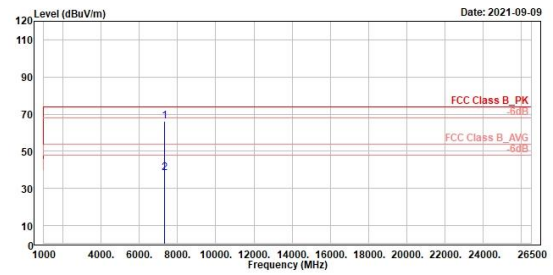
Middle Channel (Horizontal)



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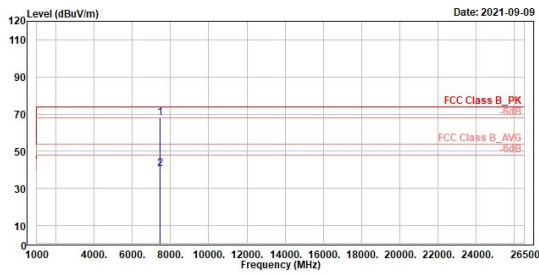


Thread

High Channel (Horizontal)



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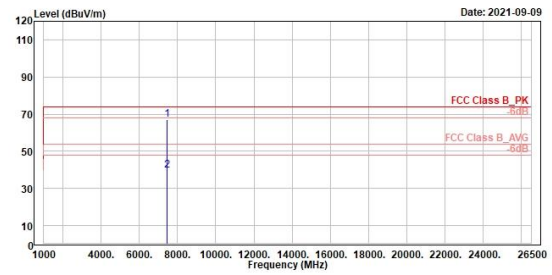


	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	7440.00	67.04	74.43	-6.59	74.00	-6.16	180	90	Peak	Horizontal		
2	7440.00	40.38	46.97	-6.59	54.00	-13.62	180	90	Average	Horizontal	CF	

High Channel (Vertical)



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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	7440.00	67.06	73.65	-6.59	74.00	-6.94	334	18	Peak	Vertical		
2	7440.00	39.60	46.19	-6.59	74.00	-34.40	334	18	Peak	Vertical	CF	

Mains Conducted Emission, 150kHz ~ 30MHz

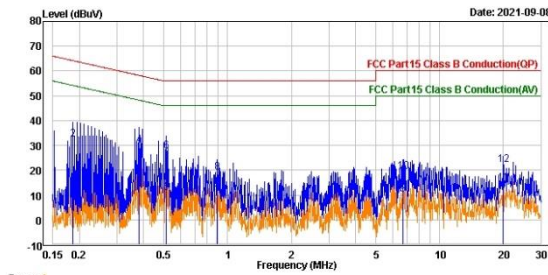
Worst Band

(Line)

(Neutral)



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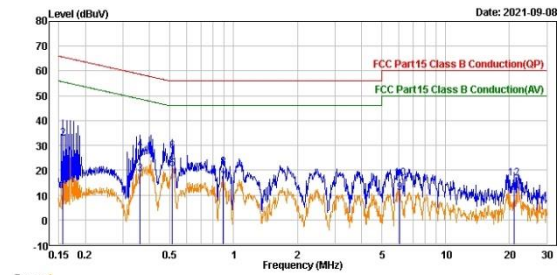


Trace: 1

	Freq	Level	Read Level Factor	Limit Line	Over Limit	Remark	Pol/Phase	Note
	MHz	dBuV	dBuV	dB	dBuV	dB		
1	0.19	7.81	-1.84	9.65	54.18	-46.37	Average	line1
2	0.19	32.32	22.67	9.65	64.18	-31.86	QP	line1
3	0.38	12.83	3.18	9.65	48.26	-35.43	Average	line1
4	0.38	30.01	20.36	9.65	58.26	-28.25	QP	line1
5	0.51	10.99	1.34	9.65	46.00	-35.01	Average	line1
6	0.51	27.54	17.89	9.65	56.00	-28.46	QP	line1
7	0.89	9.57	-0.10	9.67	46.00	-36.43	Average	line1
8	0.89	19.06	9.39	9.67	56.00	-36.94	QP	line1
9	6.69	10.23	0.49	9.74	50.00	-39.77	Average	line1
10	6.69	19.47	9.73	9.74	60.00	-40.53	QP	line1
11	19.94	14.48	4.74	9.74	50.00	-35.52	Average	line1
12	19.94	22.02	12.28	9.74	60.00	-37.98	QP	line1



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Trace: 1

	Freq	Level	Read Level Factor	Limit Line	Over Limit	Remark	Pol/Phase	Note
	MHz	dBuV	dBuV	dB	dBuV	dB		
1	0.16	11.47	1.79	9.68	55.63	-44.16	Average	neutral
2	0.16	32.76	23.08	9.68	65.63	-32.87	QP	neutral
3	0.36	18.36	8.70	9.66	48.67	-30.31	Average	neutral
4	0.36	28.41	18.75	9.66	58.67	-30.26	QP	neutral
5	0.51	20.40	10.74	9.66	46.00	-25.60	Average	neutral
6	0.51	27.76	18.10	9.66	56.00	-28.24	QP	neutral
7	0.89	15.22	5.54	9.68	46.00	-30.78	Average	neutral
8	0.89	21.28	11.60	9.68	56.00	-34.72	QP	neutral
9	6.09	10.90	1.16	9.74	50.00	-39.10	Average	neutral
10	6.09	16.64	6.90	9.74	60.00	-43.36	QP	neutral
11	20.95	9.66	-0.17	9.83	50.00	-40.34	Average	neutral
12	20.95	16.82	6.99	9.83	60.00	-43.18	QP	neutral

Test Results of Radiated Spurious Emissions for Alternative Materials

Band Edges, 2.31GHz ~ 2.9GHz

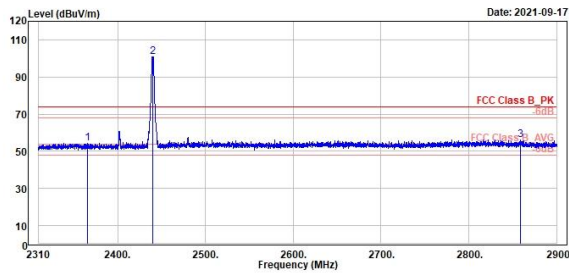
Thread

Middle Channel (Horizontal) Peak

Middle Channel (Vertical) Peak



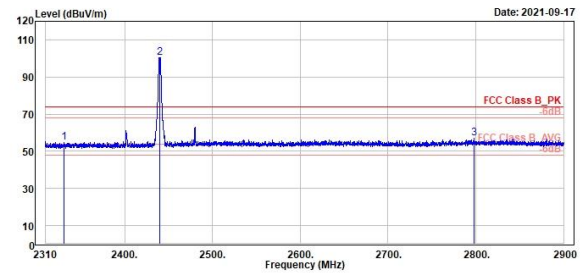
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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	dB	cm	deg			
1	2365.60	54.40	17.13	37.27	74.00	-19.60	110	207	Peak	Horizontal		
2 *	2440.00	100.87	63.43	37.44	74.00	26.87	110	207	Peak	Horizontal		
3	2858.30	56.19	17.99	38.20	74.00	-17.81	110	207	Peak	Horizontal		



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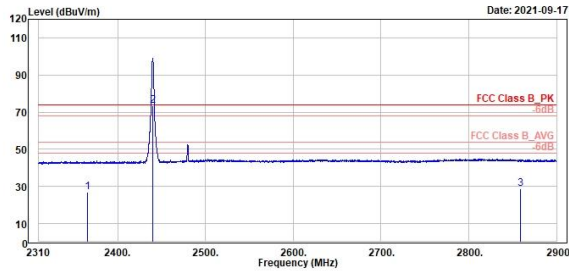
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	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	dB	cm	deg			
1	2331.00	54.86	17.74	37.12	74.00	-19.14	101	212	Peak	Vertical		
2 *	2440.00	100.59	63.15	37.44	74.00	26.59	101	212	Peak	Vertical		
3	2798.00	57.26	19.88	38.18	74.00	-16.74	101	212	Peak	Vertical		

Thread

Middle Channel (Horizontal) Average



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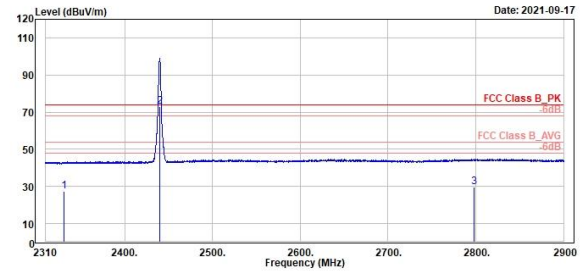


Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	2365.68	26.93	-10.34	37.27	54.00	-27.07	110	207	Average	Horizontal	CF
2 *	2440.00	73.41	35.97	37.44	54.00	19.41	110	207	Average	Horizontal	CF
3	2858.30	28.73	-9.47	38.20	54.00	-25.27	110	207	Average	Horizontal	CF

Middle Channel (Vertical) Average



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Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	2331.00	27.40	-9.72	37.12	54.00	-26.60	101	212	Average	Vertical	CF
2 *	2440.00	73.12	35.68	37.44	54.00	19.12	101	212	Average	Vertical	CF
3	2798.00	29.79	-8.39	38.18	54.00	-24.21	101	212	Average	Vertical	CF

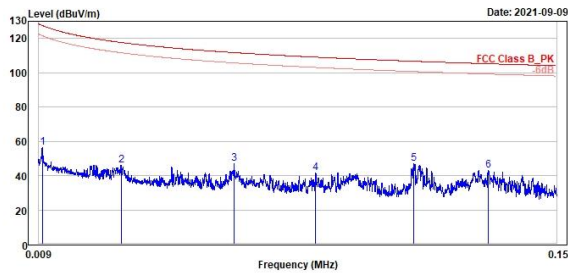
Spurious Emissions, Tx Mode, 9kHz ~ 30MHz

Thread

Middle Channel (Open) 9kHz~150kHz



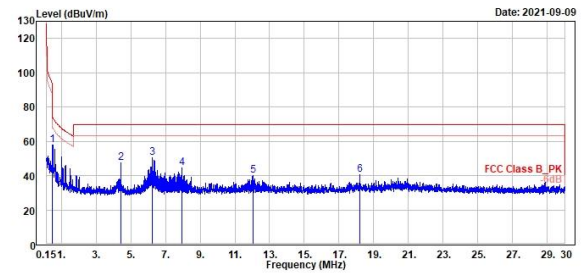
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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	0.01	56.36	36.42	19.94	127.57	-71.21	100	321	QP	Open		
2	0.03	46.06	25.77	20.29	117.64	-71.58	100	178	QP	Open		
3	0.06	47.12	26.87	20.25	111.72	-64.60	100	156	QP	Open		
4	0.08	41.44	21.23	20.21	109.07	-67.63	100	172	QP	Open		
5	0.11	47.04	26.85	20.19	106.68	-59.64	100	174	QP	Open		
6	0.13	43.09	22.92	20.17	105.23	-62.14	100	162	QP	Open		



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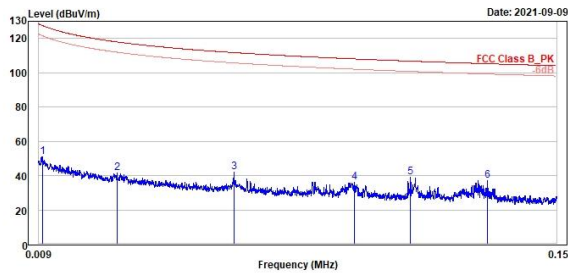
	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	0.50	57.97	37.09	20.08	73.59	-15.62	100	179	QP	Open		
2	4.43	47.31	27.06	20.25	69.50	-22.19	100	171	QP	Open		
3	6.25	50.35	30.08	20.27	69.50	-19.15	100	308	QP	Open		
4	7.95	44.63	24.29	20.34	69.50	-24.87	100	82	QP	Open		
5	12.05	40.08	19.57	20.51	69.50	-29.42	100	128	QP	Open		
6	18.18	40.40	19.78	20.62	69.50	-29.10	100	0	QP	Open		

Thread

Middle Channel (Close) 9kHz~150kHz



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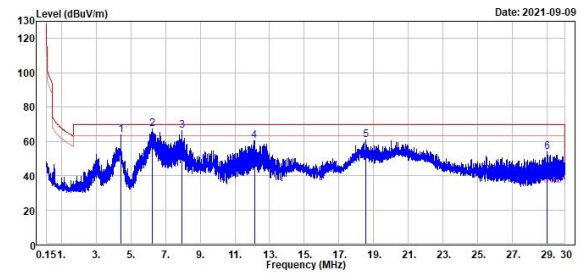


Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	0.01	51.09	31.15	19.94	127.57	-76.48	100	13	QP	Close	
2	0.03	41.43	21.15	20.28	117.94	-76.51	100	23	QP	Close	
3	0.06	41.80	21.55	20.25	111.72	-69.92	100	84	QP	Close	
4	0.09	36.32	16.12	20.20	108.04	-71.72	100	127	QP	Close	
5	0.11	39.15	18.96	20.19	106.75	-67.60	100	148	QP	Close	
6	0.13	36.92	16.75	20.17	105.24	-68.32	100	226	QP	Close	

Middle Channel (Close) 150kHz~30MHz



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Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	4.43	63.93	43.68	20.25	69.50	-5.57	100	231	QP	Close	
2	6.25	67.47	47.20	20.27	69.50	-2.03	100	310	QP	Close	
3	7.95	66.21	45.87	20.34	69.50	-3.29	100	5	QP	Close	
4	12.12	60.52	40.01	20.51	69.50	-8.98	100	343	QP	Close	
5	18.52	60.76	40.13	20.63	69.50	-8.74	100	308	QP	Close	
6	28.98	53.80	33.07	20.73	69.50	-15.70	100	335	QP	Close	

Spurious Emissions, Tx Mode, 30MHz ~ 1GHz

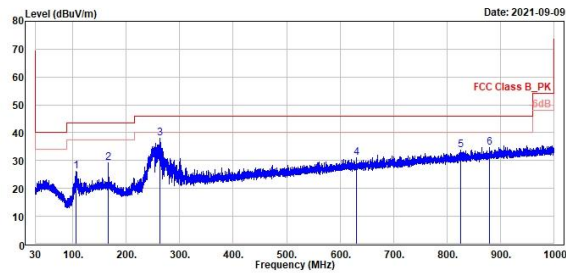
Thread

Middle Channel (Horizontal)

Middle Channel (Vertical)



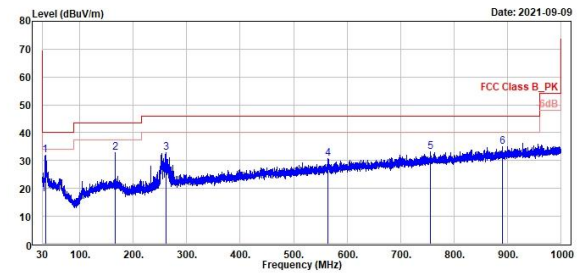
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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	105.08	26.29	36.32	-10.03	43.50	-17.21	200	360	QP	Horizontal		
2	166.58	29.25	35.03	-5.78	43.50	-14.25	200	169	QP	Horizontal		
3	263.48	38.09	44.10	-6.01	46.00	-7.91	100	183	QP	Horizontal		
4	631.21	30.88	30.12	0.76	46.00	-15.12	100	122	QP	Horizontal		
5	825.89	33.86	30.10	3.76	46.00	-12.14	100	262	QP	Horizontal		
6	879.14	34.76	30.27	4.49	46.00	-11.24	200	114	QP	Horizontal		



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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg				
1	35.24	32.01	38.08	-6.07	40.00	-7.99	100	159	QP	Vertical		
2	166.19	33.00	38.75	-5.75	43.50	-10.50	100	149	QP	Vertical		
3	261.15	33.00	39.10	-6.10	46.00	-13.00	200	149	QP	Vertical		
4	564.86	30.87	31.31	-0.44	46.00	-15.13	100	196	QP	Vertical		
5	755.95	33.14	30.25	2.89	46.00	-12.86	173	360	QP	Vertical		
6	891.26	35.00	30.30	4.70	46.00	-11.00	200	95	QP	Vertical		

Spurious Emissions, Tx Mode, 1GHz ~ 26.5GHz

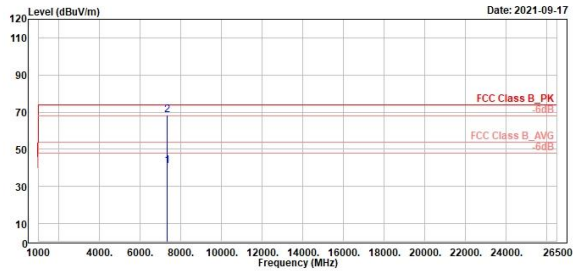
Thread

Middle Channel (Horizontal)

Middle Channel (Vertical)



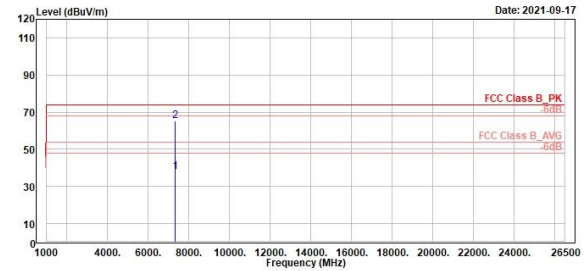
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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	cm	deg			
1	7320.00	48.96	47.59	-6.63	54.00	-13.04	180	183	Average	Horizontal	CF	
2	7320.00	68.42	75.05	-6.63	74.00	-5.58	180	183	Peak	Horizontal		



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	Freq	Level	Read	Level	Factor	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	cm	deg			
1	7320.00	37.67	44.30	-6.63	54.00	-16.33	386	0	Average	Vertical	CF	
2	7320.00	65.13	71.76	-6.63	74.00	-8.87	386	0	Peak	Vertical		