

FCC PART 15.247

TEST REPORT

For

Murata Manufacturing Co., Ltd.

10-1, Higashikotari 1-chome, Nagaokakyo-shi Kyoto 617-8555 Japan

FCC ID: VPYCMABZ

Report Type: CIIPC Report	Product Type: LoRa module
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Report Number: RKSA180809001-00A	
Report Date: 2018-08-21	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	Murata Manufacturing Co., Ltd.
Tested Model	CMWX1ZZABZ
Product Type	LoRa module
Dimension	12.5 mm(L)×11.6 mm(W)×1.76 mm(H)
Power Supply	DC 3.3V

**All measurement and test data in this report was gathered from production sample serial number: 201800809001. (Assigned by BACL, Kunshan). The EUT was received on 2018-08-09.*

Objective

This report is prepared on behalf of Murata Manufacturing Co., Ltd. in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.209 and 15.247 rules.

This is a CIIPC report base on the original report with FCC ID: VPYCMABZ which was granted on 2017-02-08, the difference between the original device and the current one is as follows:

Item	Original Device	Current Device
Type of Antenna	Monopole Antenna	PCB Antenna, Chip Antenna

The above difference will affect “part of tests”, all test data were presented in this report, and other data were referred to the original report.

Related Submittal(s)/Grant(s)

No Related Submittal(s)/Grant(s).

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and FCC 558074 D01 15.247 Meas Guidance v05.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Item		Uncertainty
Radiated emission	30MHz~1GHz	6.11dB
	1GHz~6GHz	4.45dB
	6GHz~18GHz	5.23dB
Temperature		1.0°C
Humidity		6%

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

Test channel list as below,

For 125 kHz channel, EUT was tested with channel 0, 31 and 63;

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	902.3	32	908.7
1	902.5	33	908.9
2	902.7	34	909.1
3	902.9	35	909.3
4	903.1	36	909.5
5	903.3	37	909.7
6	903.5	38	909.9
7	903.7	39	910.1
8	903.9	40	910.3
9	904.1	41	910.5
10	904.3	42	910.7
11	904.5	43	910.9
12	904.7	44	911.1
13	904.9	45	911.3
14	905.1	46	911.5
15	905.3	47	911.7
16	905.5	48	911.9
17	905.7	49	912.1
18	905.9	50	912.3
19	906.1	51	912.5
20	906.3	52	912.7
21	906.5	53	912.9
22	906.7	54	913.1
23	906.9	55	913.3
24	907.1	56	913.5
25	907.3	57	913.7
26	907.5	58	913.9
27	907.7	59	914.1
28	907.9	60	914.3
29	908.1	61	914.5
30	908.3	62	914.7
31	908.5	63	914.9

For 500 kHz channel, EUT was tested with channel 64, 67 and 71.

Channel	Frequency (MHz)	Channel	Frequency (MHz)
64	903.0	68	909.4
65	904.6	69	911.0
66	906.2	70	912.6
67	907.8	71	914.2

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

RF test tool : FSK-LoRa Modulation Test Tool

Power level setting: 20

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
DELL	Notebook	GX620	D65874152
DELL	Adapter	LA65NS0-00	DF263

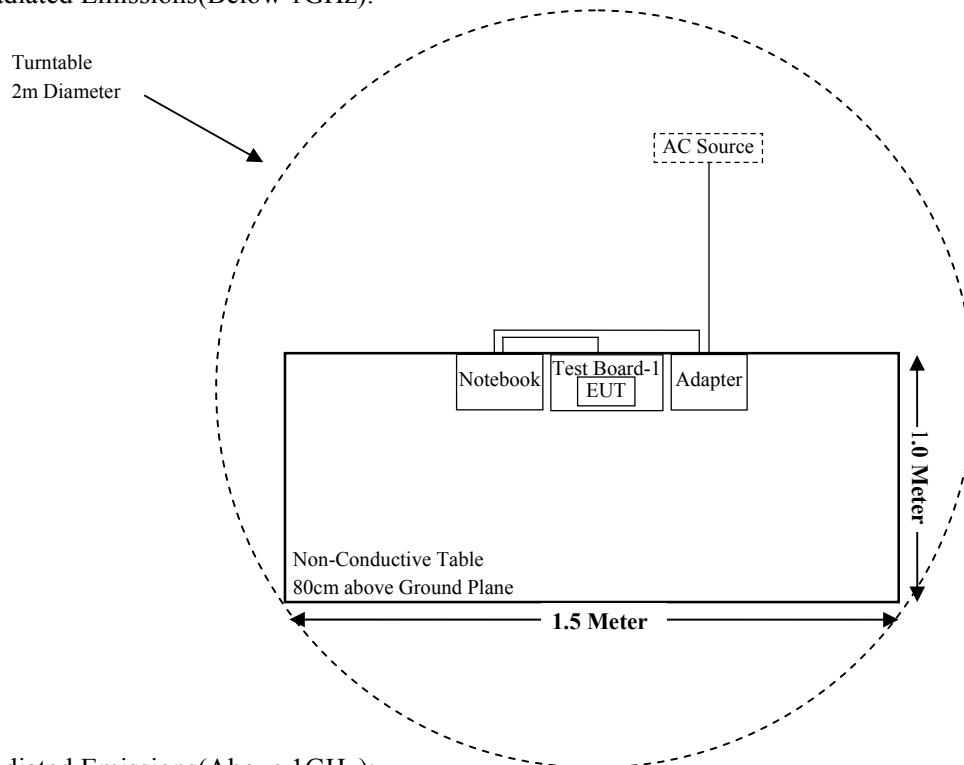
External I/O Cable

Cable Description	Shielding Type	Length (m)	From Port	To
Data Cable-1	Un-Shielding	0.3	Test Board-1 (PCB Antenna)	Notebook
Data Cable-2	Un-Shielding	0.3	Test Board-2 (Chip Antenna)	Notebook

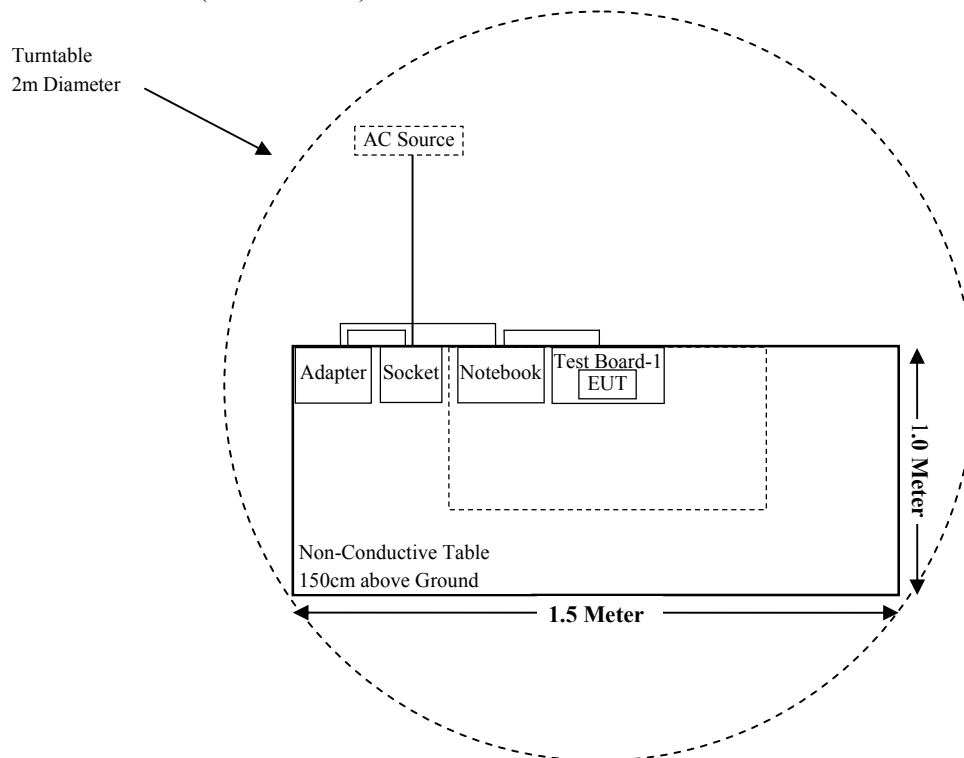
Block Diagram of Test Setup

For PCB Antenna:

For Radiated Emissions(Below 1GHz):

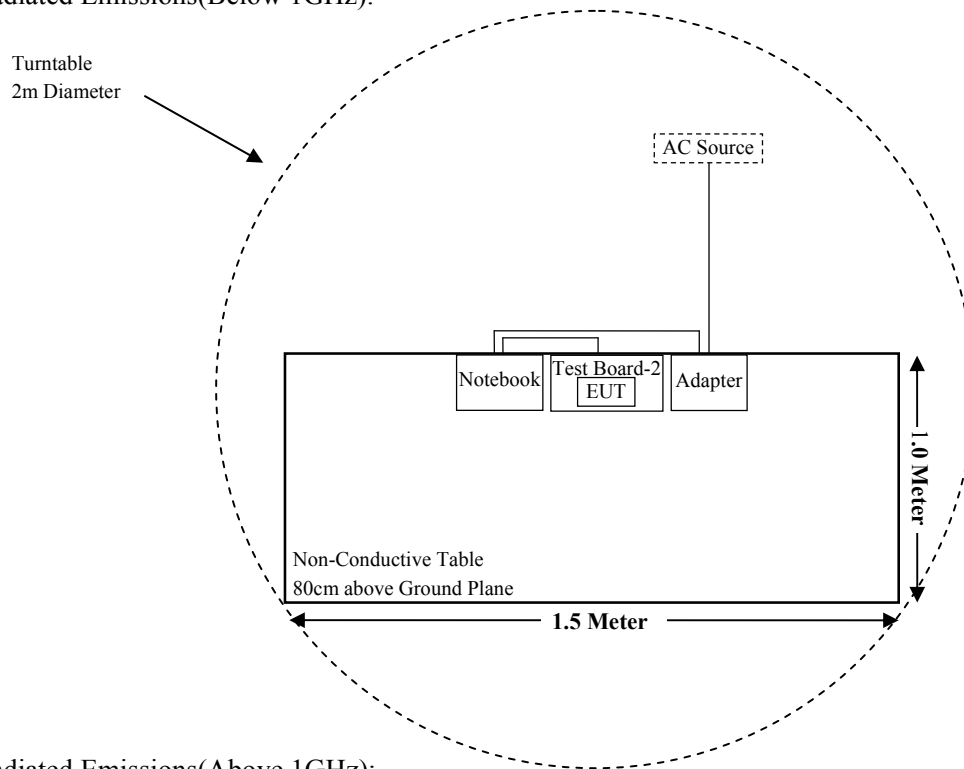


For Radiated Emissions(Above 1GHz):

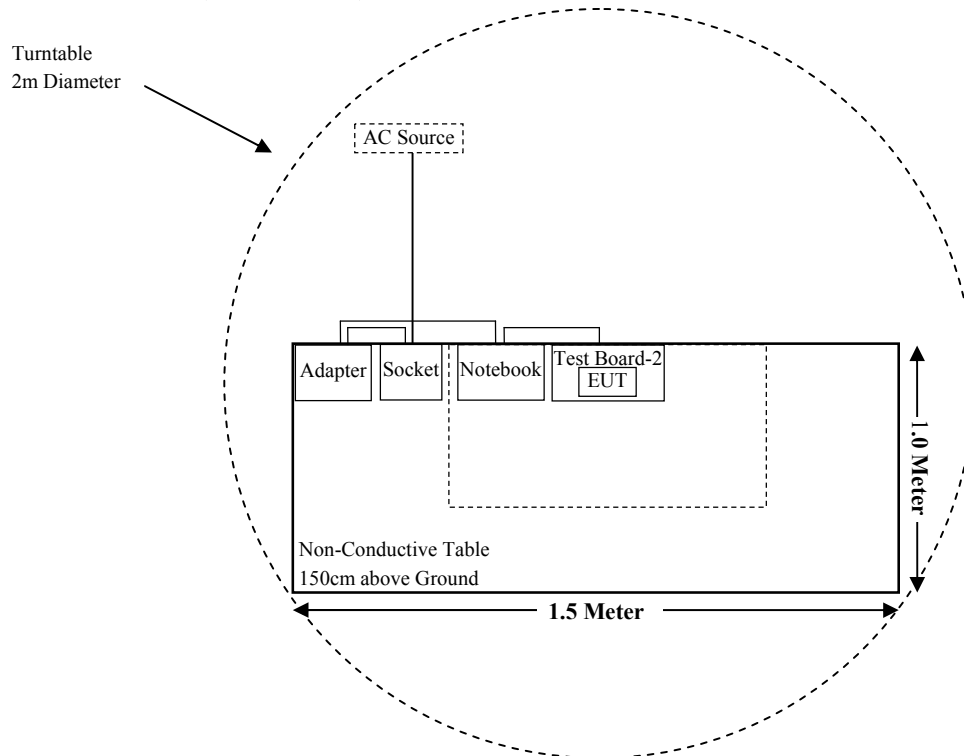


For Chip Antenna:

For Radiated Emissions(Below 1GHz):



For Radiated Emissions(Above 1GHz):



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliant
§1.1310 & §2.1091	Maximum Permissible Exposure (MPE)	Compliant*
§15.207 (a)	AC Line Conducted Emissions	Compliant*
§15.247(d)	Spurious Emissions at Antenna Port	Compliant*
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliant
§15.247(a)(1)	Channel Separation Test	Compliant*
§15.247(a)(1)	20 dB Emission Bandwidth	Compliant*
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliant*
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliant*
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliant*
§15.247(b)(3)	Maximum Conducted Output Power	Compliant*
§15.247(d)	Band Edge	Compliant*
§15.247(e) & §15.247(f)	Power Spectral Density	Compliant*

Compliant*: For these test items, all the test data were referred to the original report.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test (Chamber 1#)					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2017-11-25	2018-11-24
Sunol Sciences	Broadband Antenna	JB3	A040914-2	2016-01-09	2019-01-08
Sonoma Instrument	Pre-amplifier	310N	171205	2017-08-15	2018-08-14
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-8	008	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2018-08-15	2019-08-14
Radiated Emission Test (Chamber 2#)					
Rohde & Schwarz	EMI Test Receiver	ESU40	100207	2017-08-27	2018-08-26
ETS-LINDGREN	Horn Antenna	3115	6229	2016-01-11	2019-01-10
Mini-Circuits	Amplifier	ZVA-183W-S+	220701818	2018-05-20	2019-05-19
MICRO-TRONICS	Band Reject Filter	BRC50722	G013	2018-08-05	2019-08-04
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-11	011	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-12	012	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-13	013	2018-08-15	2019-08-14

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

- a. Antenna must be permanently attached to the unit.
 - b. Antenna must use a unique type of connector to attach to the EUT.
- Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

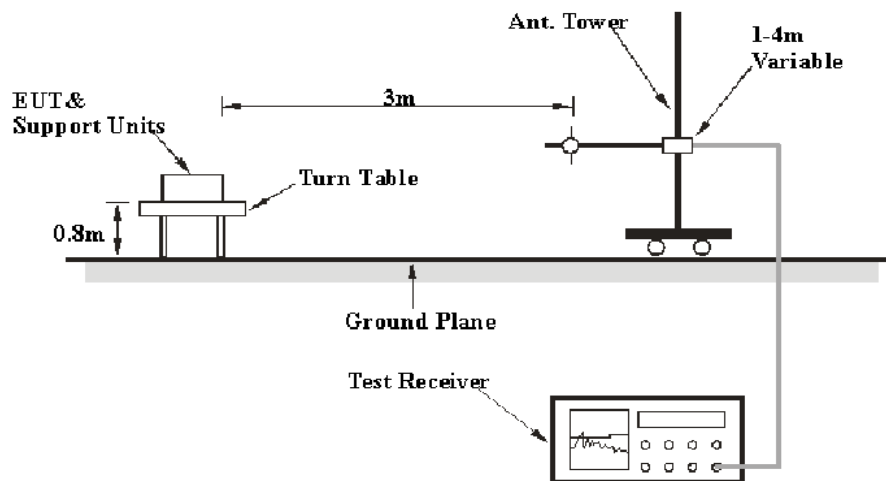
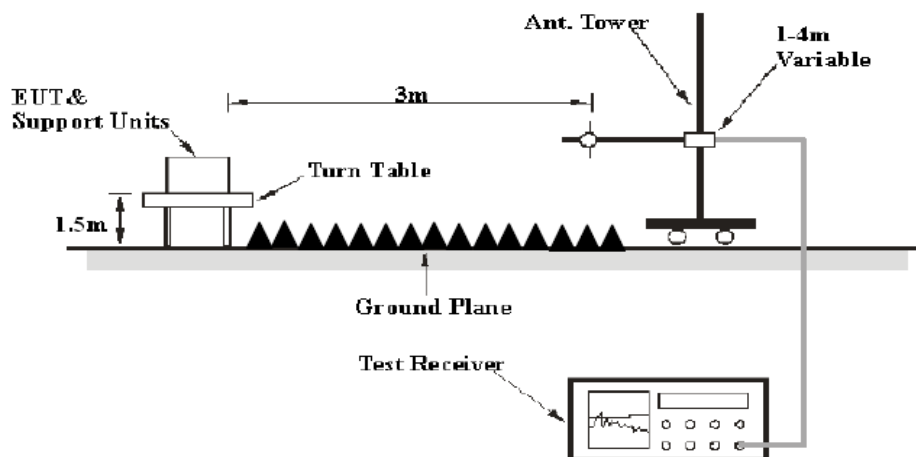
The EUT has two types of antennas as below, which was permanently attached, fulfill the requirement of this section. Please refer to the EUT photos.

Antenna Type	Antenna Gain (dBi)
PCB Antenna	1.0
Chip Antenna	-2.1

Result: Compliance.

FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS**Applicable Standard**

FCC §15.247 (d); §15.209; §15.205;

EUT Setup**Below 1 GHz:****Above 1GHz:**

The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

EMI Test Receiver Setup

The system was investigated from 30 MHz to 10 GHz.

During the radiated emission test, the EMI test receiver setup was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1GHz	1MHz	3 MHz	/	PK
	1MHz	3 MHz	/	Ave

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude (dB}\mu\text{V /m)} = \text{Meter Reading (dB}\mu\text{V)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} - \text{Amplifier Gain (dB)}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin (dB)} = \text{Limit (dB}\mu\text{V/m)} - \text{Corrected Amplitude (dB}\mu\text{V /m)}$$

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247.

Test Data**Environmental Conditions**

Temperature:	24.2°C
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

The testing was performed by Hope Zhang on 2018-08-18.

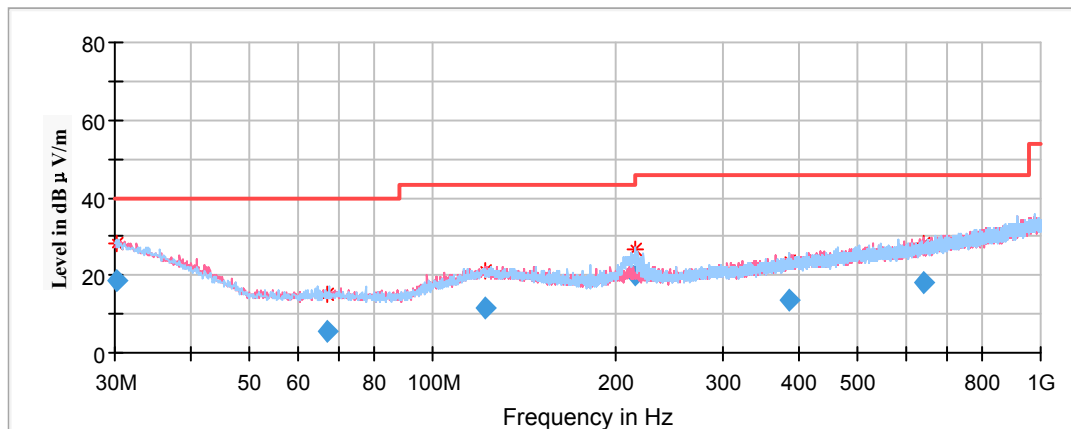
EUT operation mode: Transmitting

Data for PCB antenna at 125kHz channel:**Spurious Emission Test:****30MHz-1GHz**

(Pre-scan with low, middle and high channels of operation in the X,Y and Z axes of orientation, the worst case **low channel of operation in X-axis of orientation** was recorded)

Note:

1. This test was performed with the 902 – 928MHz notch filter.
2. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) - Amplifier Factor (dB)
 Corrected Amplitude (dBμV/m) = Corrected Factor (dB/m) + Reading (dBμV)
 Margin (dB) = Limit (dBμV/m) - Corrected Amplitude (dBμV /m)



Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	QuasiPeak (dBμV/m)	Height (cm)	Polar (H/V)				
30.202388	18.75	199.0	V	233.0	-4.1	40.00	21.25
67.205300	5.47	101.0	H	25.0	-17.5	40.00	34.53
122.002300	11.39	101.0	V	65.0	-11.3	43.50	32.11
215.358350	20.00	101.0	H	73.0	-12.3	43.50	23.50
386.620200	13.68	101.0	H	83.0	-8.4	46.00	32.32
640.504300	18.15	101.0	V	86.0	-4.4	46.00	27.85

1GHz-10GHz

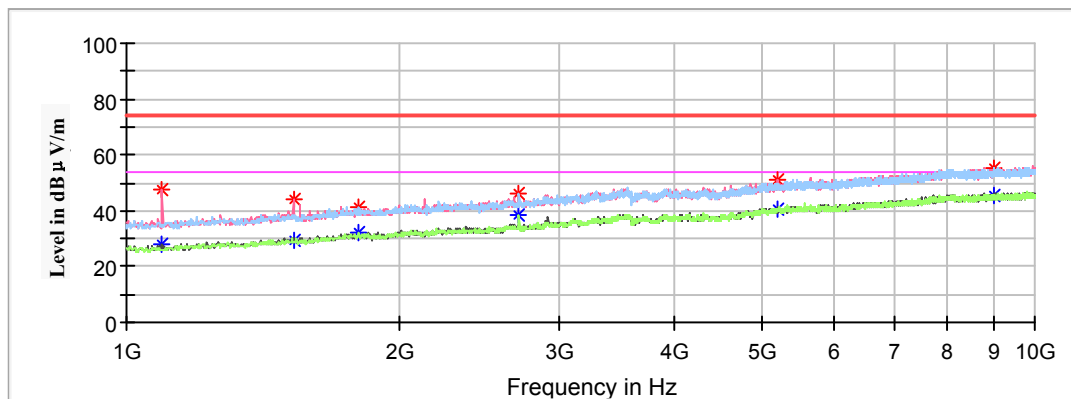
(Pre-scan in the X,Y and Z axes of orientation, the worst case **X-axis of orientation** was recorded)

Note:

- Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) - Amplifier Factor (dB)
 Corrected Amplitude (dBμV/m) = Corrected Factor (dB/m) + Reading (dBμV)
 Margin (dB) = Limit (dBμV/m) - Corrected Amplitude (dBμV /m)

Low Channel: 902.3MHz

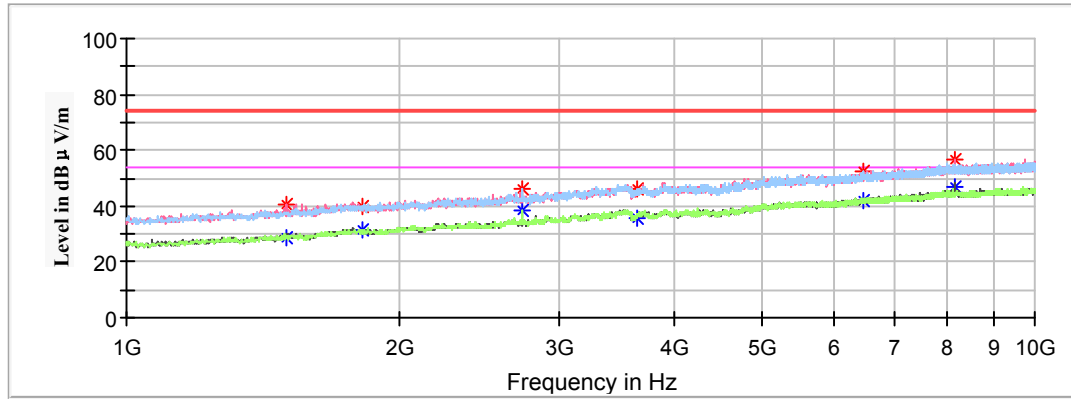
Full Spectrum



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV /m)	Average (dBμV /m)	Height (cm)	Polar (H/V)				
1095.400000	---	27.84	100.0	V	120.0	-3.7	54.00	26.16
1095.400000	47.88	---	100.0	V	120.0	-3.7	74.00	26.12
1527.400000	---	29.09	100.0	V	45.0	-1.1	54.00	24.91
1527.400000	44.13	---	100.0	V	45.0	-1.1	74.00	29.87
1804.600000	---	31.87	250.0	H	237.0	0.8	54.00	22.13
1804.600000	41.18	---	250.0	H	237.0	0.8	74.00	32.82
2706.900000	---	38.33	100.0	H	144.0	4.3	54.00	15.67
2706.900000	45.88	---	100.0	H	144.0	4.3	74.00	28.12
5215.600000	---	40.90	200.0	V	217.0	12.0	54.00	13.10
5215.600000	51.16	---	200.0	V	217.0	12.0	74.00	22.84
9001.000000	---	45.15	100.0	H	38.0	17.5	54.00	8.85
9001.000000	55.58	---	100.0	H	38.0	17.5	74.00	18.42

Middle Channel: 908.5MHz

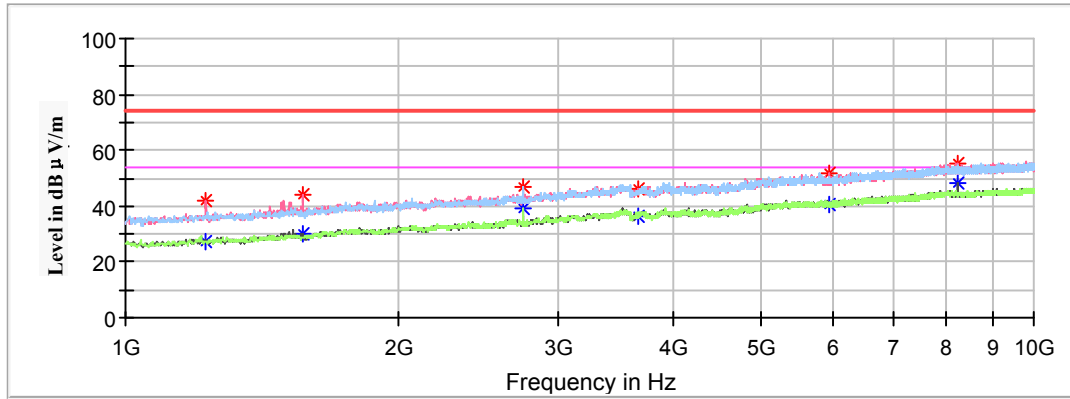
Full Spectrum



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1500.400000	---	28.59	200.0	V	71.0	-1.3	54.00	25.41
1500.400000	40.28	---	200.0	V	71.0	-1.3	74.00	33.72
1817.000000	39.71	---	100.0	H	255.0	0.9	74.00	34.29
1817.000000	---	31.19	100.0	H	255.0	0.9	54.00	22.81
2725.500000	46.22	---	150.0	H	256.0	4.5	74.00	27.78
2725.500000	---	38.60	150.0	H	256.0	4.5	54.00	15.40
3634.000000	---	35.69	200.0	H	201.0	7.8	54.00	18.31
3634.000000	45.94	---	200.0	H	201.0	7.8	74.00	28.06
6479.200000	---	41.61	150.0	H	19.0	14.3	54.00	12.39
6479.200000	52.61	---	150.0	H	19.0	14.3	74.00	21.39
8178.400000	---	47.02	250.0	V	164.0	17.2	54.00	6.98
8178.400000	56.33	---	250.0	V	164.0	17.2	74.00	17.67

High Channel: 914.9MHz

Full Spectrum



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dB μ V/m)	Margin (dB)
	MaxPeak (dB μ V /m)	Average (dB μ V /m)	Height (cm)	Polar (H/V)				
1226.800000	---	27.42	200.0	V	337.0	-2.9	54.00	26.58
1226.800000	41.61	---	200.0	V	337.0	-2.9	74.00	32.39
1568.800000	---	29.94	100.0	V	214.0	-0.8	54.00	24.06
1568.800000	43.85	---	100.0	V	214.0	-0.8	74.00	30.15
2744.700000	---	39.36	200.0	H	310.0	4.6	54.00	14.64
2744.700000	46.87	---	200.0	H	310.0	4.6	74.00	27.13
3659.600000	---	36.49	200.0	H	57.0	7.9	54.00	17.51
3659.600000	46.04	---	200.0	H	57.0	7.9	74.00	27.96
5953.600000	---	40.70	100.0	V	45.0	12.9	54.00	13.30
5953.600000	51.48	---	100.0	V	45.0	12.9	74.00	22.52
8236.000000	---	48.23	200.0	V	170.0	17.2	54.00	5.77
8236.000000	55.06	---	200.0	V	170.0	17.2	74.00	18.94

Fundamental Test & Band Edge Test:

(Pre-scan in the X,Y and Z axes of orientation, the worst case X-axis of orientation was recorded)

Note:

1. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) - Amplifier Factor (dB)

Corrected Amplitude (dBμV/m) = Corrected Factor (dB/m) + Reading (dBμV)

Margin (dB) = Limit (dBμV/m) - Corrected Amplitude (dBμV /m)

Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV /m)	Average (dBμV /m)	Height (cm)	Polar (H/V)				
Fundamental Test								
902.300000	117.32	---	200.0	H	251.0	0.2	/	/
902.300000	---	107.50	200.0	H	251.0	0.2	/	/
902.300000	112.55	---	200.0	V	275.0	0.2	/	/
902.300000	---	102.77	200.0	V	275.0	0.2	/	/
908.500000	116.94	---	250.0	H	36.0	0.3	/	/
908.500000	---	106.96	250.0	H	36.0	0.3	/	/
908.500000	112.58	---	200.0	V	98.0	0.3	/	/
908.500000	---	102.75	200.0	V	98.0	0.3	/	/
914.900000	116.48	---	200.0	H	263.0	0.5	/	/
914.900000	---	106.62	200.0	H	263.0	0.5	/	/
914.900000	112.41	---	200.0	V	85.0	0.5	/	/
914.900000	---	102.59	200.0	V	85.0	0.5	/	/

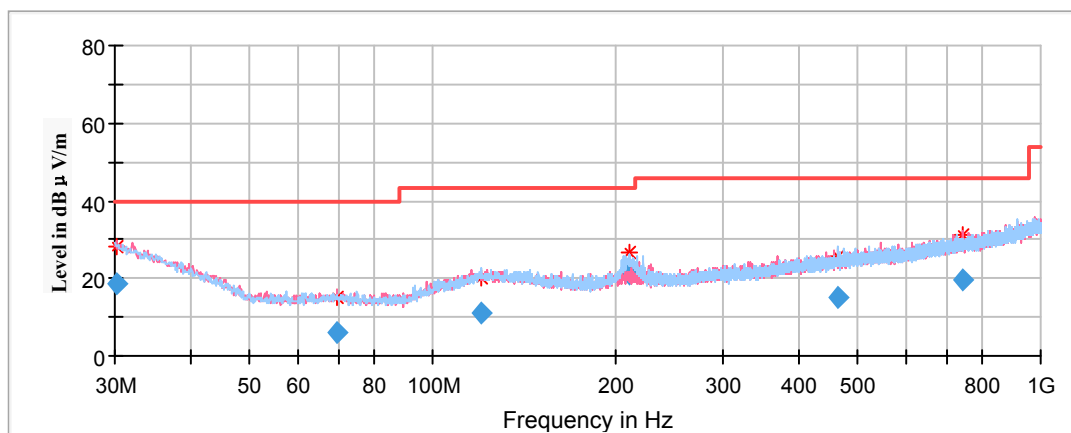
Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	QuasiPeak (dBμV/m)	Height (cm)	Polar (H/V)				
Band Edge Test							
902.000000	42.72	100.0	H	114.0	0.2	46.00	3.28
902.000000	41.69	150.0	V	124.0	0.2	46.00	4.31
928.000000	38.12	100.0	H	266.0	0.8	46.00	7.88
928.000000	37.68	200.0	V	290.0	0.8	46.00	8.32

Data for PCB antenna at 500kHz channel:**Spurious Emission Test:****30MHz-1GHz**

(Pre-scan with low, middle and high channels of operation in the X,Y and Z axes of orientation, the worst case **middle channel of operation in X-axis of orientation** was recorded)

Note:

1. This test was performed with the 902 – 928MHz notch filter.
2. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) - Amplifier Factor (dB)
 Corrected Amplitude (dBμV/m) = Corrected Factor (dB/m) + Reading (dBμV)
 Margin (dB) = Limit (dBμV/m) - Corrected Amplitude (dBμV /m)



Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	QuasiPeak (dBμV/m)	Height (cm)	Polar (H/V)				
30.267223	18.65	199.0	V	106.0	-4.1	40.00	21.35
69.585400	5.89	199.0	V	0.0	-17.3	40.00	34.11
119.948800	11.00	101.0	H	39.0	-11.2	43.50	32.50
210.060250	21.01	101.0	H	60.0	-12.3	43.50	22.49
463.471450	15.18	101.0	H	29.0	-7.1	46.00	30.82
743.695600	19.61	199.0	V	283.0	-2.6	46.00	26.39

1GHz-10GHz

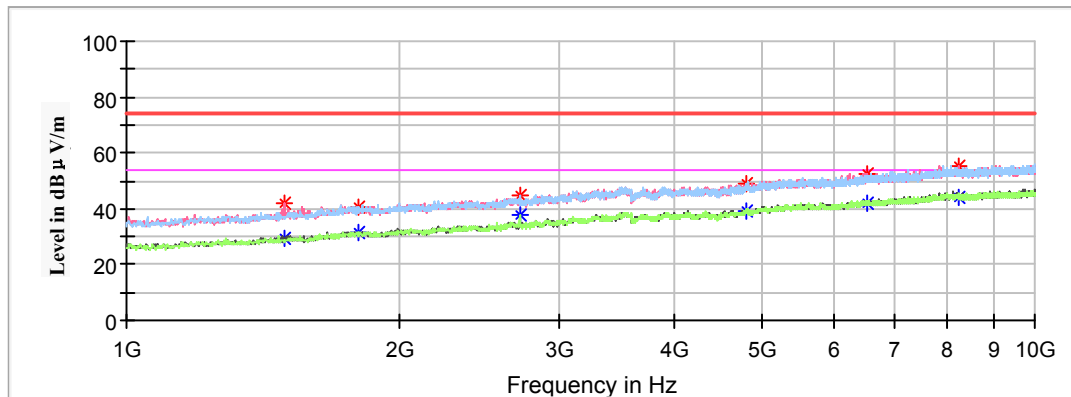
(Pre-scan in the X,Y and Z axes of orientation, the worst case **X-axis of orientation** was recorded)

Note:

- Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) - Amplifier Factor (dB)
 Corrected Amplitude (dBμV/m) = Corrected Factor (dB/m) + Reading (dBμV)
 Margin (dB) = Limit (dBμV/m) - Corrected Amplitude (dBμV /m)

Low Channel: 903MHz

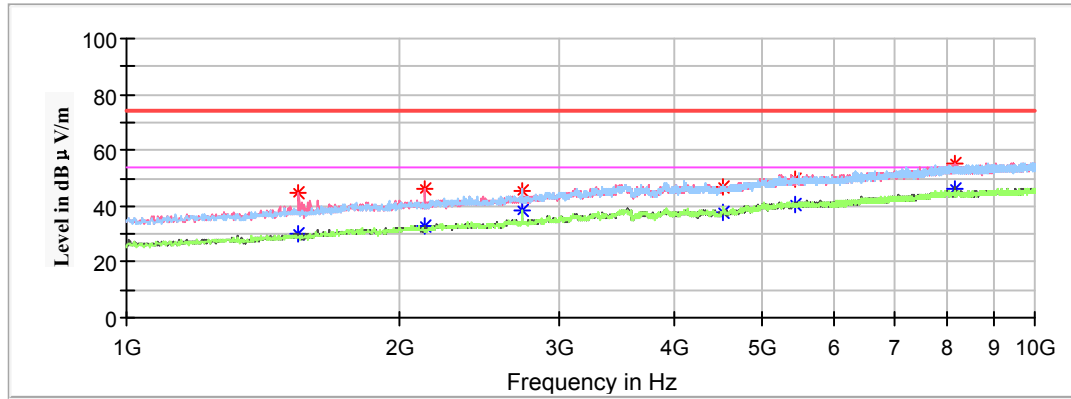
Full Spectrum



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV /m)	Average (dBμV /m)	Height (cm)	Polar (H/V)				
1493.200000	---	29.31	200.0	V	66.0	-1.3	54.00	24.69
1493.200000	42.13	---	200.0	V	66.0	-1.3	74.00	31.87
1806.000000	---	31.27	150.0	H	86.0	0.8	54.00	22.73
1806.000000	40.48	---	150.0	H	86.0	0.8	74.00	33.52
2709.000000	---	37.97	250.0	H	253.0	4.4	54.00	16.03
2709.000000	44.95	---	250.0	H	253.0	4.4	74.00	29.05
4812.400000	---	39.30	200.0	H	164.0	10.8	54.00	14.70
4812.400000	48.85	---	200.0	H	164.0	10.8	74.00	25.15
6524.200000	---	42.31	150.0	V	33.0	14.3	54.00	11.69
6524.200000	52.69	---	150.0	V	33.0	14.3	74.00	21.31
8245.000000	---	44.34	200.0	V	107.0	17.2	54.00	9.66
8245.000000	55.06	---	200.0	V	107.0	17.2	74.00	18.94

Middle Channel: 907.8MHz

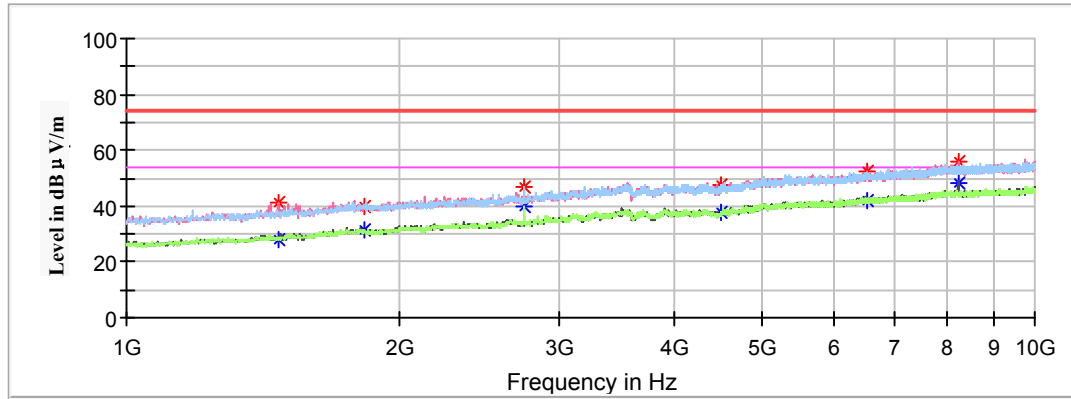
Full Spectrum



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1547.200000	44.85	---	200.0	V	211.0	-0.9	74.00	29.15
1547.200000	---	30.21	200.0	V	211.0	-0.9	54.00	23.79
2126.800000	45.93	---	100.0	V	271.0	2.3	74.00	28.07
2126.800000	---	32.77	100.0	V	271.0	2.3	54.00	21.23
2723.400000	45.49	---	100.0	H	129.0	4.4	74.00	28.51
2723.400000	---	38.71	100.0	H	129.0	4.4	54.00	15.29
4539.000000	---	37.55	250.0	H	208.0	9.4	54.00	16.45
4539.000000	46.90	---	250.0	H	208.0	9.4	74.00	27.10
5446.800000	---	40.58	100.0	H	172.0	12.3	54.00	13.42
5446.800000	49.64	---	100.0	H	172.0	12.3	74.00	24.36
8171.200000	---	46.48	250.0	V	351.0	17.2	54.00	7.52
8171.200000	55.32	---	250.0	V	351.0	17.2	74.00	18.68

High Channel: 914.2MHz

Full Spectrum



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dB μ V/m)	Margin (dB)
	MaxPeak (dB μ V /m)	Average (dB μ V /m)	Height (cm)	Polar (H/V)				
1468.000000	---	28.20	100.0	V	294.0	-1.4	54.00	25.80
1468.000000	41.39	---	100.0	V	294.0	-1.4	74.00	32.61
1828.400000	---	31.13	100.0	H	208.0	1.0	54.00	22.87
1828.400000	40.06	---	100.0	H	208.0	1.0	74.00	33.94
2742.600000	---	40.12	200.0	H	198.0	4.6	54.00	13.88
2742.600000	46.77	---	200.0	H	198.0	4.6	74.00	27.23
4520.800000	---	37.49	100.0	H	255.0	9.3	54.00	16.51
4520.800000	47.24	---	100.0	H	255.0	9.3	74.00	26.76
6529.600000	---	41.83	200.0	V	103.0	14.4	54.00	12.17
6529.600000	52.53	---	200.0	V	103.0	14.4	74.00	21.47
8228.800000	56.06	---	100.0	V	132.0	17.2	74.00	17.94
8228.800000	---	48.32	100.0	V	132.0	17.2	54.00	5.68

Fundamental Test & Band Edge Test:

(Pre-scan in the X,Y and Z axes of orientation, the worst case X-axis of orientation was recorded)

Note:

1. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) - Amplifier Factor (dB)

Corrected Amplitude (dBμV/m) = Corrected Factor (dB/m) + Reading (dBμV)

Margin (dB) = Limit (dBμV/m) - Corrected Amplitude (dBμV /m)

Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV /m)	Average (dBμV /m)	Height (cm)	Polar (H/V)				
Fundamental Test								
903.000000	117.26	---	200.0	H	282.0	0.2	/	/
903.000000	---	107.41	200.0	H	282.0	0.2	/	/
903.000000	112.43	---	200.0	V	68.0	0.2	/	/
903.000000	---	102.64	200.0	V	68.0	0.2	/	/
907.800000	117.34	---	200.0	H	323.0	0.3	/	/
907.800000	---	107.36	200.0	H	323.0	0.3	/	/
907.800000	112.85	---	150.0	V	102.0	0.3	/	/
907.800000	---	103.05	150.0	V	102.0	0.3	/	/
914.200000	116.51	---	200.0	H	163.0	0.5	/	/
914.200000	---	106.63	200.0	H	163.0	0.5	/	/
914.200000	112.63	---	150.0	V	122.0	0.5	/	/
914.200000	---	102.72	150.0	V	122.0	0.5	/	/

Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	QuasiPeak (dBμV/m)	Height (cm)	Polar (H/V)				
Band Edge Test							
902.000000	44.28	200.0	H	43.0	0.2	46.00	1.72
902.000000	43.16	150.0	V	69.0	0.2	46.00	2.84
928.000000	38.22	200.0	H	336.0	0.8	46.00	7.78
928.000000	37.73	200.0	V	134.0	0.8	46.00	8.27

Data for Chip antenna at 125kHz channel:**Spurious Emission Test:****30MHz-1GHz**

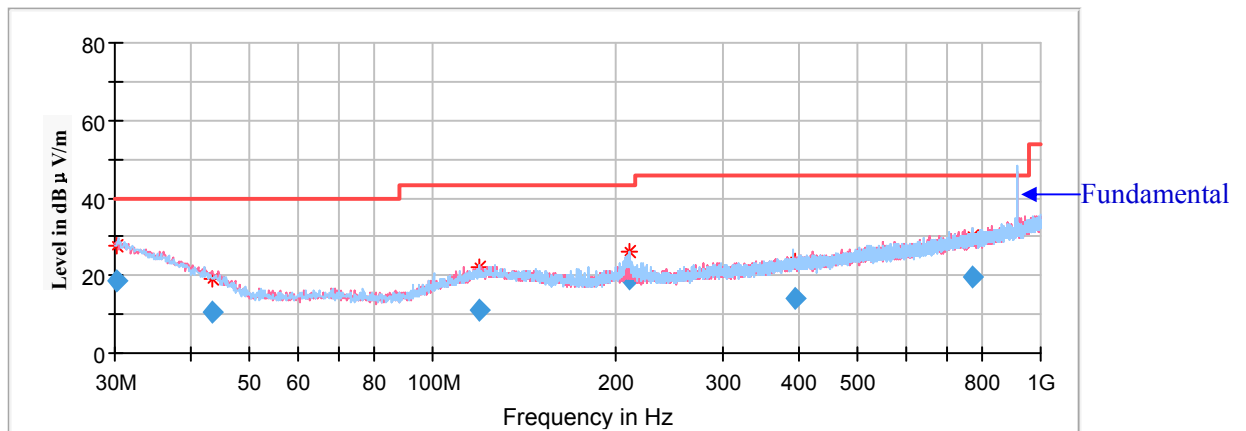
(Pre-scan with low, middle and high channels of operation in the X,Y and Z axes of orientation, the worst case **low** channel of operation in X-axis of orientation was recorded)

Note:

1. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) - Amplifier Factor (dB)

Corrected Amplitude (dBμV/m) = Corrected Factor (dB/m) + Reading (dBμV)

Margin (dB) = Limit (dBμV/m) - Corrected Amplitude (dBμV /m)



Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	QuasiPeak (dBμV/m)	Height (cm)	Polar (H/V)				
30.131550	18.76	199.0	H	0.0	-4.0	40.00	21.24
43.520650	10.35	199.0	V	314.0	-13.1	40.00	29.65
119.404750	10.89	101.0	H	65.0	-11.3	43.50	32.61
210.158400	19.35	199.0	H	198.0	-12.3	43.50	24.15
393.320500	13.84	199.0	H	329.0	-8.3	46.00	32.16
771.727350	19.74	101.0	H	330.0	-2.1	46.00	26.26

1GHz-10GHz

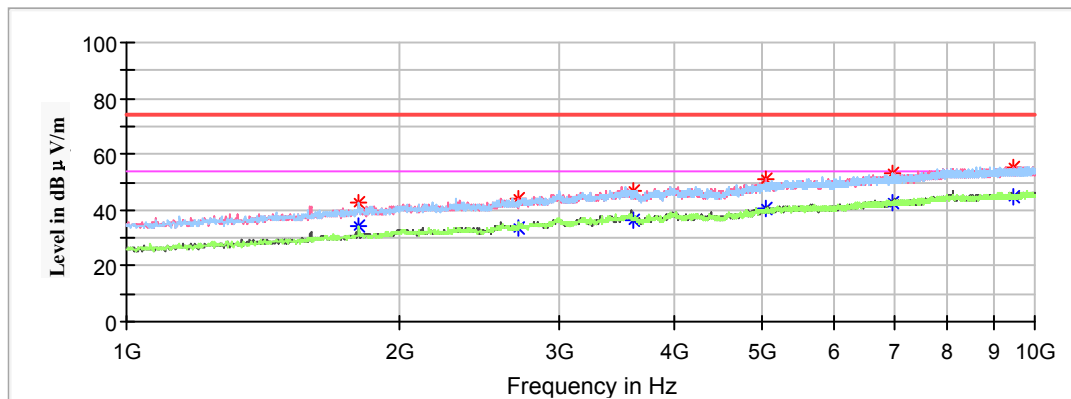
(Pre-scan in the X,Y and Z axes of orientation, the worst case **X-axis of orientation** was recorded)

Note:

- Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) - Amplifier Factor (dB)
 Corrected Amplitude (dB μ V/m) = Corrected Factor (dB/m) + Reading (dB μ V)
 Margin (dB) = Limit (dB μ V/m) - Corrected Amplitude (dB μ V /m)

Low Channel: 902.3MHz

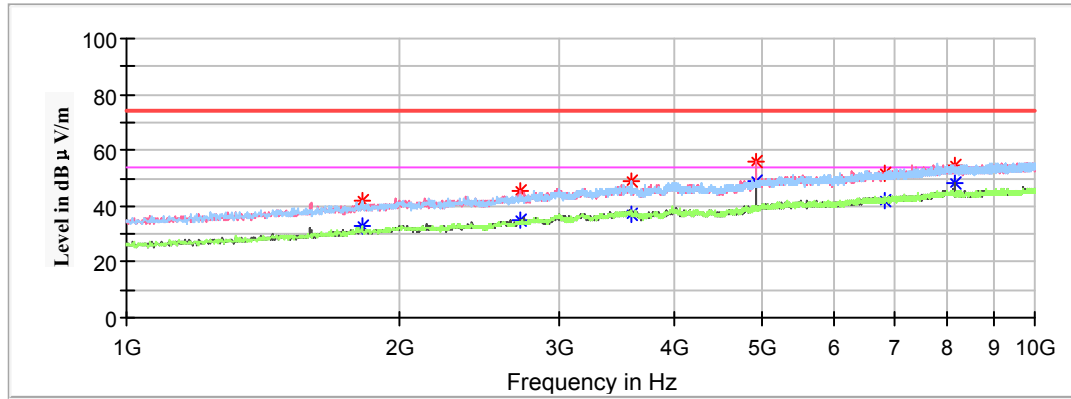
Full Spectrum



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dB μ V/m)	Margin (dB)
	MaxPeak (dB μ V /m)	Average (dB μ V /m)	Height (cm)	Polar (H/V)				
1804.600000	---	34.22	100.0	H	188.0	0.8	54.00	19.78
1804.600000	42.74	---	100.0	H	188.0	0.8	74.00	31.26
2706.900000	---	33.86	150.0	H	25.0	4.3	54.00	20.14
2706.900000	43.77	---	150.0	H	25.0	4.3	74.00	30.23
3609.200000	---	36.51	250.0	H	245.0	7.7	54.00	17.49
3609.200000	46.53	---	250.0	H	245.0	7.7	74.00	27.47
5046.400000	---	40.27	100.0	V	176.0	11.7	54.00	13.73
5046.400000	51.11	---	100.0	V	176.0	11.7	74.00	22.89
6972.400000	---	42.50	250.0	H	12.0	14.9	54.00	11.50
6972.400000	53.47	---	250.0	H	12.0	14.9	74.00	20.53
9494.200000	---	44.84	100.0	V	41.0	17.8	54.00	9.16
9494.200000	55.29	---	100.0	V	41.0	17.8	74.00	18.71

Middle Channel: 908.5MHz

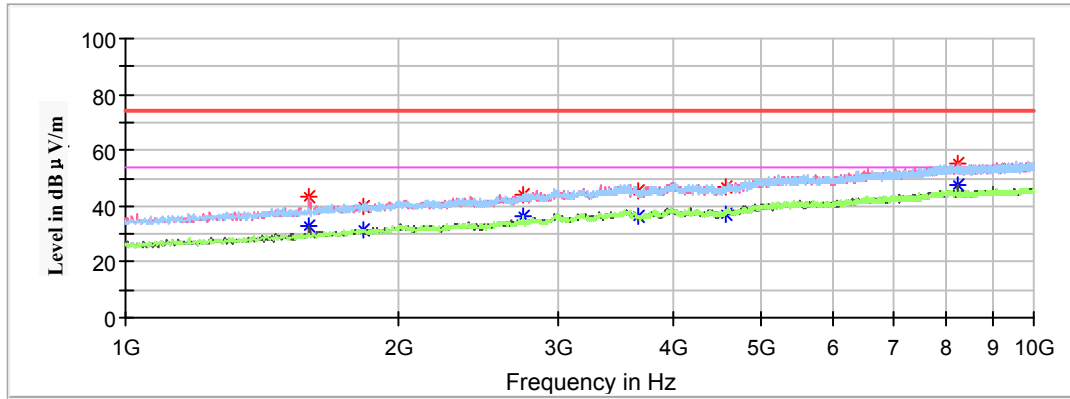
Full Spectrum



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1817.000000	41.89	---	250.0	H	152.0	0.9	74.00	32.11
1817.000000	---	32.85	250.0	H	152.0	0.9	54.00	21.15
2725.500000	45.13	---	150.0	H	184.0	4.5	74.00	28.87
2725.500000	---	34.86	150.0	H	184.0	4.5	54.00	19.14
3592.000000	48.62	---	100.0	H	251.0	7.6	74.00	25.38
3592.000000	---	37.40	100.0	H	251.0	7.6	54.00	16.60
4934.800000	55.81	---	200.0	V	153.0	11.4	74.00	18.19
4934.800000	---	48.72	200.0	V	153.0	11.4	54.00	5.28
6839.200000	---	42.19	150.0	H	360.0	14.7	54.00	11.81
6839.200000	51.89	---	150.0	H	360.0	14.7	74.00	22.11
8176.600000	54.70	---	200.0	V	321.0	17.2	74.00	19.30
8176.600000	---	48.43	200.0	V	321.0	17.2	54.00	5.57

High Channel: 914.9MHz

Full Spectrum



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dB μ V/m)	Margin (dB)
	MaxPeak (dB μ V /m)	Average (dB μ V /m)	Height (cm)	Polar (H/V)				
1594.000000	43.13	---	250.0	V	131.0	-0.6	74.00	30.87
1594.000000	---	32.76	250.0	V	131.0	-0.6	54.00	21.24
1829.800000	40.07	---	150.0	H	331.0	1.0	74.00	33.93
1829.800000	---	31.75	150.0	H	331.0	1.0	54.00	22.25
2744.700000	---	36.47	200.0	H	107.0	4.6	54.00	17.53
2744.700000	44.14	---	200.0	H	107.0	4.6	74.00	29.86
3659.600000	45.72	---	250.0	H	41.0	7.9	74.00	28.28
3659.600000	---	36.40	250.0	H	41.0	7.9	54.00	17.60
4574.500000	47.15	---	100.0	H	171.0	9.6	74.00	26.85
4574.500000	---	37.08	100.0	H	171.0	9.6	54.00	16.92
8234.200000	---	47.66	200.0	V	171.0	17.2	54.00	6.34
8234.200000	55.14	---	200.0	V	171.0	17.2	74.00	18.86

Fundamental Test & Band Edge Test:

(Pre-scan in the X,Y and Z axes of orientation, the worst case X-axis of orientation was recorded)

Note:

1. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) - Amplifier Factor (dB)

Corrected Amplitude (dBμV/m) = Corrected Factor (dB/m) + Reading (dBμV)

Margin (dB) = Limit (dBμV/m) - Corrected Amplitude (dBμV /m)

Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV /m)	Average (dBμV /m)	Height (cm)	Polar (H/V)				
Fundamental Test								
902.300000	117.28	---	200.0	H	239.0	0.2	/	/
902.300000	---	107.43	200.0	H	239.0	0.2	/	/
902.300000	112.59	---	200.0	V	158.0	0.2	/	/
902.300000	---	102.77	200.0	V	158.0	0.2	/	/
908.500000	116.88	---	200.0	H	296.0	0.3	/	/
908.500000	---	106.93	200.0	H	296.0	0.3	/	/
908.500000	112.49	---	200.0	V	148.0	0.3	/	/
908.500000	---	102.64	200.0	V	148.0	0.3	/	/
914.900000	116.53	---	250.0	H	352.0	0.5	/	/
914.900000	---	106.71	250.0	H	352.0	0.5	/	/
914.900000	112.45	---	250.0	V	10.0	0.5	/	/
914.900000	---	102.65	250.0	V	10.0	0.5	/	/

Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	QuasiPeak (dBμV/m)	Height (cm)	Polar (H/V)				
Band Edge Test							
902.000000	42.68	150.0	H	117.0	0.2	46.00	3.32
902.000000	41.57	150.0	V	50.0	0.2	46.00	4.43
928.000000	38.23	150.0	H	354.0	0.8	46.00	7.77
928.000000	37.71	250.0	V	111.0	0.8	46.00	8.29

Data for Chip antenna at 500kHz channel:**Spurious Emission Test:****30MHz-1GHz**

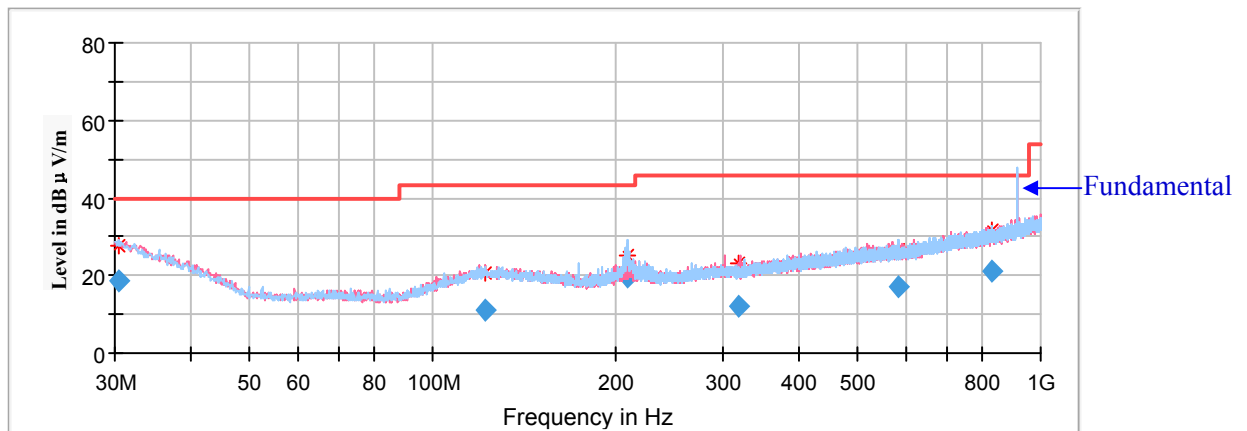
(Pre-scan with low, middle and high channels of operation in the X,Y and Z axes of orientation, the worst case **middle channel of operation in X-axis of orientation** was recorded)

Note:

1. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) - Amplifier Factor (dB)

Corrected Amplitude (dB μ V/m) = Corrected Factor (dB/m) + Reading (dB μ V)

Margin (dB) = Limit (dB μ V/m) - Corrected Amplitude (dB μ V /m)



Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dB μ V/m)	Margin (dB)
	QuasiPeak (dB μ V/m)	Height (cm)	Polar (H/V)				
30.389355	18.53	199.0	H	60.0	-4.2	40.00	21.47
122.265750	11.32	199.0	V	0.0	-11.3	43.50	32.18
208.930250	19.70	199.0	H	209.0	-12.3	43.50	23.80
318.627950	12.09	101.0	V	277.0	-10.1	46.00	33.91
582.803700	16.99	101.0	H	112.0	-5.4	46.00	29.01
831.065550	21.12	199.0	H	309.0	-1.3	46.00	24.88

1GHz-10GHz

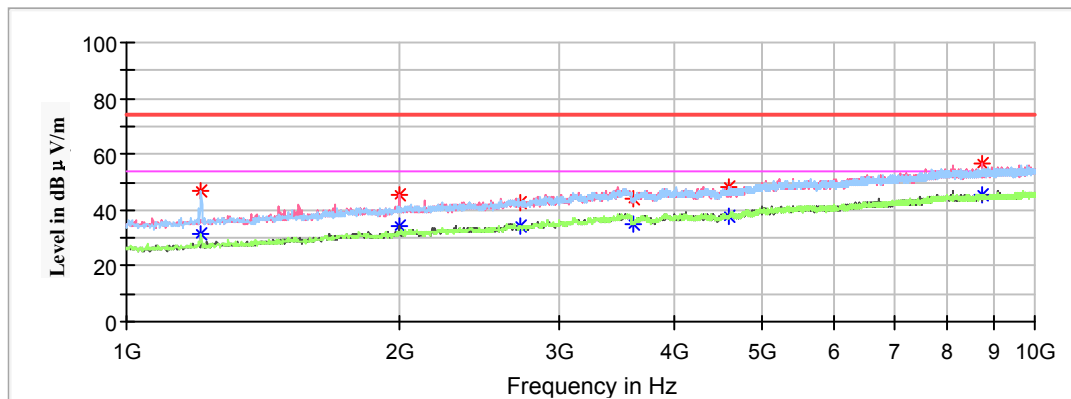
(Pre-scan in the X,Y and Z axes of orientation, the worst case **X-axis of orientation** was recorded)

Note:

- Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) - Amplifier Factor (dB)
 Corrected Amplitude (dB μ V/m) = Corrected Factor (dB/m) + Reading (dB μ V)
 Margin (dB) = Limit (dB μ V/m) - Corrected Amplitude (dB μ V /m)

Low Channel: 903MHz

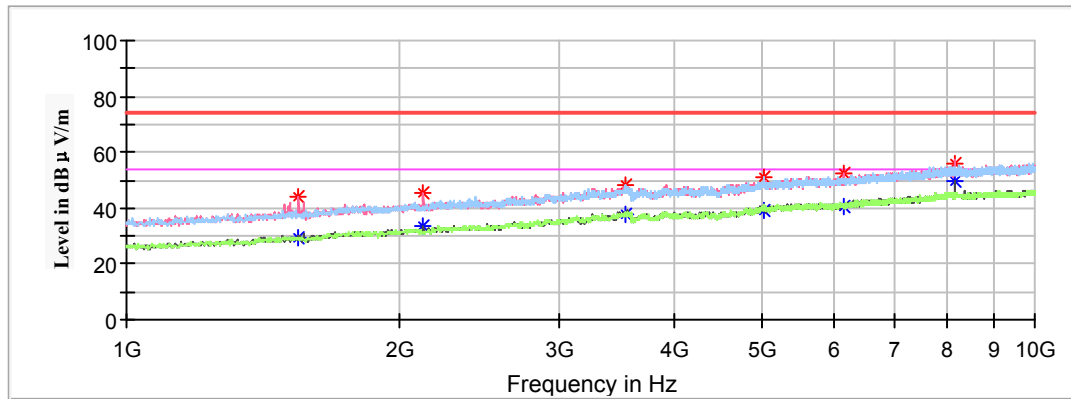
Full Spectrum



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dB μ V/m)	Margin (dB)
	MaxPeak (dB μ V /m)	Average (dB μ V /m)	Height (cm)	Polar (H/V)				
1208.800000	---	31.74	100.0	H	297.0	-3.0	54.00	22.26
1208.800000	46.71	---	100.0	H	297.0	-3.0	74.00	27.29
1999.000000	---	34.07	150.0	V	107.0	2.0	54.00	19.93
1999.000000	45.11	---	150.0	V	107.0	2.0	74.00	28.89
2709.000000	---	34.16	250.0	H	158.0	4.4	54.00	19.84
2709.000000	42.80	---	250.0	H	158.0	4.4	74.00	31.20
3612.000000	---	34.63	100.0	H	308.0	7.7	54.00	19.37
3612.000000	44.10	---	100.0	H	308.0	7.7	74.00	29.90
4601.800000	---	37.72	200.0	H	77.0	9.7	54.00	16.28
4601.800000	48.50	---	200.0	H	77.0	9.7	74.00	25.50
8738.200000	---	45.41	150.0	V	350.0	17.4	54.00	8.59
8738.200000	56.32	---	150.0	V	350.0	17.4	74.00	17.68

Middle Channel: 907.8MHz

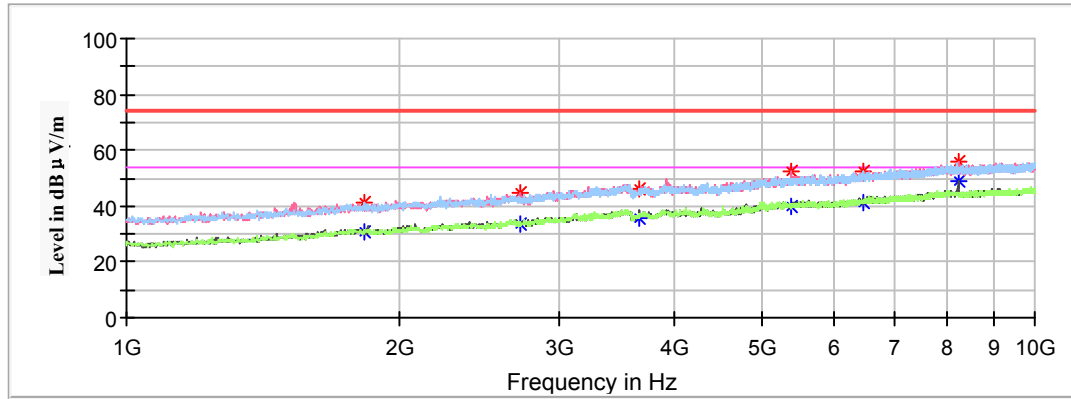
Full Spectrum



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1547.200000	44.22	---	150.0	V	288.0	-0.9	74.00	29.78
1547.200000	---	29.03	150.0	V	288.0	-0.9	54.00	24.97
2123.200000	45.28	---	100.0	V	100.0	2.3	74.00	28.72
2123.200000	---	33.49	100.0	V	100.0	2.3	54.00	20.51
3545.200000	48.54	---	250.0	H	359.0	7.4	74.00	25.46
3545.200000	---	37.62	250.0	H	359.0	7.4	54.00	16.38
5023.000000	---	39.41	100.0	H	108.0	11.7	54.00	14.59
5023.000000	50.93	---	100.0	H	108.0	11.7	74.00	23.07
6169.600000	---	40.73	200.0	V	192.0	13.4	54.00	13.27
6169.600000	52.23	---	200.0	V	192.0	13.4	74.00	21.77
8169.400000	56.05	---	100.0	V	280.0	17.2	74.00	17.95
8169.400000	---	49.39	100.0	V	280.0	17.2	54.00	4.61

High Channel: 914.2MHz

Full Spectrum



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dB μ V/m)	Margin (dB)
	MaxPeak (dB μ V /m)	Average (dB μ V /m)	Height (cm)	Polar (H/V)				
1828.400000	---	30.64	100.0	H	21.0	1.0	54.00	23.36
1828.400000	41.00	---	100.0	H	21.0	1.0	74.00	33.00
2708.200000	---	33.74	150.0	V	168.0	4.4	54.00	20.26
2708.200000	44.68	---	150.0	V	168.0	4.4	74.00	29.32
3656.800000	---	36.01	250.0	H	141.0	7.9	54.00	17.99
3656.800000	46.19	---	250.0	H	141.0	7.9	74.00	27.81
5384.800000	---	39.60	100.0	V	348.0	12.3	54.00	14.40
5384.800000	52.22	---	100.0	V	348.0	12.3	74.00	21.78
6464.800000	---	41.44	250.0	H	266.0	14.2	54.00	12.56
6464.800000	52.61	---	250.0	H	266.0	14.2	74.00	21.39
8228.800000	---	48.90	150.0	V	147.0	17.2	54.00	5.10
8228.800000	55.86	---	150.0	V	147.0	17.2	74.00	18.14

Fundamental Test & Band Edge Test:

(Pre-scan in the X,Y and Z axes of orientation, the worst case X-axis of orientation was recorded)

Note:

1. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) - Amplifier Factor (dB)

Corrected Amplitude (dBμV/m) = Corrected Factor (dB/m) + Reading (dBμV)

Margin (dB) = Limit (dBμV/m) - Corrected Amplitude (dBμV /m)

Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV /m)	Average (dBμV /m)	Height (cm)	Polar (H/V)				
Fundamental Test								
903.000000	117.33	---	200.0	H	258.0	0.2	/	/
903.000000	---	107.51	200.0	H	258.0	0.2	/	/
903.000000	112.45	---	150.0	V	264.0	0.2	/	/
903.000000	---	102.70	150.0	V	264.0	0.2	/	/
907.800000	117.39	---	150.0	H	91.0	0.3	/	/
907.800000	---	107.28	150.0	H	91.0	0.3	/	/
907.800000	112.82	---	250.0	V	354.0	0.3	/	/
907.800000	---	103.01	250.0	V	354.0	0.3	/	/
914.200000	116.49	---	200.0	H	288.0	0.5	/	/
914.200000	---	106.64	200.0	H	288.0	0.5	/	/
914.200000	112.66	---	250.0	V	136.0	0.5	/	/
914.200000	---	102.78	250.0	V	136.0	0.5	/	/

Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	QuasiPeak (dBμV/m)	Height (cm)	Polar (H/V)				
Band Edge Test							
902.000000	44.33	150.0	H	265.0	0.2	46.00	1.67
902.000000	43.18	200.0	V	225.0	0.2	46.00	2.82
928.000000	38.18	200.0	H	86.0	0.8	46.00	7.82
928.000000	37.81	150.0	V	158.0	0.8	46.00	8.19

***** END OF REPORT *****