TEST REPORT

Application No.:	KSCR2112000377AT
FCC ID:	2ADTD-CP03029601220
Applicant:	Hangzhou Hikvision Digital Technology Co.,Ltd.
Address of Applicant:	No. 555, Qianmo Road, Binjiang District,Hangzhou
Manufacturer:	Hangzhou Hikvision Digital Technology Co.,Ltd.
Address of Manufacturer:	No. 555, Qianmo Road, Binjiang District,Hangzhou
Factory:	1.Hangzhou Hikvision Electronics Co., Ltd. 2.Hangzhou Hikvision Technology Co., Ltd. 3.CHONGQING HIKVISION TECHNOLOGY CO.,LTD.
Address of Factory:	1.No.299,Qiushi Road,Tonglu Economic Development Zone,Tonglu County, Hangzhou,Zhejiang 2.No.700 Dongliu Road, Binjiang District, Hangzhou 310052, China 3.No.118, Haikang Road, Area C, Jianqiao Industrial Park, Dadukou District, Chongqing, 401325,China
Equipment Under Test (EUT):	
EUT Name:	AX PRO
Model No.:	DS-PWA96-M2H-WA,DS-PWA96-M2H-WAUHK, DS-PWA96-M2H-WACKV,DS-PWA96-M2H-WAUVS, DS-PWA96-M2H-WAKVO,DS-PWA96-M2H-WAHUN¤
¤	Please refer to section 2 of this report which indicates which model was actually tested and which were electrically identical.
Trade mark:	HIKVISION
Standard(s) :	47 CFR Part 15, Subpart C 15.247
Date of Receipt:	2021-12-23
Date of Test:	2022-01-06 to 2022-01-26
Date of Issue:	2022-01-27
Test Result:	**Pass***

* In the configuration tested, the EUT complied with the standards specified above.

Eric Lin
Laboratory Manager

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Revision Record			
Version	**Description**	**Date**	**Remark**
00	Original	2022-01-27	/

Authorized for issue by:				
		Damon zhou		
		Damon Zhou / Project Engineer		
		Eric Lin		
		Eric Lin / Reviewer		

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2 Test Summary

Radio Spectrum Technical Requirement				
Item	**Standard**	**Method**	**Requirement**	**Result**
Antenna Requirement	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)	Pass
Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.247(a)(1), (g), (h)	Pass

Radio Spectrum Matter Part				
Item	**Standard**	**Method**	**Requirement**	**Result**
Conducted Emissions at AC Power Line (150kHz-30MHz)	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.2	47 CFR Part 15, Subpart C 15.207	Pass
Conducted Peak Output Power	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.5	47 CFR Part 15, Subpart C 15.247(b)(2)	Pass
20dB Bandwidth	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.7	47 CFR Part 15, Subpart C 15.247(a)(1)	Pass
Carrier Frequencies Separation	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.2	47 CFR Part 15, Subpart C 15.247a(1)	Pass
Hopping Channel Number	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.3	47 CFR Part 15, Subpart C 15.247a(1)(i)	Pass
Dwell Time	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.4	47 CFR Part 15, Subpart C 15.247a(1)(i)	Pass
Conducted Band Edges Measurement	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.6	47 CFR Part 15, Subpart C 15.247(d)	Pass
Conducted Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.8	47 CFR Part 15, Subpart C 15.247(d)	Pass
Radiated Emissions which fall in the restricted bands	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.209 & 15.247(d)	Pass

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Declaration of EUT Family Grouping:

Note: There are series models mentioned in this report, and they are the similar in electrical and electronic characters. Only the model DS-PWA96-M2H-WA was tested since their differences were the model number and appearance.

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4 General Information

4.1 Details of E.U.T.

Power supply:	AC 100~240V 50/60Hz
Test voltage:	AC 120V/60Hz
Operation Frequency:	912.5MHz ~ 917.4MHz
Spectrum Spread:	Frequency Hopping Spread Spectrum (FHSS)
Number of Channels:	50
Channel Spacing:	100kHz
Modulation Type:	FSK
Antenna Gain:	Ant1: 3.30dBi (Provided by manufacturer)
	Ant2: -0.39dBi (Provided by manufacturer)
Antenna Type:	Ant1: PCB Antenna
	Ant2: PCB Antenna

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Notebook	Lenovo	N/A	N/A

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4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	8.4×10^{-8}
2	Timeout	2s
3	Duty cycle	0.37%
4	Occupied Bandwidth	3%
5	RF conducted power	0.6dB
6	RF power density	2.9dB
7	Conducted Spurious emissions	0.75dB
8	RF Radiated power	4.2dB (Below 1GHz)
		4.1dB (Above 1GHz)
9	Radiated Spurious emission test	4.2dB (Below 30MHz)
		4.6dB (30MHz-1GHz)
		4.8dB (1GHz-18GHz)
		5.5dB (Above 18GHz)
10	Temperature test	1°C
11	Humidity test	3%
12	Supply voltages	1.5%
13	Time	3%

Note: The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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4.4 Test Location

All tests were performed at:

Compliance Certification Services (Kunshan) Inc.

No.10 Weiye Rd, Innovation park, Eco&Tec, Development Zone, Kunshan City, Jiangsu, China.

Tel: +86 512 5735 5888 Fax: +86 512 5737 0818

No tests were sub-contracted.

4.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L4354)**

CNAS has accredited Compliance Certification Services (Kunshan) Inc. to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **A2LA (Certificate No. 2541.01)**

Compliance Certification Services (Kunshan) Inc. is accredited by the American Association for Laboratory Accreditation (A2LA). Certificate No. 2541.01.

- **FCC (Designation Number: CN1172)**

Compliance Certification Services Inc. has been recognized as an accredited testing laboratory.

Designation Number: CN1172.

- **ISED (CAB Identifier: CN0072)**

Compliance Certification Services (Kunshan) Inc. has been recognized by Innovation, Science and Economic Development (ISED) Canada as an accredited testing laboratory.

CAB Identifier: CN0072.

- **VCCI (Member No.: 1938)**

The 3m and 10m Semi-anechoic chamber and Shielded Room of Compliance Certification Services (Kunshan) Inc. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-20134, R-11600,C-11707, T-11499, G-10216 respectively.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None

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5 Equipment List

Item	Equipment	Manufacturer	Model	Serial Number	Cal Date	Cal. Due Date
Conducted Emission at Mains Terminals (150kHz-30MHz)						
1	EMI Test Receive	R&S	ESCI	100781	02/01/2021	01/31/2022
2	LISN	R&S	ENV216	101604	10/12/2021	10/11/2022
3	LISN	Schwarzbeck	NNLK 8129	8129-143	10/12/2021	10/11/2022
4	Pulse Limiter	R&S	ESH3-Z2	100609	02/01/2021	01/31/2022
5	CE test Cable	Thermax	/	14	10/16/2021	10/15/2022
6	Test Software	Farad	EZ-EMC	CCS-03A1	N.C.R	N.C.R
RF Conducted Test						
1	Spectrum Analyzer	Agilent	E4446A	MY44020154	04/16/2021	04/15/2022
2	Spectrum Analyzer	Keysight	N9020A	MY55370209	10/11/2021	10/10/2022
3	Spectrum Analyzer	Keysight	N9010A	MY56480443	02/01/2021	01/31/2022
4	Signal Generator	Agilent	N5182A	MY50142015	08/27/2021	08/26/2022
5	Radio Communication Test Station	Anritsu	MT8000A	6262012849	N/A	N/A
6	Radio Communication Analyzer	Anritsu	MT8821C	6201692222	N/A	N/A
7	Universal Radio Communication Tester	R&S	CMW500	159275	10/12/2021	10/11/2022
8	Universal Radio Communication Tester	R&S	CMW500	167239	04/16/2021	04/15/2022
9	Power Meter	Anritsu	ML2495A	1445010	04/15/2021	04/14/2022
10	Switcher	CCSRF	FY562	KUS2001M001-3	10/12/2021	10/11/2022
11	AC Power Source	EXTECH	6605	1570106	N.C.R	N.C.R
12	DC Power Supply	Aglient	E3632A	MY50340053	N.C.R	N.C.R
13	6dB Attenuator	Mini-Circuits	NAT-6-2W	15542-1	N.C.R	N.C.R
14	Power Divider	AISI	IOWOPE2068	PE2068	N.C.R	N.C.R
15	Filter	MICRO-TRONICS	BRM50701	5	N.C.R	N.C.R
16	Conducted test cable	/	RF01-RF04	/	04/15/2021	04/14/2022
17	Software	BST	TST-PASS	N/A	N/A	N/A
18	Temp. / Humidity Chamber	TERCHY	MHK-120AK	X30109	04/15/2021	04/14/2022
19	Thermometer	Anymetre	TH603	CCS007	10/14/2021	10/13/2022
RF Radiated Test						
1	Spectrum Analyzer	R&S	FSV40	101493	10/11/2021	10/10/2022
2	Signal Generator	Agilent	E8257C	MY43321570	10/18/2021	10/17/2022
3	Loop Antenna	Schwarzbeck	HXYZ9170	9170-108	02/22/2021	02/21/2022
4	Bilog Antenna	TESEQ	CBL 6112D	35403	06/21/2021	06/20/2023
5	Bilog Antenna	SCHWARZBECK	VULB9160	9160-3342	04/13/2021	04/12/2023
6	Horn-antenna(1-18GHz)	Schwarzbeck	BBHA9120D	267	10/26/2020	10/25/2022
7	Horn-antenna(1-18GHz)	ETS-LINDGREN	3117	00143290	02/22/2021	02/21/2023
8	Horn Antenna(18-40GHz)	Schwarzbeck	BBHA9170	BBHA9170171	02/22/2021	02/21/2022
9	Pre-Amplifier(30MHz~18GHz)	LNA	/	/	04/15/2021	04/14/2022
10	Amplifier(18~40GHz)	COM-POWER	PAM-840A	461332	10/18/2021	10/17/2022
11	Low Pass Filter	MICRO-TRONICS	VLFX-950	RV142900829	N.C.R	N.C.R
12	High Pass Filter	Mini-Circuits	VHF-1200	15542	N.C.R	N.C.R
13	Filter (5450MHz～5770 MHz）	MICRO-TRONICS	BRC50704-01	2	N.C.R	N.C.R
14	Filter (5690 MHz～5930 MHz）	MICRO-TRONICS	BRC50705-01	4	N.C.R	N.C.R

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15	Filter (5150 MHz～5350 MHz）	MICRO-TRONICS	BRC50703-01	2	N.C.R	N.C.R
16	Filter (885 MHz～915 MHz）	MICRO-TRONICS	BRM14698	1	N.C.R	N.C.R
17	Filter (815 MHz～860 MHz）	MICRO-TRONICS	BRM14697	1	N.C.R	N.C.R
18	Filter (1745 MHz～1910 MHz)	MICRO-TRONICS	BRM14700	1	N.C.R	N.C.R
19	Filter (1922 MHz～1977 MHz)	MICRO-TRONICS	BRM50715	1	N.C.R	N.C.R
20	Filter (2550 MHz)	MICRO-TRONICS	HPM13362	5	N.C.R	N.C.R
21	Filter (1532 MHz～1845 MHz)	MICRO-TRONICS	BRM50713	1	N.C.R	N.C.R
22	Filter (2.4GHz)	MICRO-TRONICS	BRM50701	5	N.C.R	N.C.R
23	RE test cable	/	RE01-RE04	/	04/15/2021	04/14/2022
24	Software	Faratronic	EZ_EMC-v 3A1	N/A	N/A	N/A

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6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)

6.1.2 Conclusion

Standard Requirement:

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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

EUT Antenna:

The antenna 1 and antenna 2 is PCB antenna, and all no consideration of replacement. The best case gain of the antenna 1 is 3.30dBi. and antenna 2 is -0.39dBi.

Antenna location: Refer to Appendix (Internal photo)

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6.2 Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence

6.2.1 Test Requirement:

47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)

6.2.2 Conclusion

Standard Requirement:

The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

Compliance for section 15.247(a)(1): According to Technical Specification, when transmitting continuously, device radios will hop over 50 frequency channels. They will select the transmit frequency from a pseudorandom sequence stored in a frequency hopping table. This ensures the equally usage of all channels

An example of Pseudorandom Frequency Hopping Sequence as follow:

Each frequency used equally on the average by each transmitter.

According to Technical Specification, the receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any transmitters and shift frequencies in synchronization with the transmitted signals.

Compliance for section 15.247(g): According to Technical Specification, the device uses a single side band modulation with a fully suppressed carrier, where a subcarrier is modulated. The offset of this SSB subcarrier is related to the central frequency “F0” of each declared 100 KHz channel in which the device is hopping 50 channels for continuous transmission.

Compliance for section 15.247(h): According to Technical specification, When the radio switches on, it starts on the first channel of the declared hopping list. Transmission can stop before going over the 50 channels if the message is short. No individual channel will ever be used more often than it is allowed.

The system is designed not have the ability to coordinated with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.

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7 Radio Spectrum Matter Test Results

7.1 Conducted Emissions at AC Power Line (150kHz-30MHz)

Test Requirement 47 CFR Part 15, Subpart C 15.207

Test Method: ANSI C63.10 (2013) Section 6.2

Limit:

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
*Decreases with the logarithm of the frequency.		

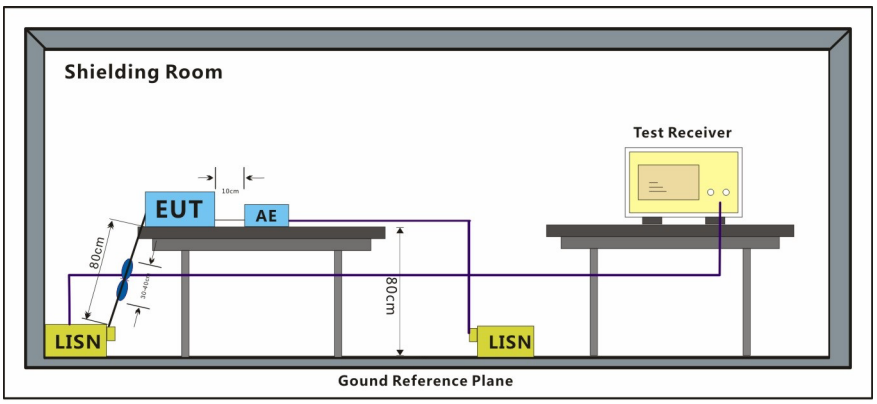
7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 24 °C Humidity: 48 % RH Atmospheric Pressure: 1010 mbar

Test mode b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with FSK modulation

7.1.2 Test Setup Diagram



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7.1.3 Measurement Procedure and Data

1) The mains terminal disturbance voltage test was conducted in a shielded room.

2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50μH + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,

4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.

5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

Remark: LISN = Read Level + Cable Loss + LISN Factor

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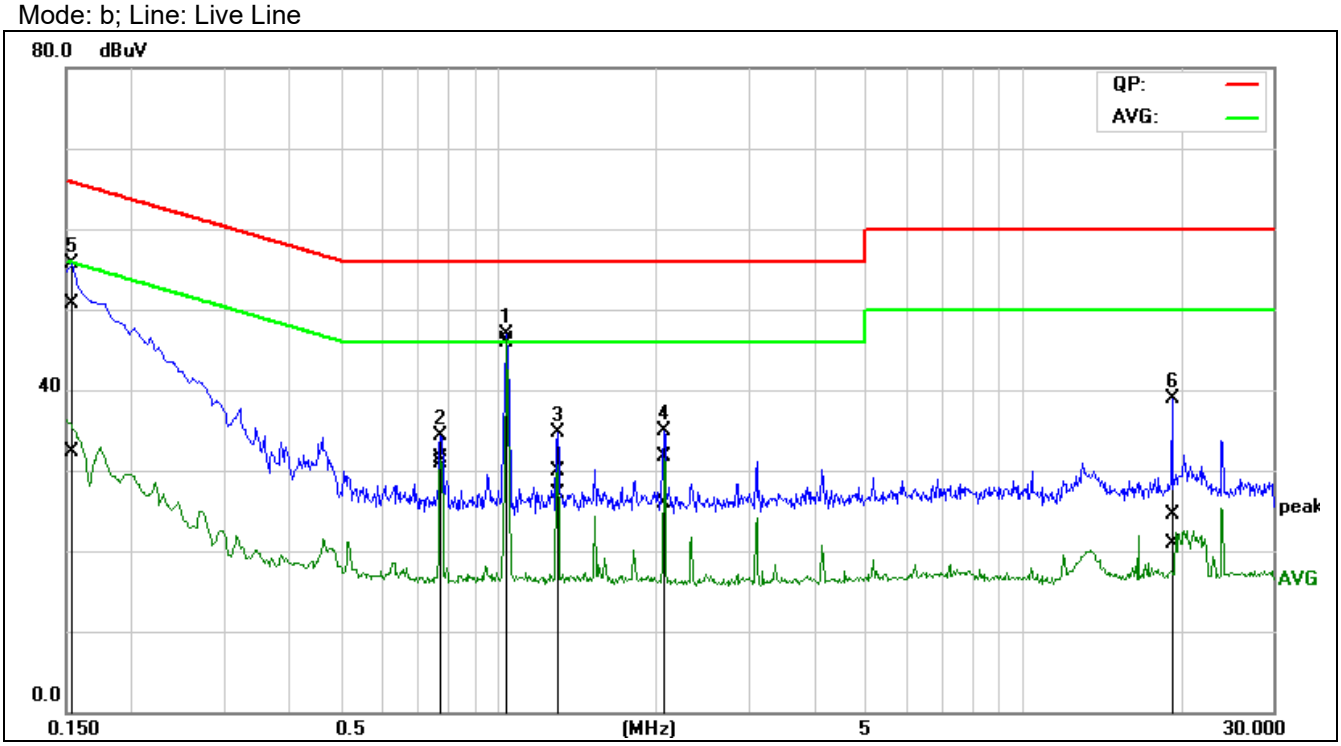
Mode: b; Line: Live Line



No.	Frequency	QuasiPeak reading	Average reading	Correction factor	QuasiPeak result	Average result	QuasiPeak limit	Average limit	QuasiPeak margin	Average margin	Remark
	(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	
1*	1.0391	26.41	26.26	19.69	46.10	45.95	56.00	46.00	-9.90	-0.05	Pass
2	0.7786	11.85	11.22	19.71	31.56	30.93	56.00	46.00	-24.44	-15.07	Pass
3	1.3017	10.16	7.39	19.70	29.86	27.09	56.00	46.00	-26.14	-18.91	Pass
4	2.0824	11.92	6.18	19.72	31.64	25.90	56.00	46.00	-24.36	-20.10	Pass
5	0.1532	31.00	12.50	19.76	50.76	32.26	65.82	55.82	-15.06	-23.56	Pass
6	19.1935	4.31	0.64	20.17	24.48	20.81	60.00	50.00	-35.52	-29.19	Pass

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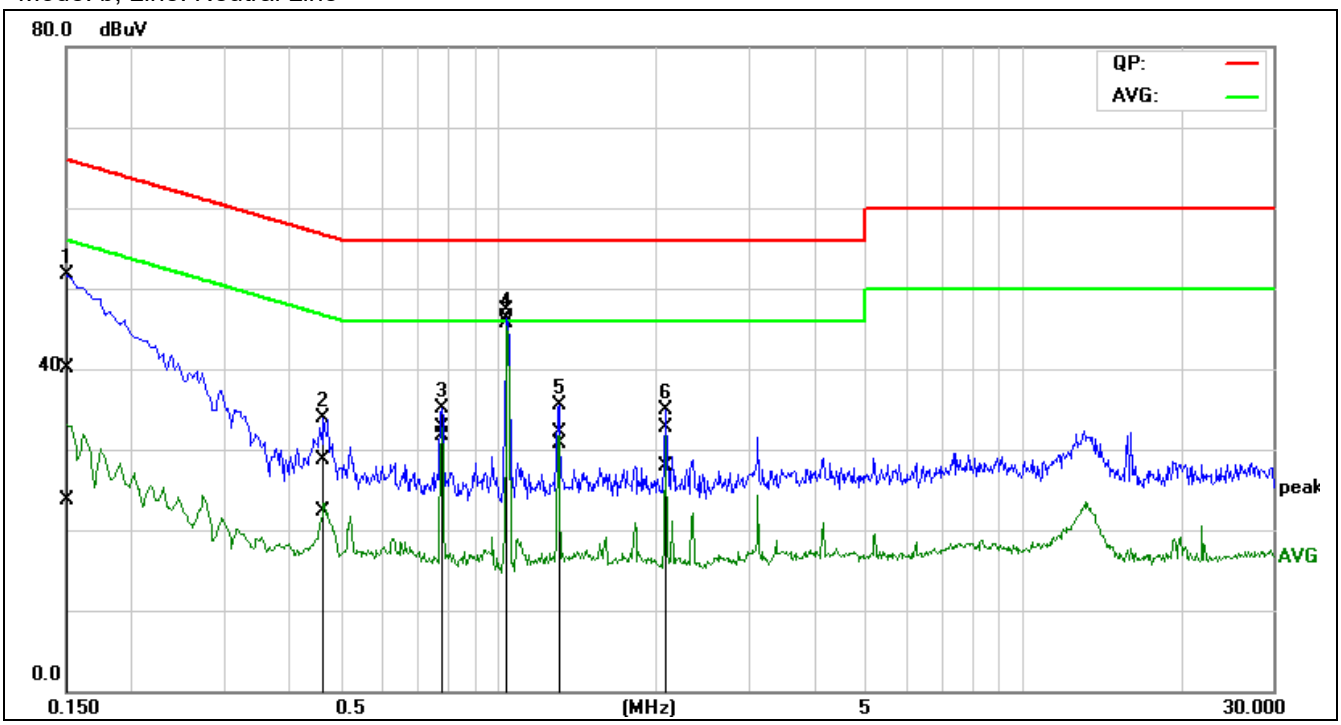
Mode: b; Line: Neutral Line



No.	Frequency	QuasiPeak reading	Average reading	Correction factor	QuasiPeak result	Average result	QuasiPeak limit	Average limit	QuasiPeak margin	Average margin	Remark
	(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	
1	0.1506	20.34	3.87	19.76	40.10	23.63	65.97	55.97	-25.87	-32.34	Pass
2	0.4679	8.91	2.52	19.80	28.71	22.32	56.55	46.55	-27.84	-24.23	Pass
3	0.7787	13.03	12.08	19.71	32.74	31.79	56.00	46.00	-23.26	-14.21	Pass
4*	1.0395	27.63	25.96	19.69	47.32	45.65	56.00	46.00	-8.68	-0.35	Pass
5	1.2986	12.46	10.94	19.70	32.16	30.64	56.00	46.00	-23.84	-15.36	Pass
6	2.0752	13.06	8.27	19.72	32.78	27.99	56.00	46.00	-23.22	-18.01	Pass

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7.2 Conducted Peak Output Power

Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(2)

Test Method: ANSI C63.10 (2013) Section 7.8.5

Limit:

Frequency Range (MHz)	Output power of the intentional radiator (watt)
902-928	1 for ≥50 hopping channels
	0.25 for 25≤ hopping channels <50
	1 for digital modulation
2400-2483.5	1 for ≥75 non-overlapping hopping channels
	0.125 for all other frequency hopping systems
	1 for digital modulation
5725-5850	1 for frequency hopping systems and digital modulation

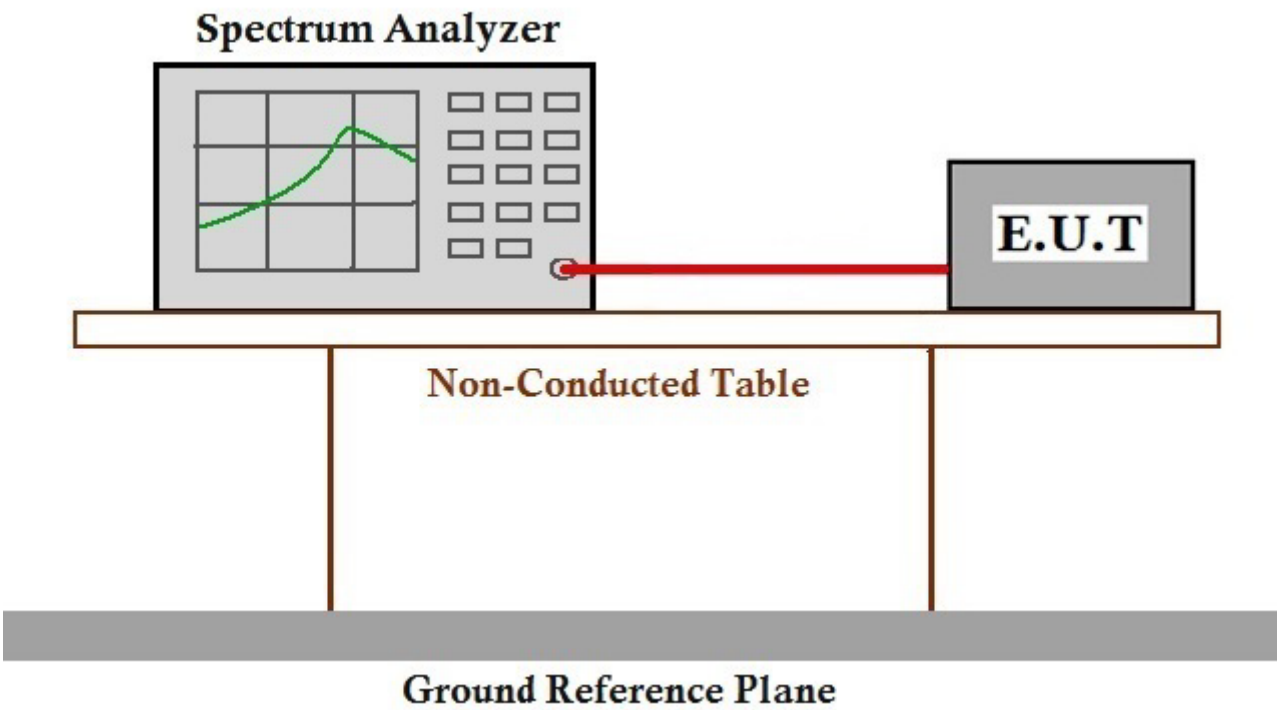
7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 25 °C Humidity: 49 % RH Atmospheric Pressure: 1008 mbar

Test mode b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with FSK modulation

7.2.2 Test Setup Diagram



7.2.3 Measurement Procedure and Data

The detailed test data see: Appendix A for KSCR211200037701

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7.3 20dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.247(a)(1)

Test Method: ANSI C63.10 (2013) Section 7.8.7

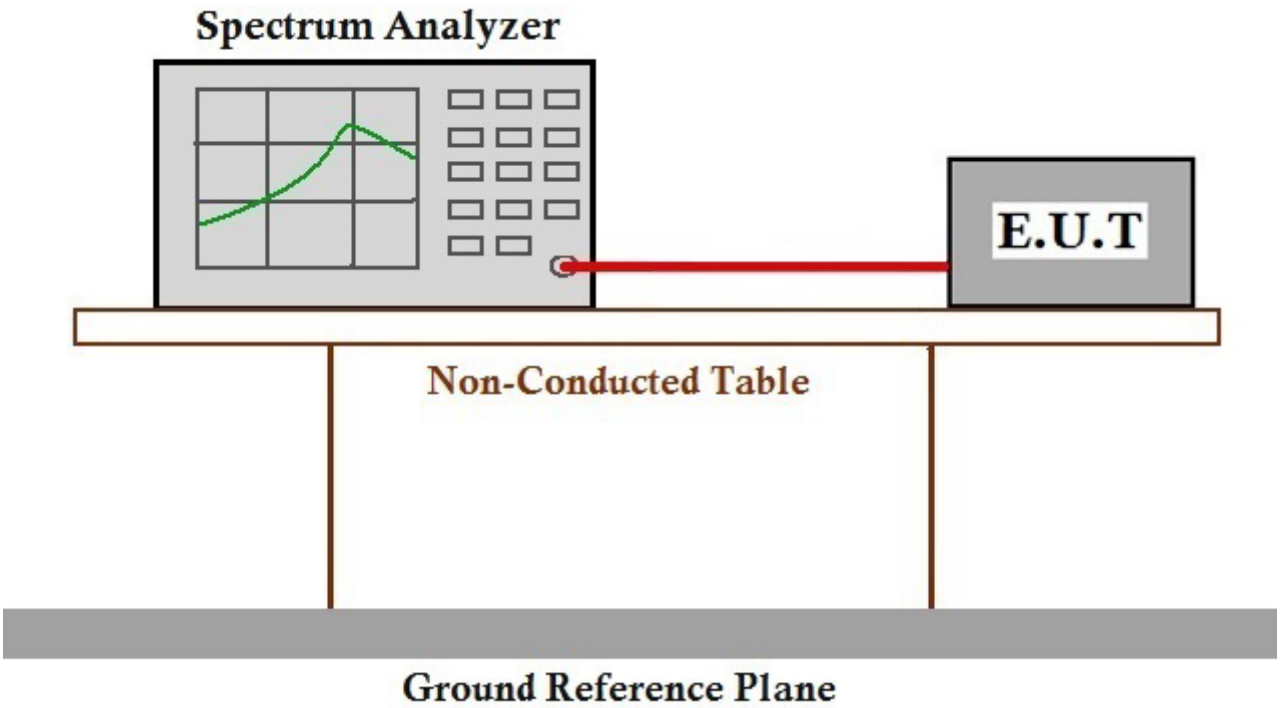
7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 25 °C Humidity: 49 % RH Atmospheric Pressure: 1008 mbar

Test mode b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with FSK modulation

7.3.2 Test Setup Diagram



7.3.3 Measurement Procedure and Data

The detailed test data see: Appendix A for KSCR211200037701

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7.4 Carrier Frequencies Separation

Test Requirement 47 CFR Part 15, Subpart C 15.247(a)(1)

Test Method: ANSI C63.10 (2013) Section 7.8.7

Limit: Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

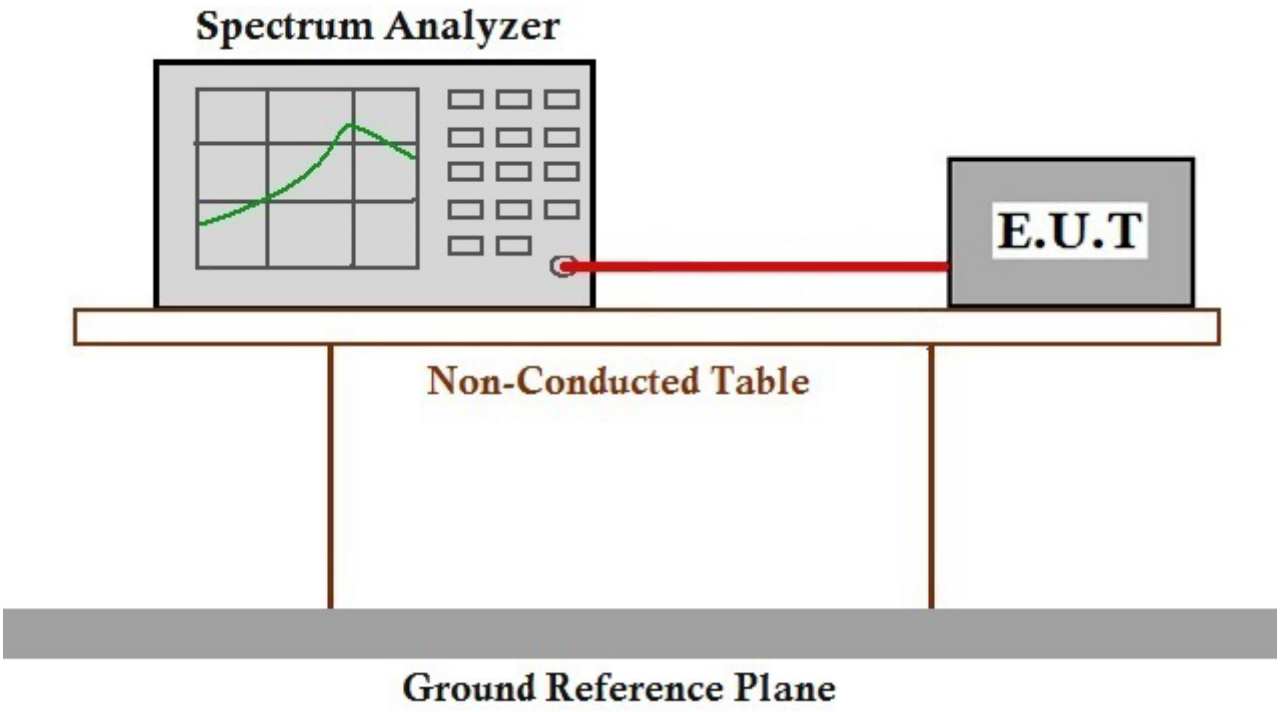
7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 25 °C Humidity: 49 % RH Atmospheric Pressure: 1008 mbar

Test mode a:TX_Hop mode_Keep the EUT in frequency hopping mode with FSK modulation.

7.4.2 Test Setup Diagram



7.4.3 Measurement Procedure and Data

The detailed test data see: Appendix A for KSCR211200037701

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7.5 Hopping Channel Number

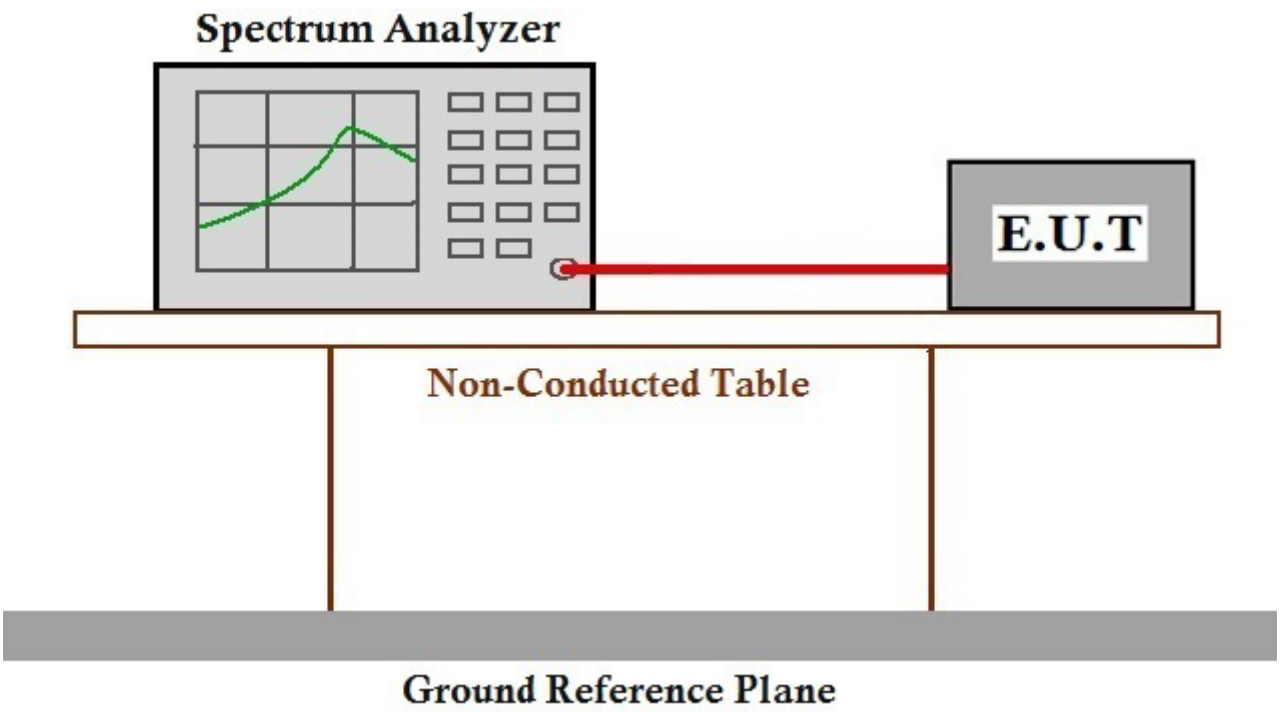
Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)(i)
Test Method: ANSI C63.10 (2013) Section 7.8.3
Limit:

Frequency Range (MHz)	Number of hopping channels (minimum)
902-928	50 for 20dB bandwidth <250kHz
	25 for 20dB bandwidth ≥250kHz
2400-2483.5	15
5725-5850	75

7.5.1 E.U.T. Operation

Operating Environment:
Temperature: 25 °C Humidity: 49 % RH Atmospheric Pressure: 1008 mbar
Test mode a:TX_Hop mode_Keep the EUT in frequency hopping mode with FSK modulation.

7.5.2 Test Setup Diagram



7.5.3 Measurement Procedure and Data

The detailed test data see: Appendix A for KSCR211200037701

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7.6 Dwell Time

Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)(i)

Test Method: ANSI C63.10 (2013) Section 7.8.4

Limit:

Frequency (MHz)	Limit
902-928	0.4S within a 20S period(20dB bandwidth<250kHz)
	0.4S within a 10S period(20dB bandwidth≥250kHz)
2400-2483.5	0.4S within a period of 0.4S multiplied by the number of hopping channels
5725-5850	0.4S within a 30S period

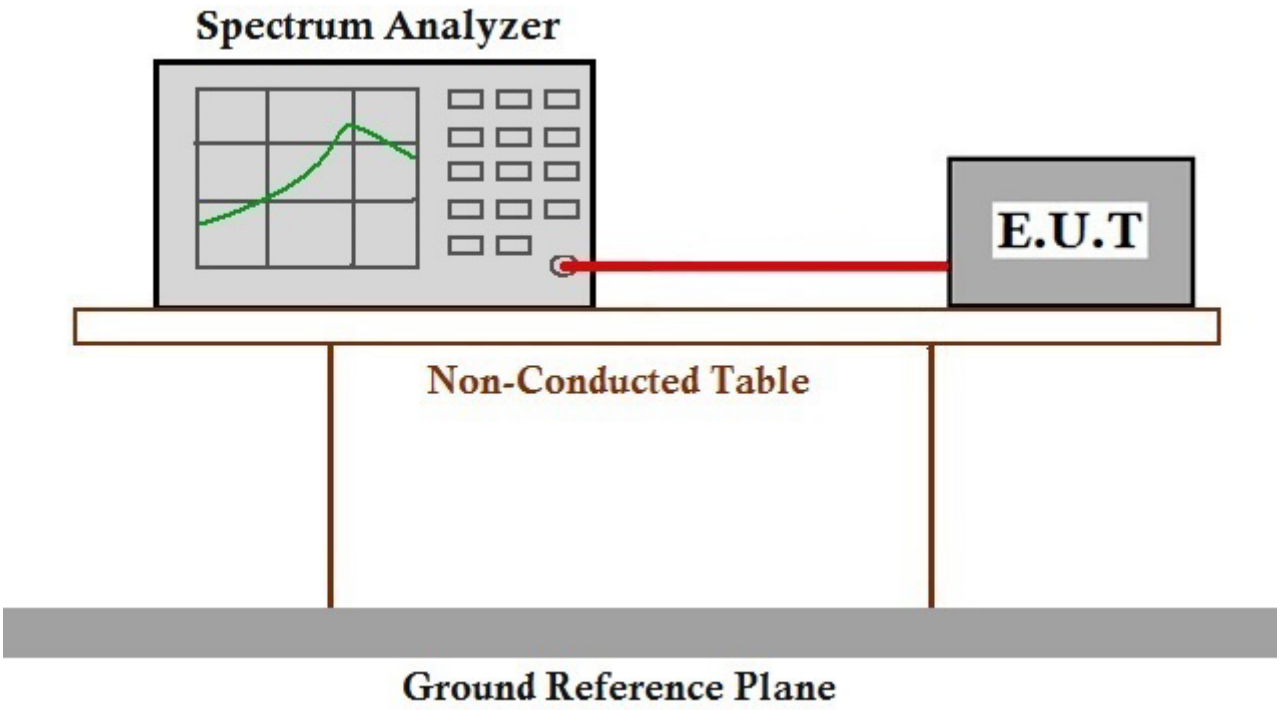
7.6.1 E.U.T. Operation

Operating Environment:

Temperature: 25 °C Humidity: 49 % RH Atmospheric Pressure: 1008 mbar

Test mode a:TX_Hop mode_Keep the EUT in frequency hopping mode with FSK modulation.

7.6.2 Test Setup Diagram



7.6.3 Measurement Procedure and Data

The detailed test data see: Appendix A for KSCR211200037701

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7.7 Conducted Band Edges Measurement

Test Requirement: 47 CFR Part 15, Subpart C 15.247(d)

Test Method: ANSI C63.10 (2013) Section 7.8.6

Limit: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)

7.7.1 E.U.T. Operation

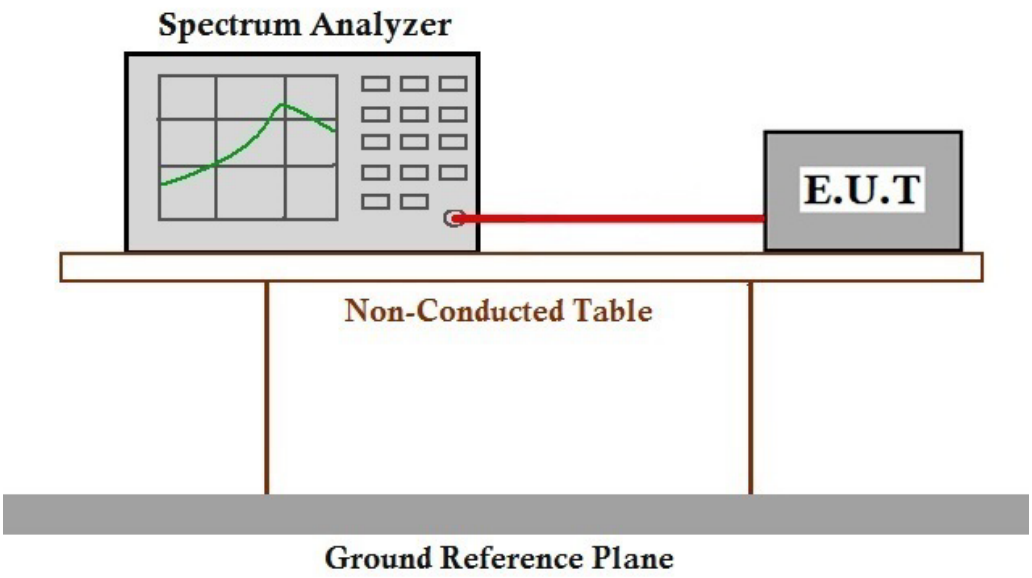
Operating Environment:

Temperature: 25 °C Humidity: 49 % RH Atmospheric Pressure: 1008 mbar

Test Mode: a:TX_Hop mode_Keep the EUT in frequency hopping mode with FSK modulation.

b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with FSK modulation.

7.7.2 Test Setup Diagram



7.7.3 Measurement Procedure and Data

The detailed test data see: Appendix A for KSCR211200037701

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7.8 Conducted Spurious Emissions

Test Requirement: 47 CFR Part 15, Subpart C 15.247(d)

Test Method: ANSI C63.10 (2013) Section 7.8.8

Limit: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)

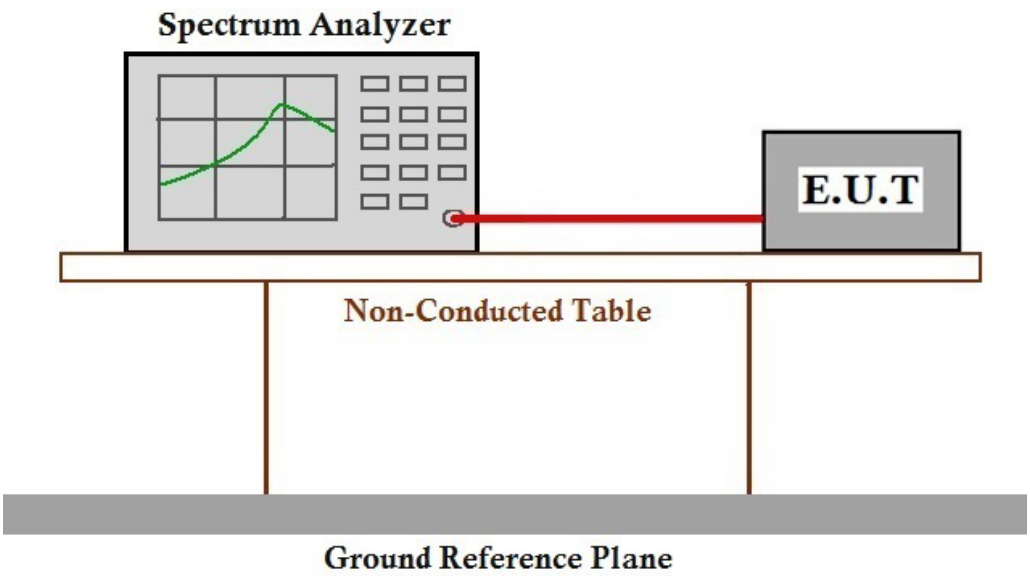
7.8.1 E.U.T. Operation

Operating Environment:

Temperature: 25 °C Humidity: 49 % RH Atmospheric Pressure: 1008 mbar

Test mode: b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with FSK modulation

7.8.2 Test Setup Diagram



7.8.3 Measurement Procedure and Data

The detailed test data see: Appendix A for KSCR211200037701

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7.9 Radiated Emissions which fall in the restricted bands

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

Test Method: ANSI C63.10 (2013) Section 6.10.5

Limit:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3
Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.		

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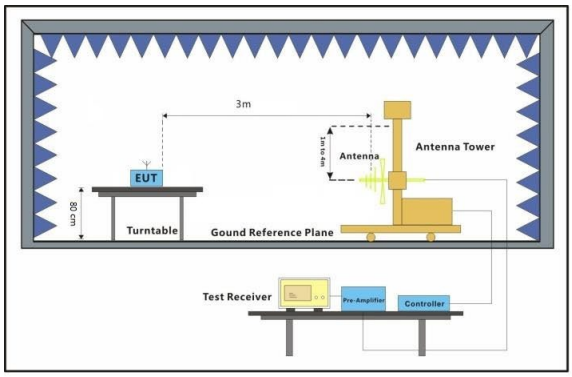
7.9.1 E.U.T. Operation

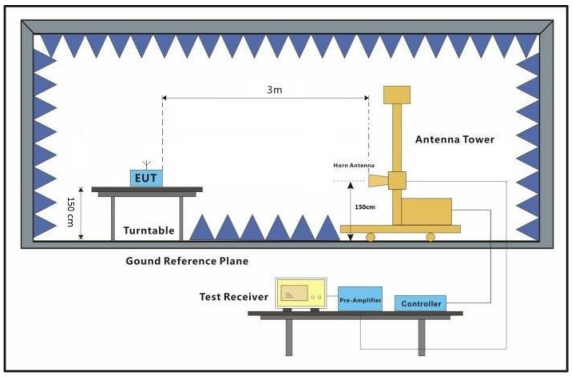
Operating Environment:

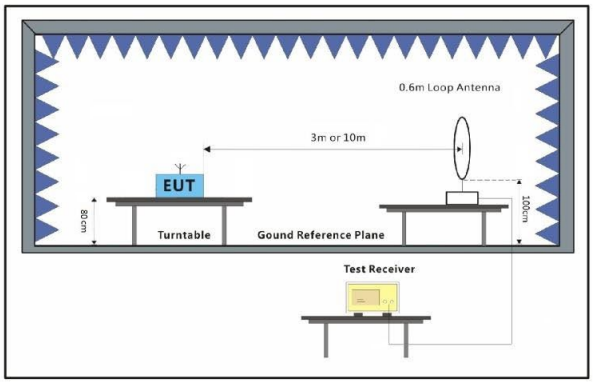
Temperature: 25 °C Humidity: 49 % RH Atmospheric Pressure: 1008 mbar

Test mode b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with FSK modulation

7.9.2 Test Setup Diagram







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7.9.3 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d. The antenna height 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.

e. 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

h. Test the EUT in the lowest channel, the middle channel, the Highest channel.

i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

j. Repeat above procedures until all frequencies measured was complete.

Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

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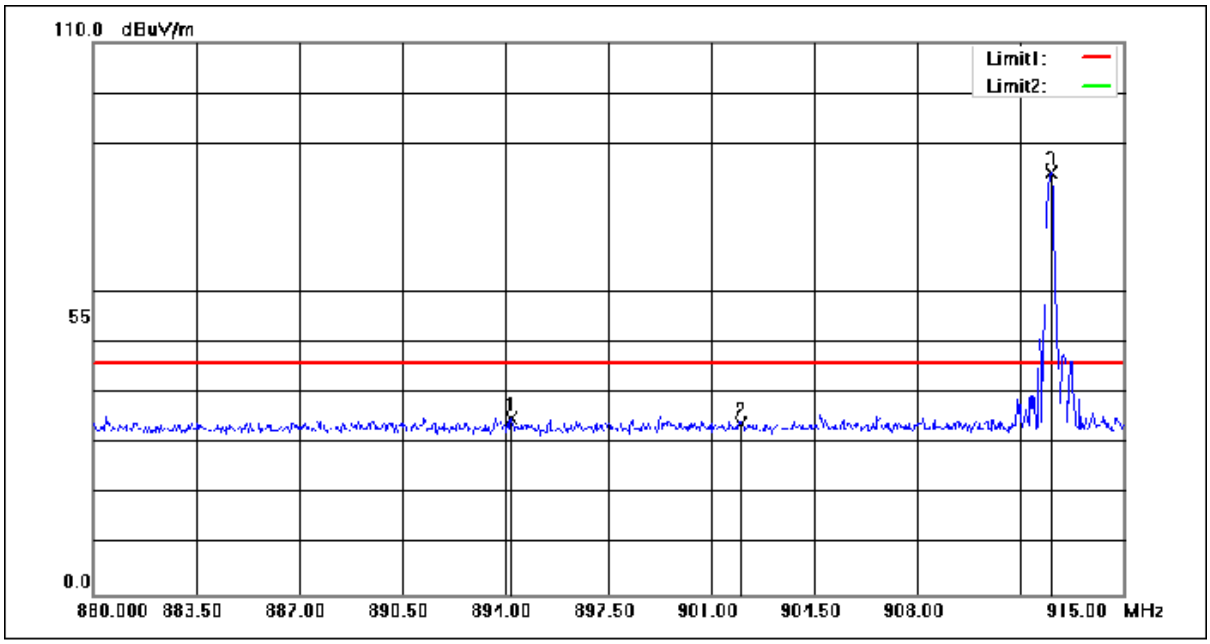
For ANT1 of 915MHz:

Mode: b; Polarization: Horizontal; Modulation: FSK; Channel: Low



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	894.2100	6.54	28.60	35.14	46.00	-10.86	QP
2	902.0000	5.29	28.70	33.99	46.00	-12.01	QP
3	912.5500	55.09	28.83	83.92	46.00	37.92	peak

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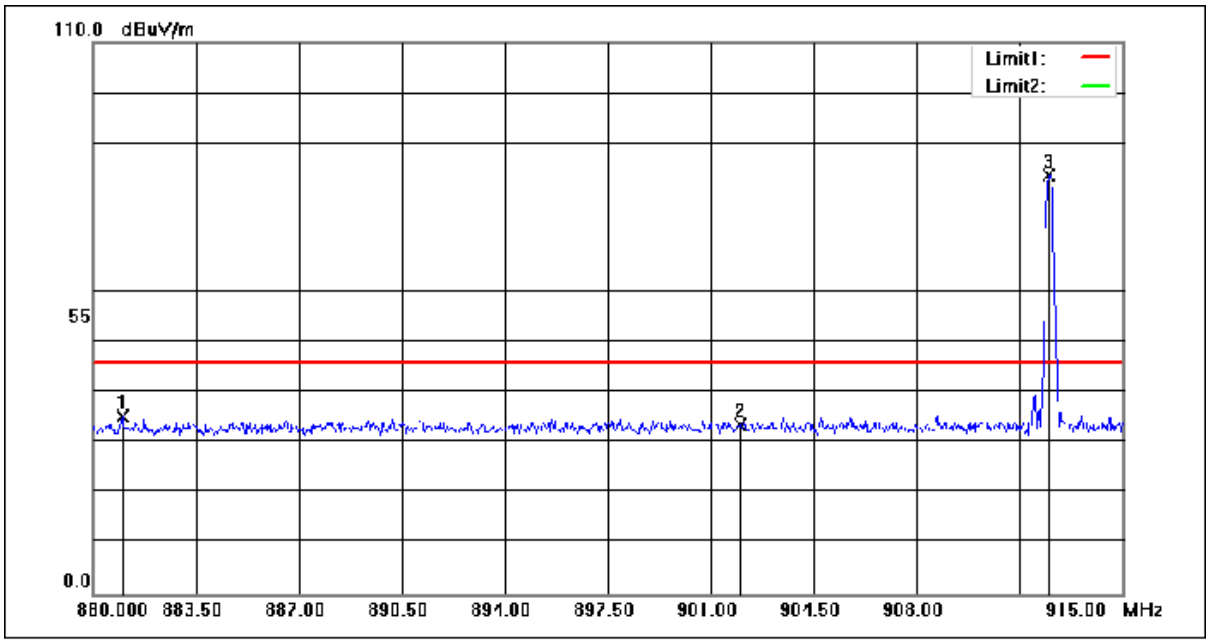
Mode: b; Polarization: Vertical; Modulation: FSK; Channel: Low



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	880.9800	6.95	28.45	35.40	46.00	-10.60	QP
2	902.0000	5.06	28.70	33.76	46.00	-12.24	QP
3	912.4800	54.61	28.83	83.44	46.00	37.44	peak

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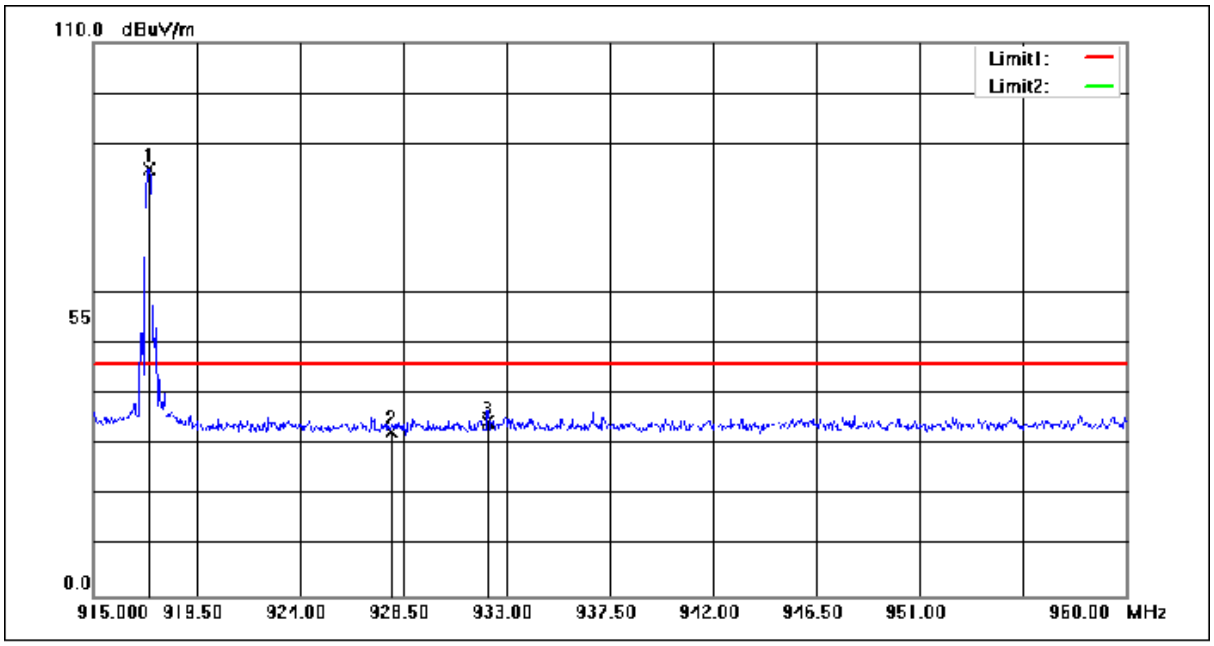
Mode: b; Polarization: Horizontal; Modulation: FSK; Channel: High



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	917.4300	56.07	28.89	84.96	46.00	38.96	peak
2	928.0000	3.55	29.02	32.57	46.00	-13.43	QP
3	932.1900	5.47	29.08	34.55	46.00	-11.45	QP

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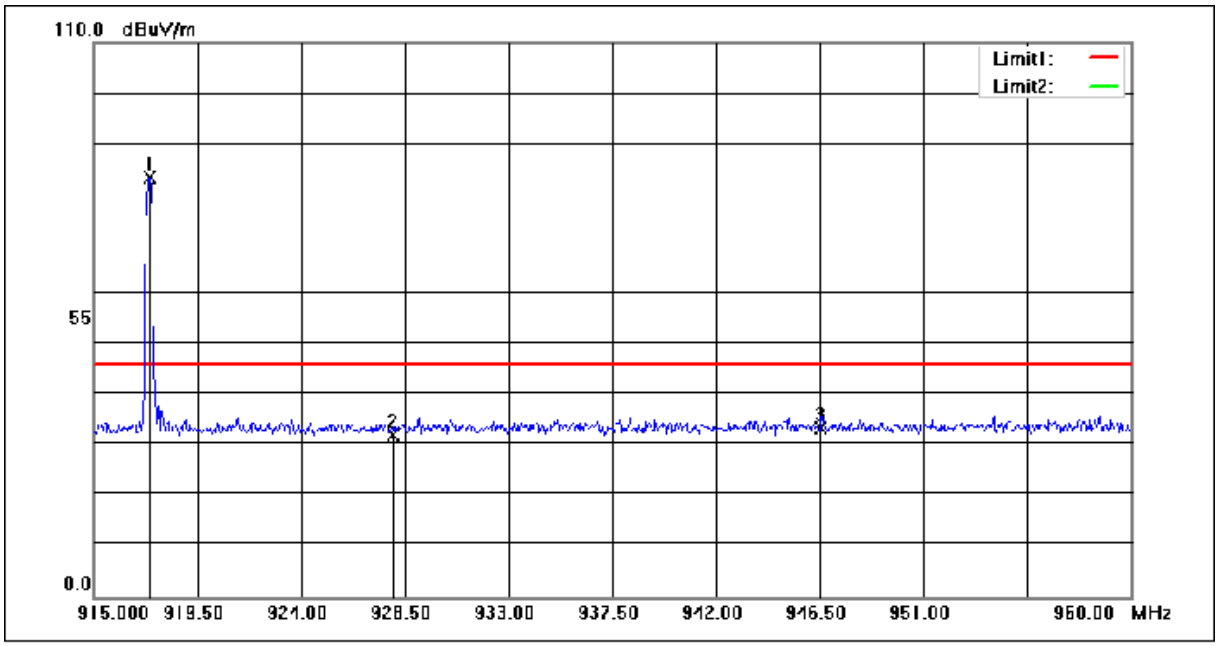
Mode: b; Polarization: Vertical; Modulation: FSK; Channel: High



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	917.4300	54.42	28.89	83.31	46.00	37.31	peak
2	928.0000	3.06	29.02	32.08	46.00	-13.92	QP
3	946.5450	4.23	29.26	33.49	46.00	-12.51	QP

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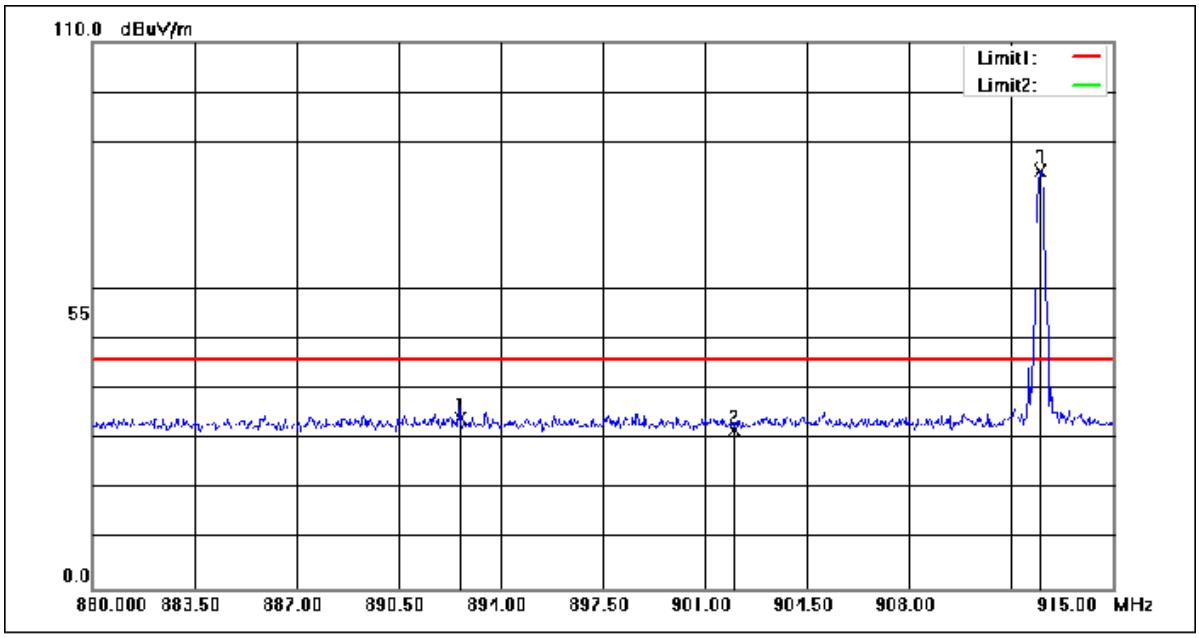
For ANT2 of 915MHz:

Mode: b; Polarization: Horizontal; Modulation: FSK; Channel: Low



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	892.6000	5.60	28.58	34.18	46.00	-11.82	QP
2	902.0000	3.19	28.70	31.89	46.00	-14.11	QP
3	912.4800	55.26	28.83	84.09	46.00	38.09	peak

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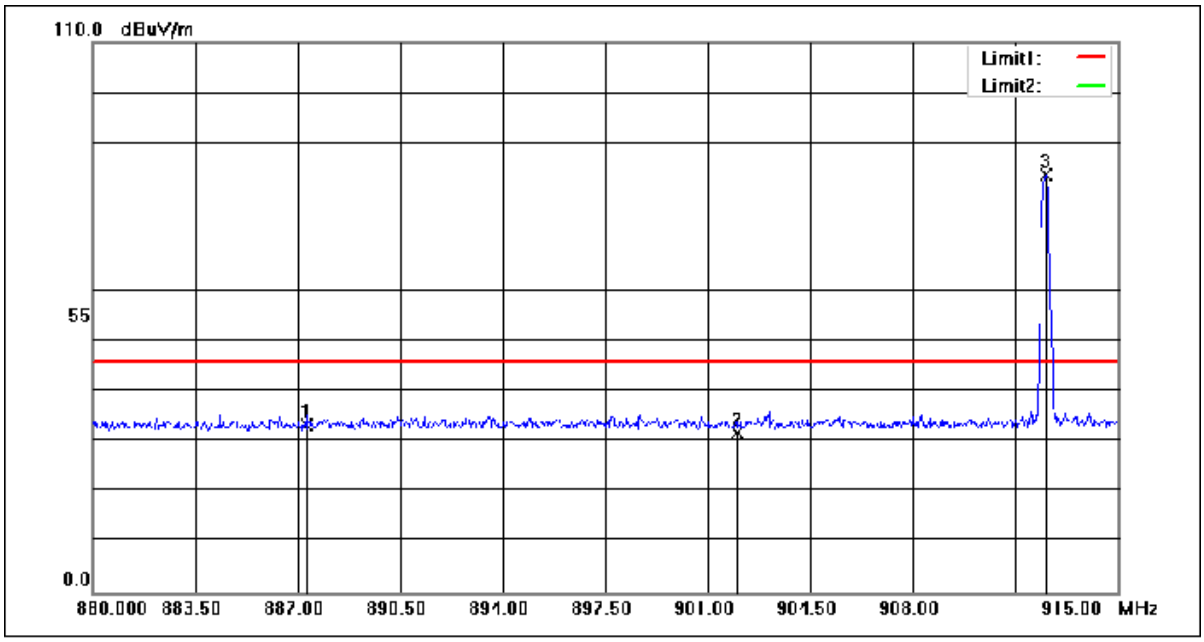
Mode: b; Polarization: Vertical; Modulation: FSK; Channel: Low



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	887.3150	4.92	28.52	33.44	46.00	-12.56	QP
2	902.0000	3.14	28.70	31.84	46.00	-14.16	QP
3	912.5500	54.50	28.83	83.33	46.00	37.33	peak

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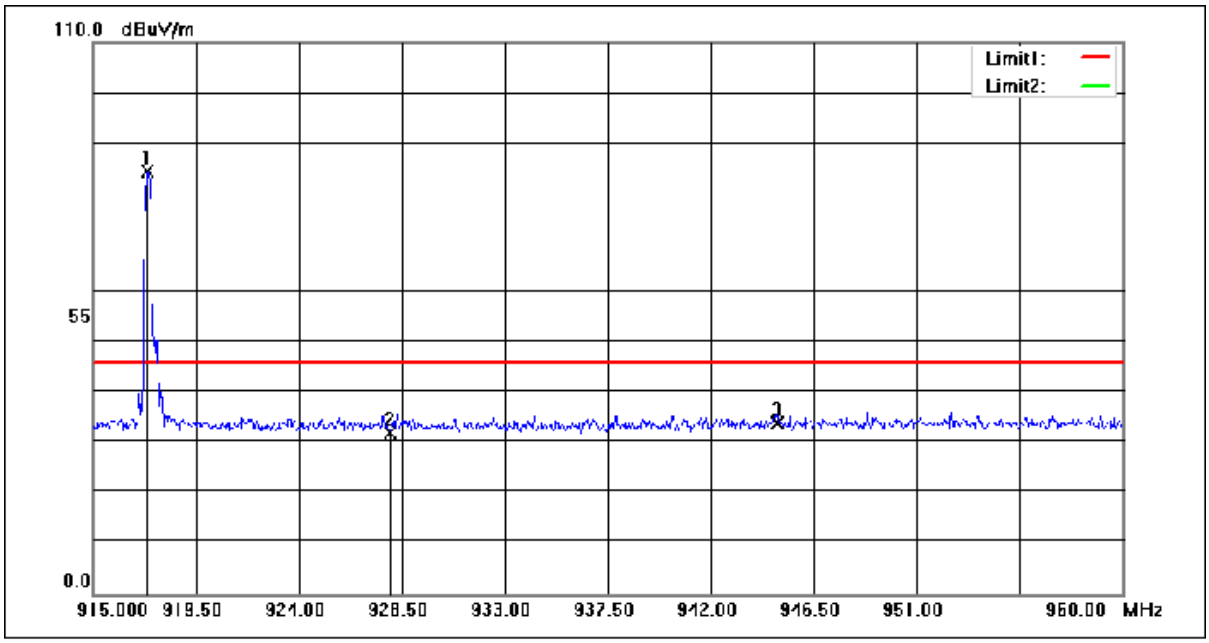
Mode: b; Polarization: Horizontal; Modulation: FSK; Channel: High



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	917.3850	55.47	28.89	84.36	46.00	38.36	peak
2	928.0000	3.09	29.02	32.11	46.00	-13.89	QP
3	944.8800	4.82	29.24	34.06	46.00	-11.94	QP

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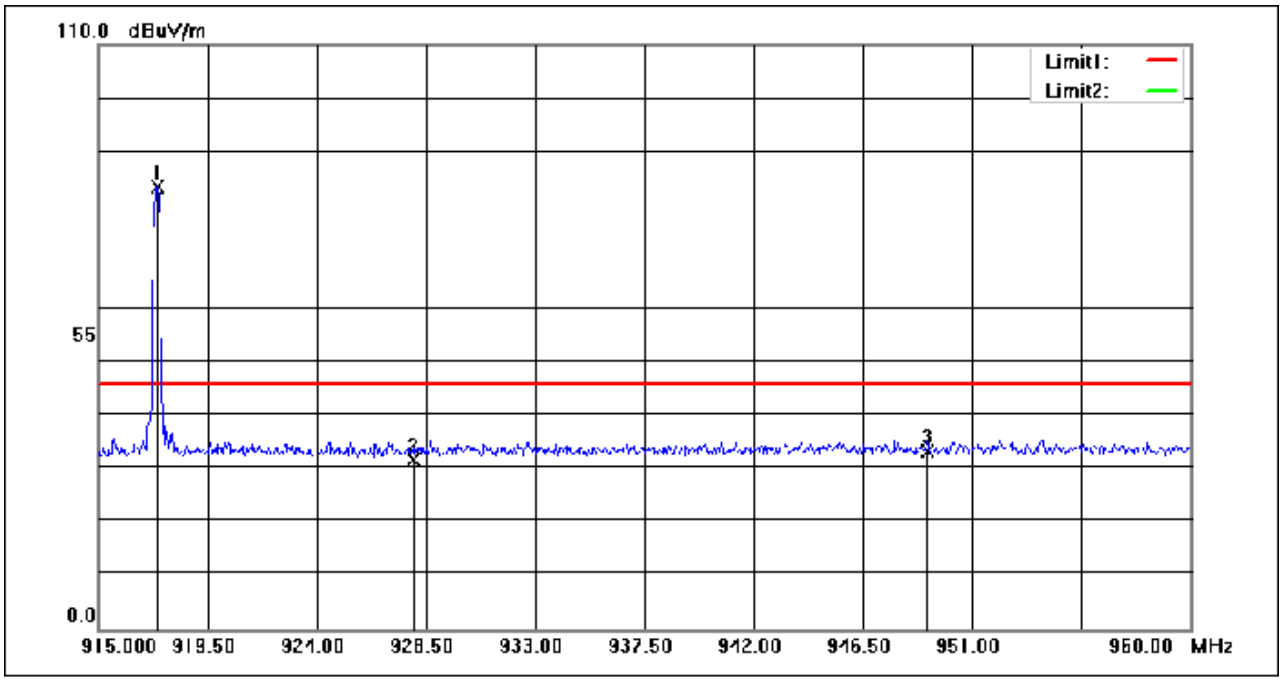
Mode: b; Polarization: Vertical; Modulation: FSK; Channel: High



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	917.4300	54.27	28.89	83.16	46.00	37.16	peak
2	928.0000	2.86	29.02	31.88	46.00	-14.12	QP
3	949.1550	4.20	29.29	33.49	46.00	-12.51	QP

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7.10 Radiated Spurious Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

Test Method: ANSI C63.10 (2013) Section 6.4,6.5,6.6

Limit:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3
Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.		

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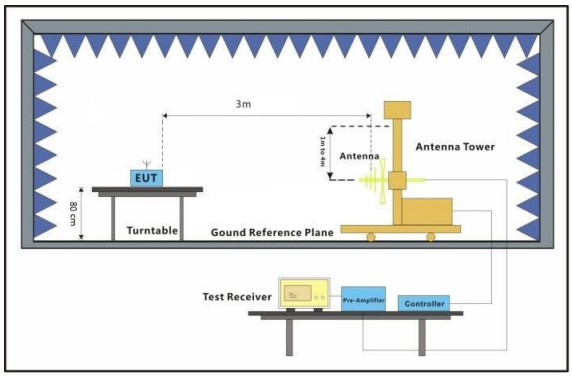
7.10.1 E.U.T. Operation

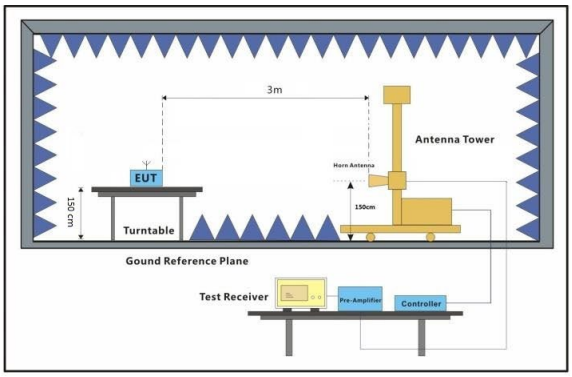
Operating Environment:

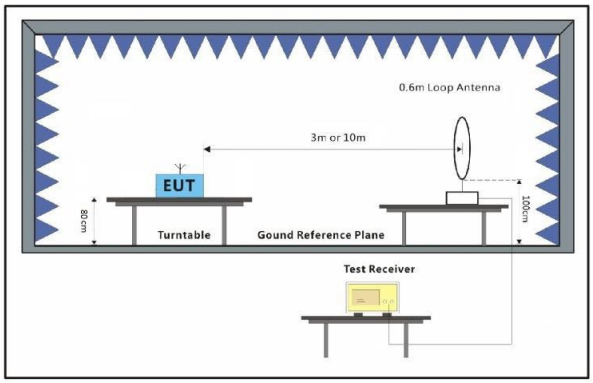
Temperature: 25 °C Humidity: 49 % RH Atmospheric Pressure: 1008 mbar

Test mode b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with FSK modulation

7.10.2 Test Setup Diagram







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7.10.3 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d. The antenna height 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.

e. 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

h. Test the EUT in the lowest channel, the middle channel, the Highest channel.

i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

j. Repeat above procedures until all frequencies measured was complete.

Remark:

1) For emission below 1GHz, through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.

2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

3) Scan from 9kHz to 10GHz, the disturbance below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

4) For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

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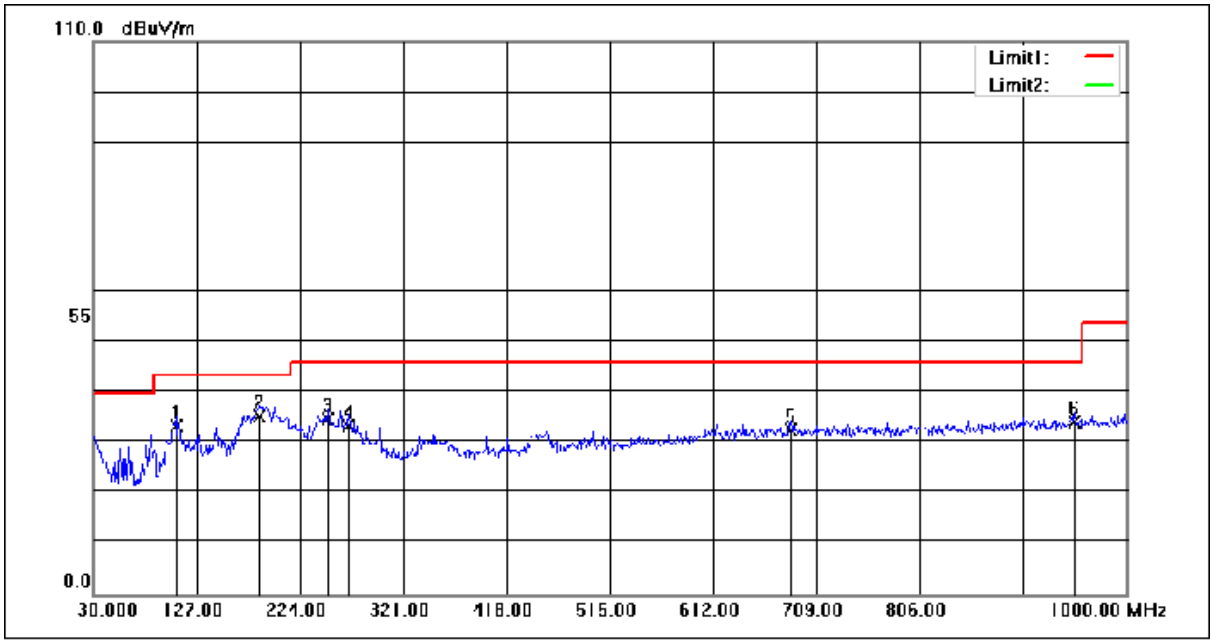
For ANT1

915MHz: Below 1GHz:

Mode: b; Polarization: Horizontal; Modulation: FSK; Channel: Low



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	107.6000	14.70	18.76	33.46	43.50	-10.04	QP
2	186.1700	17.93	17.33	35.26	43.50	-8.24	QP
3	250.1900	15.43	19.32	34.75	46.00	-11.25	QP
4	269.5900	13.66	19.83	33.49	46.00	-12.51	QP
5	684.7500	5.17	27.38	32.55	46.00	-13.45	QP
6	951.5000	4.87	29.30	34.17	46.00	-11.83	QP

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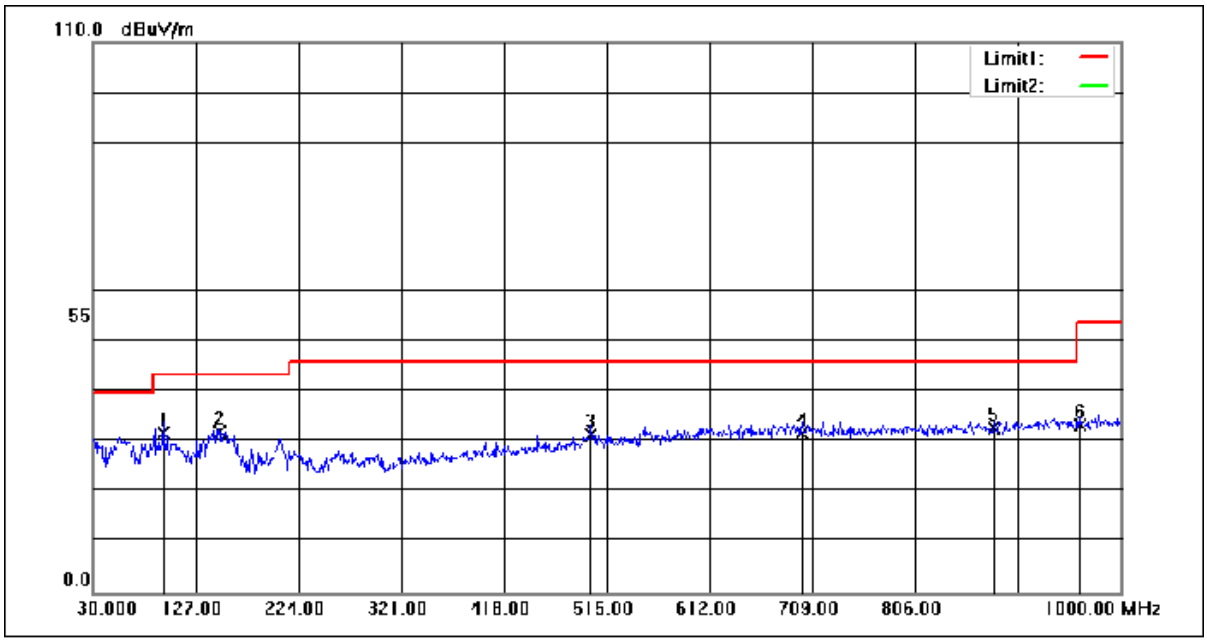
Mode: b; Polarization: Vertical; Modulation: FSK; Channel: Low



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	95.9600	14.15	17.74	31.89	43.50	-11.61	QP
2	149.3100	11.96	20.12	32.08	43.50	-11.42	QP
3	500.4500	6.30	25.25	31.55	46.00	-14.45	QP
4	699.3000	4.15	27.49	31.64	46.00	-14.36	QP
5	880.6900	4.50	28.44	32.94	46.00	-13.06	QP
6	961.2000	4.21	29.28	33.49	54.00	-20.51	QP

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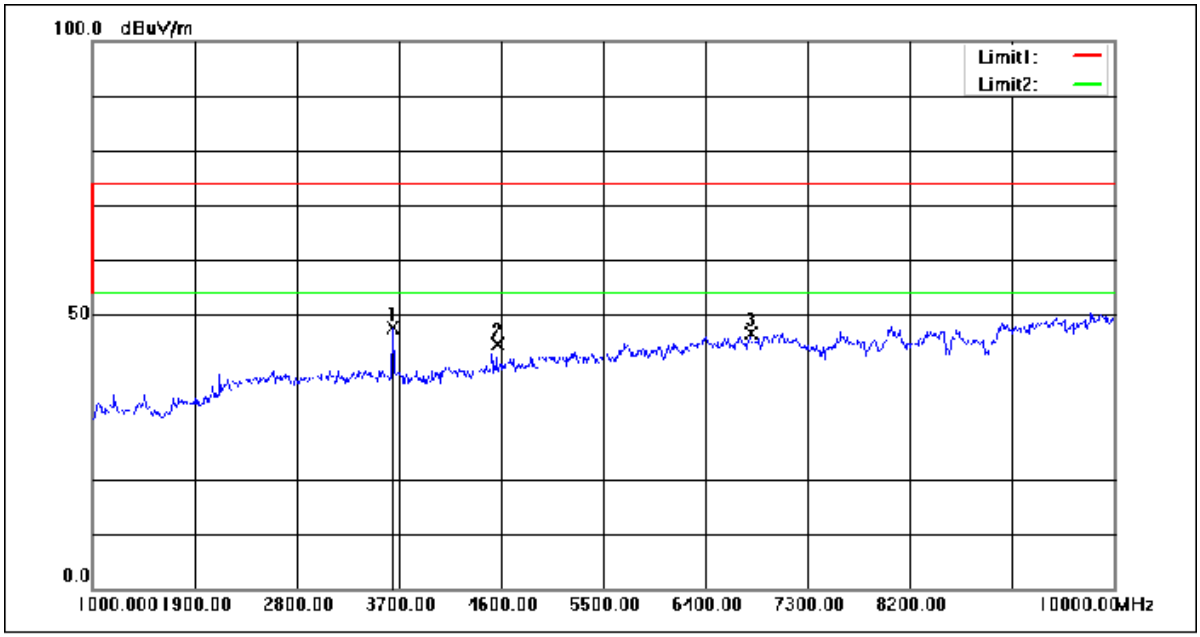
For ANT1

915MHz: Above 1GHz:

Mode: b; Polarization: Horizontal; Modulation: FSK; Channel: Low



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3646.000	62.26	-14.67	47.59	74.00	-26.41	peak
2	4564.000	57.07	-12.36	44.71	74.00	-29.29	peak
3	6796.000	52.72	-6.06	46.66	74.00	-27.34	peak

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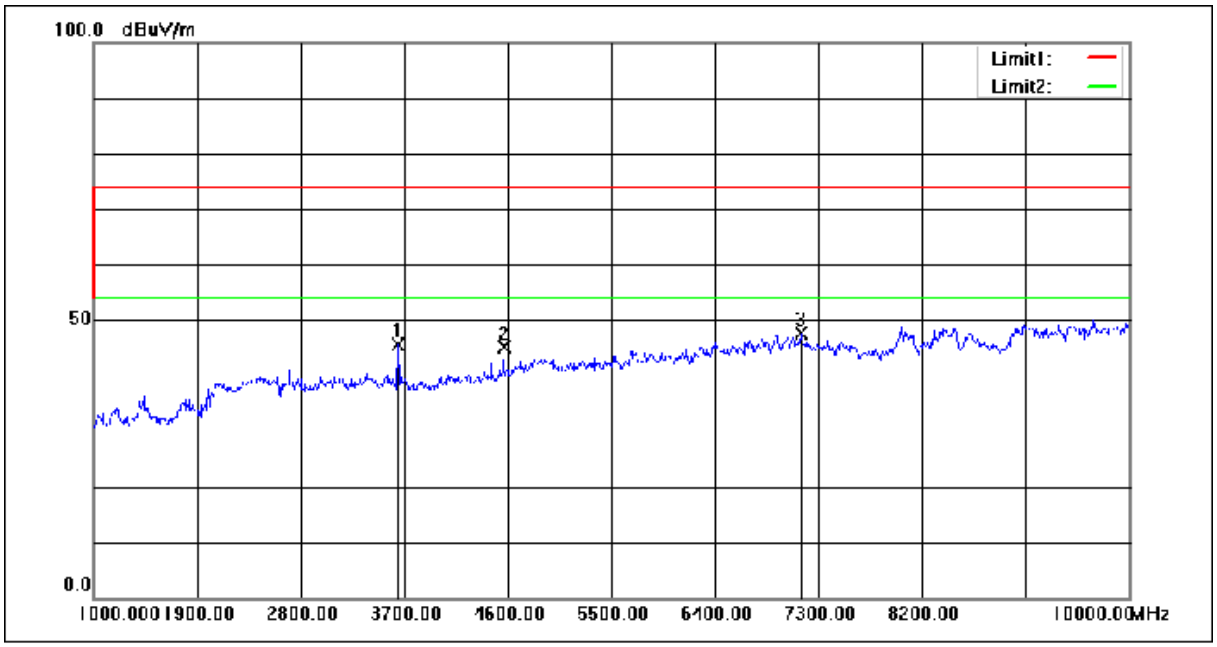
Mode: b; Polarization: Vertical; Modulation: FSK; Channel: Low



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3646.000	60.28	-14.67	45.61	74.00	-28.39	peak
2	4564.000	57.56	-12.36	45.20	74.00	-28.80	peak
3	7147.000	52.99	-5.30	47.69	74.00	-26.31	peak

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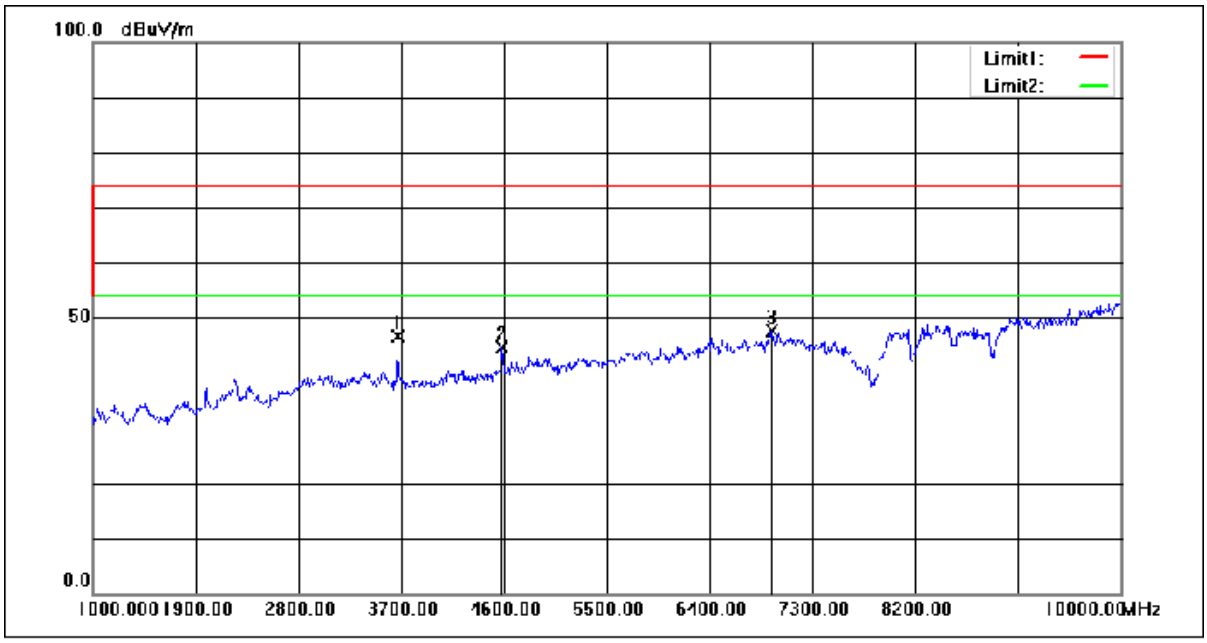
Mode: b; Polarization: Horizontal; Modulation: FSK; Channel: High



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3664.000	61.27	-14.66	46.61	74.00	-27.39	peak
2	4582.000	56.97	-12.29	44.68	74.00	-29.32	peak
3	6940.000	53.51	-5.84	47.67	74.00	-26.33	peak

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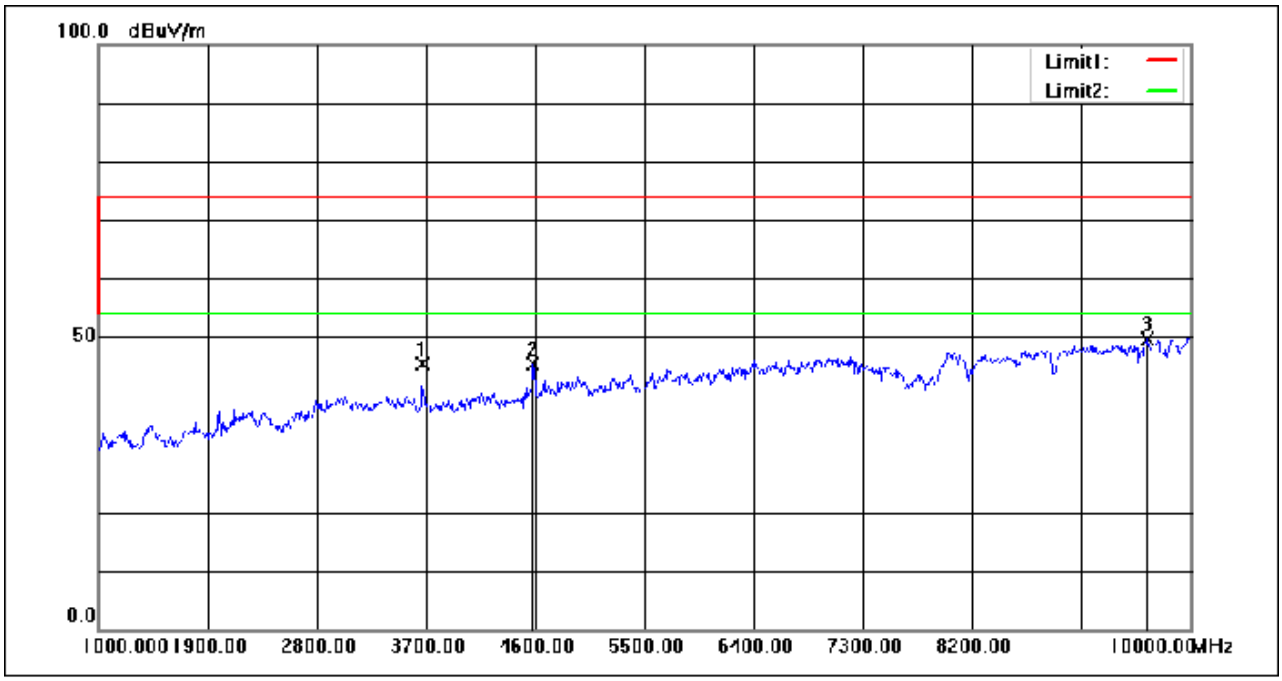
Mode: b; Polarization: Vertical; Modulation: FSK; Channel: High



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3664.000	59.99	-14.66	45.33	74.00	-28.67	peak
2	4582.000	57.78	-12.29	45.49	74.00	-28.51	peak
3	9649.000	50.37	-0.72	49.65	74.00	-24.35	peak

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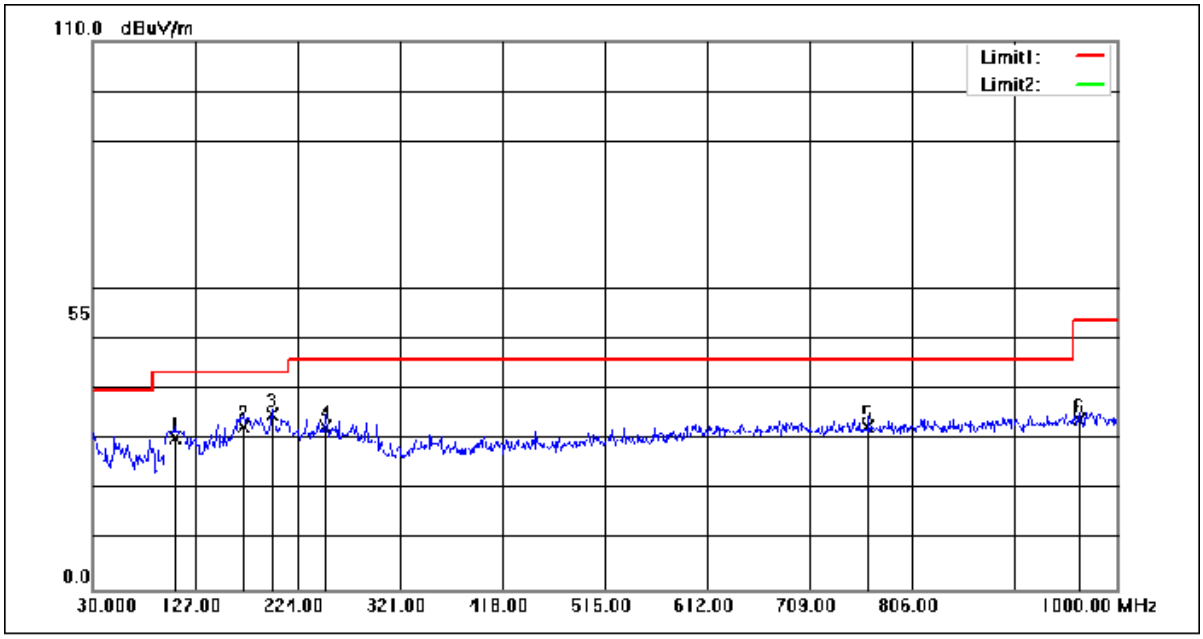
For ANT2

915MHz: Below 1GHz:

Mode: b; Polarization: Horizontal; Modulation: FSK; Channel: Low



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	107.6000	11.72	18.76	30.48	43.50	-13.02	QP
2	172.5900	14.16	18.38	32.54	43.50	-10.96	QP
3	199.7500	18.72	16.27	34.99	43.50	-8.51	QP
4	250.1900	13.26	19.32	32.58	46.00	-13.42	QP
5	764.2900	5.01	27.58	32.59	46.00	-13.41	QP
6	964.1100	4.57	29.27	33.84	54.00	-20.16	QP

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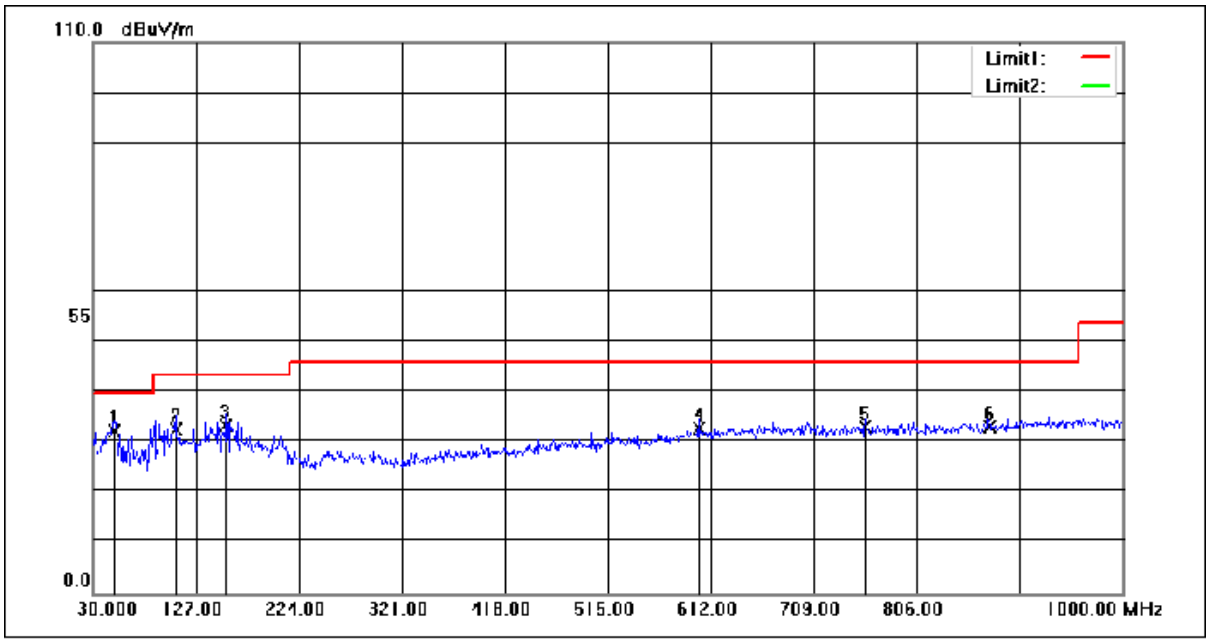
Mode: b; Polarization: Vertical; Modulation: FSK; Channel: Low



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	49.4000	17.44	15.00	32.44	40.00	-7.56	QP
2	107.6000	13.83	18.76	32.59	43.50	-10.91	QP
3	155.1300	13.75	19.74	33.49	43.50	-10.01	QP
4	600.3600	6.38	26.51	32.89	46.00	-13.11	QP
5	757.5000	5.67	27.53	33.20	46.00	-12.80	QP
6	874.8700	4.82	28.37	33.19	46.00	-12.81	QP

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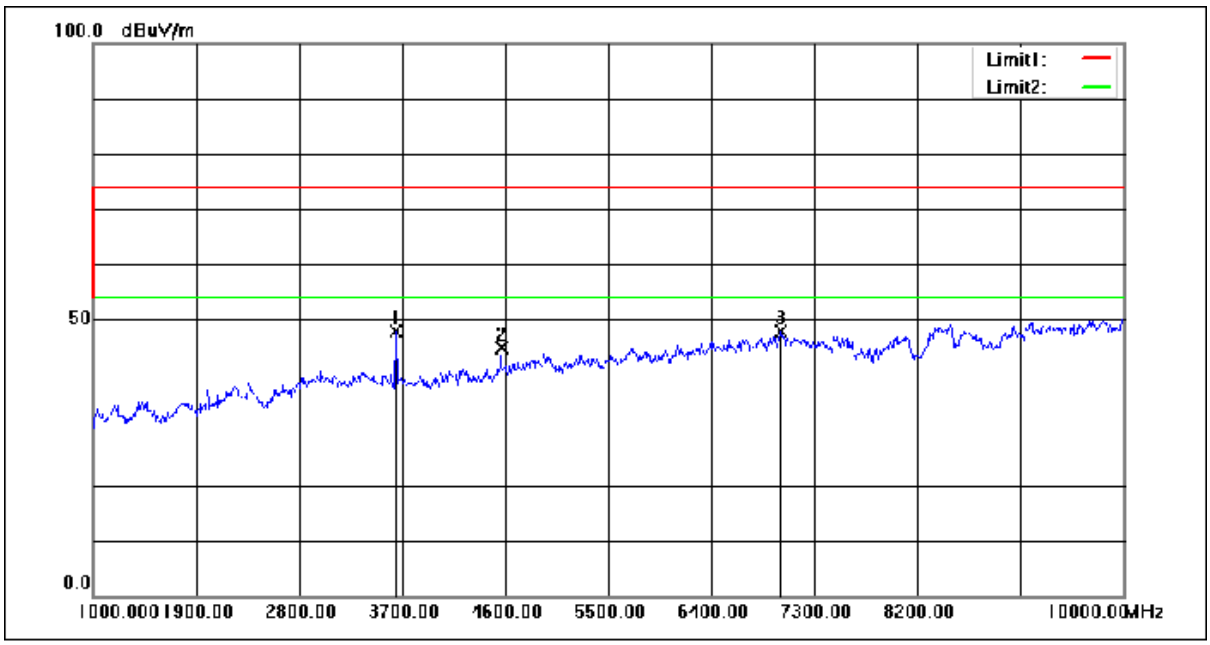
For ANT2

915MHz: Above 1GHz:

Mode: b; Polarization: Horizontal; Modulation: FSK; Channel: Low



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3646.000	62.46	-14.67	47.79	74.00	-26.21	peak
2	4564.000	57.23	-12.36	44.87	74.00	-29.13	peak
3	7003.000	53.56	-5.74	47.82	74.00	-26.18	peak

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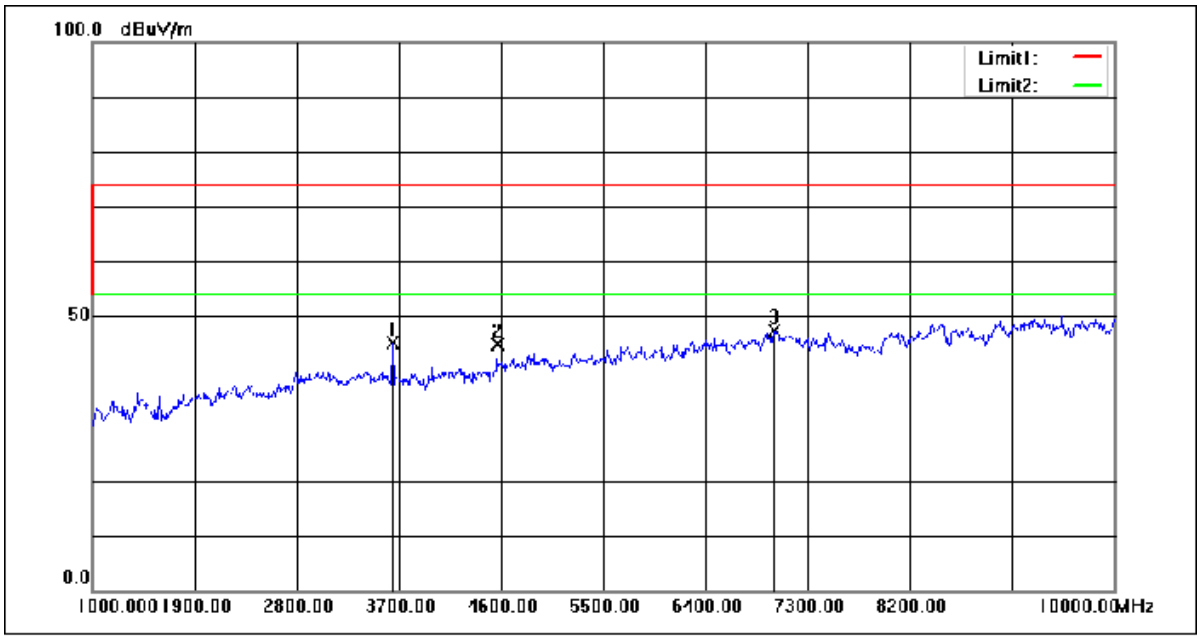
Mode: b; Polarization: Vertical; Modulation: FSK; Channel: Low



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3646.000	59.79	-14.67	45.12	74.00	-28.88	peak
2	4564.000	57.36	-12.36	45.00	74.00	-29.00	peak
3	7003.000	53.00	-5.74	47.26	74.00	-26.74	peak

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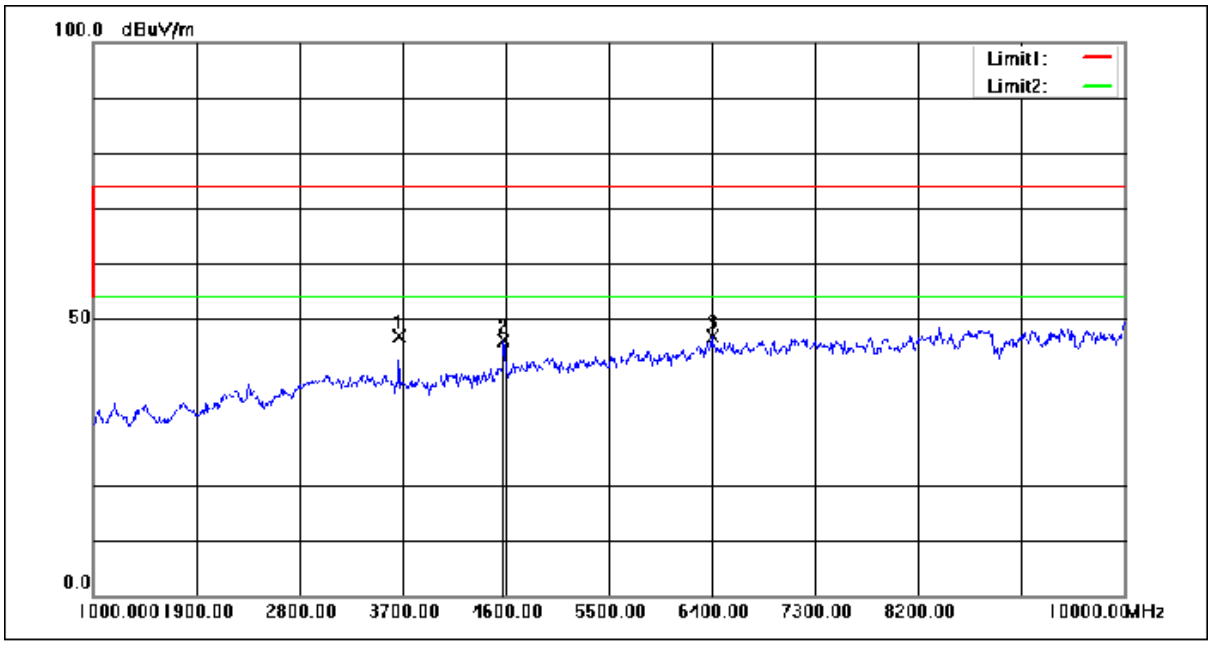
Mode: b; Polarization: Horizontal; Modulation: FSK; Channel: High



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3664.000	61.62	-14.66	46.96	74.00	-27.04	peak
2	4582.000	58.41	-12.29	46.12	74.00	-27.88	peak
3	6400.000	53.81	-6.92	46.89	74.00	-27.11	peak

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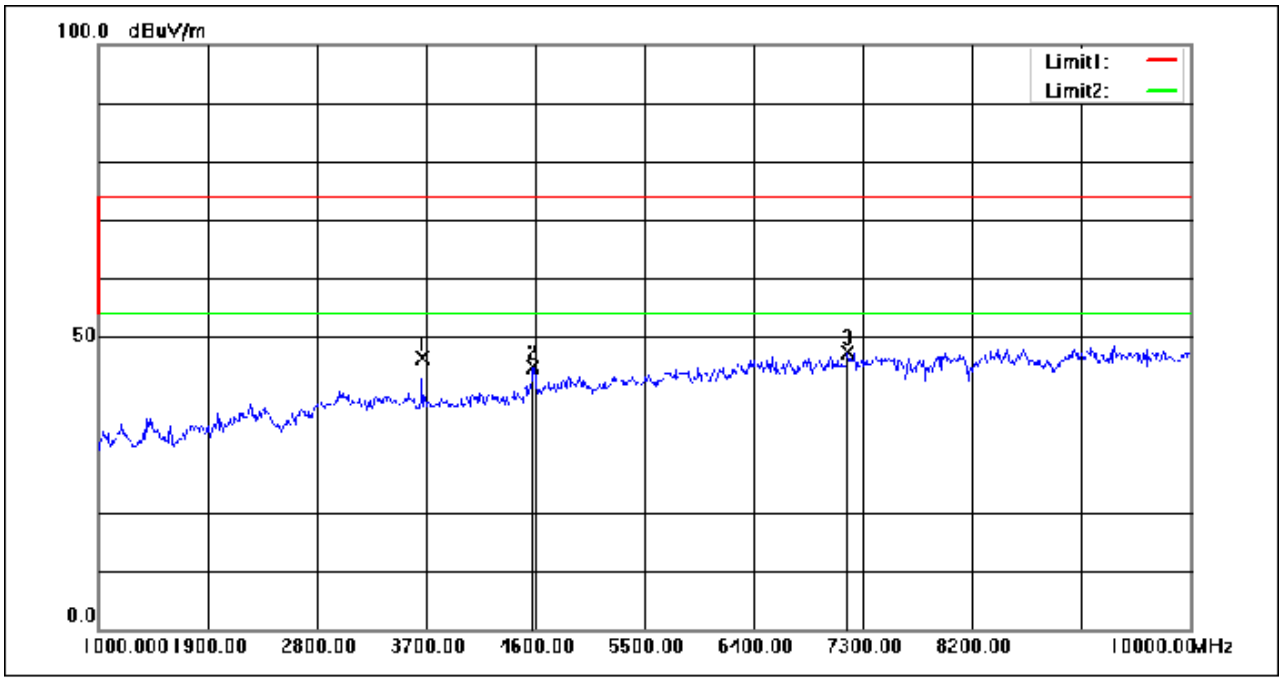
Mode: b; Polarization: Vertical; Modulation: FSK; Channel: High



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3664.000	61.16	-14.66	46.50	74.00	-27.50	peak
2	4582.000	57.23	-12.29	44.94	74.00	-29.06	peak
3	7174.000	52.53	-5.21	47.32	74.00	-26.68	peak

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8 Test Setup Photographs

Refer to the < Test Setup photos-FCC>.

9 EUT Constructional Details

Refer to the < External Photos > & < Internal Photos >.

- End of the Report -

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