



FCC RADIO TEST REPORT

FCC ID : XRAFB511
Equipment : Smartwatch
Brand Name : Fitbit
Model Name : FB511
Applicant : Fitbit, Inc.
199 Fremont Street, 14th Floor, San Francisco, CA 94105 USA
Manufacturer : Fitbit, Inc.
199 Fremont Street, 14th Floor, San Francisco, CA 94105 USA
Standard : FCC Part 15 Subpart C §15.225

The product was received on Mar. 20, 2020 and testing was started from Apr. 24, 2020 and completed on May 30, 2020. We, SPORTON INTERNATIONAL INC., EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Reviewed by: Louis Wu

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)



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History of this test report

Report No.	Version	Description	Issued Date
FR032014D	01	Initial issue of report	Jul. 17, 2020



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
-	15.207	AC Power Line Conducted Emissions	Not Required	-
3.1	15.215(c)	20dB Spectrum Bandwidth	Pass	-
	2.1049	99% OBW Spectrum Bandwidth	Reporting only	-
3.2	15.225(e)	Frequency Stability	Pass	-
3.3	15.225(a)(b)(c)	Field Strength of Fundamental Emissions	Pass	Max level 13.28 dBµV/m at 13.560 MHz
3.4	15.225(d) 15.209	Radiated Spurious Emissions	Pass	Under limit 7.54 dB at 705.120MHz
3.5	15.203	Antenna Requirements	Pass	-

Note: Not required means after assessing, test items are not necessary to carry out.

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Wii Chang

Report Producer: Amy Chen



1. General Description

1.1 Product Feature of Equipment Under Test

Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n, NFC, and GNSS.

Product Specification subjective to this standard	
Sample 1	Iron strap
Sample 2	Cloth strap
Sample 3	Plastic strap
Antenna Type	WLAN: Ring slot Antenna Bluetooth: Ring slot Antenna GPS: Metal split-ring Antenna NFC: Loop Antenna

1.2 Modification of EUT

No modifications are made to the EUT during all test items.

1.3 Testing Location

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	Sporton Site No. TH03-HY
Test Engineer	Louis Chung
Temperature	22~24°C
Relative Humidity	53~55%

Note: The test site complies with ANSI C63.4 2014 requirement.



Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	Sporton Site No. 03CH11-HY
Test Engineer	Cookie Ku, Fu Chen, and Troye Hsieh
Temperature	19.1~28.6°C
Relative Humidity	43.2~69.4%

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC designation No.: TW1190 and TW0007

1.4 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ FCC Part 15 Subpart C §15.225
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01
- ♦ ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. The TAF code is not including all the FCC KDB listed without accreditation.
3. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2. Test Configuration of Equipment Under Test

2.1 Descriptions of Test Mode

Investigation has been done on all the possible configurations.

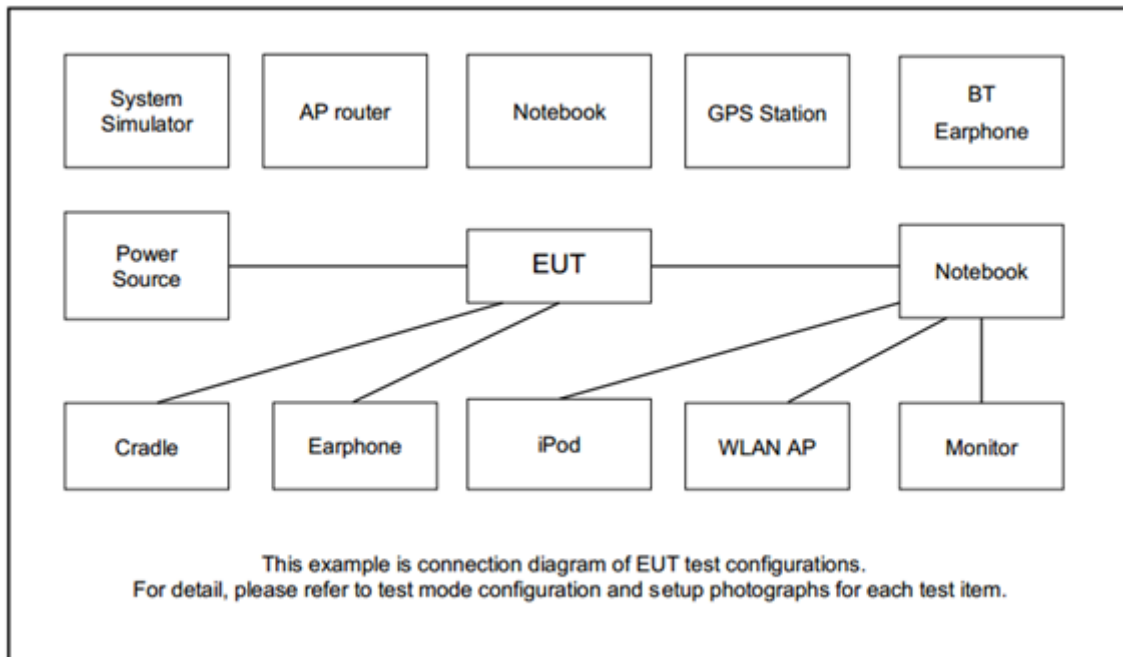
The following table is a list of the test modes shown in this test report.

Test Items	
AC Power Line Conducted Emissions	Field Strength of Fundamental Emissions
20dB Spectrum Bandwidth	Frequency Stability
Radiated Emissions 9kHz~30MHz	Radiated Emissions 30MHz~1GHz

The EUT pre-scanned in four NFC type, A, B, F. The worst type (type F) was recorded in this report. Pre-scanned tests, X, Y, Z in three orthogonal panels to determine the final configuration (Y plane as worst plane) from all possible combinations.

Remark: For Radiated Test Cases, the tests were performed with Sample 1.

2.2 Connection Diagram of Test System



2.3 EUT Operation Test Setup

The RF test items, utility “Tera Term V4.95” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

3. Test Results

3.1 20dB and 99% OBW Spectrum Bandwidth Measurement

3.1.1 Limit

Intentional radiators must be designed to ensure that the 20dB and 99% emission bandwidth in the specific band 13.553~13.567MHz.

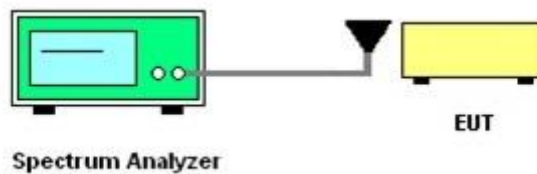
3.1.2 Measuring Instruments

See list of measuring instruments of this test report.

3.1.3 Test Procedures

1. The spectrum analyzer connected via a receive antenna placed near the EUT in peak Max hold mode.
2. The resolution bandwidth of 1 kHz and the video bandwidth of 3 kHz were used.
3. Measured the spectrum width with power higher than 20dB below carrier.
4. Measured the 99% OBW.

3.1.4 Test Setup



3.1.5 Test Result of Conducted Test Items

Please refer to Appendix A.

3.2 Frequency Stability Measurement

3.2.1 Limit

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% (100ppm) of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

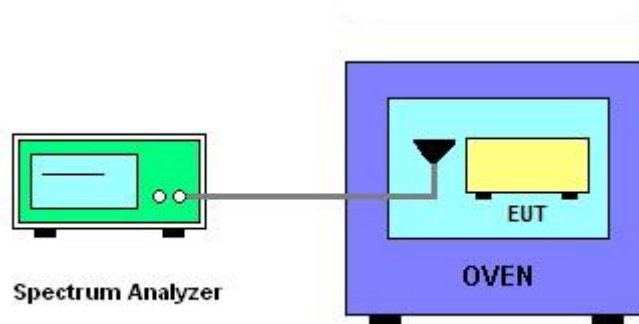
3.2.2 Measuring Instruments

See list of measuring instruments of this test report.

3.2.3 Test Procedures

1. The spectrum analyzer connected via a receive antenna placed near the EUT.
2. EUT have transmitted signal and fixed channelize.
3. Set the spectrum analyzer span to view the entire emissions bandwidth.
4. Set RBW = 1 kHz, VBW = 3 kHz with peak detector and maxhold settings.
5. The f_c is declaring of channel frequency. Then the frequency error formula is $(f_c - f) / f_c \times 10^6$ ppm and the limit is less than ± 100 ppm.
6. Extreme temperature rule is -20°C~50°C.

3.2.4 Test Setup



3.2.5 Test Result of Conducted Test Items

Please refer to Appendix A.



3.3 Field Strength of Fundamental Emissions and Mask Measurement

3.3.1 Limit

Rules and specifications	FCC CFR 47 Part 15 section 15.225			
Description	Compliance with the spectrum mask is tested with RBW set to 9kHz.			
Freq. of Emission (MHz)	Field Strength ($\mu\text{V/m}$) at 30m	Field Strength ($\text{dB}\mu\text{V/m}$) at 30m	Field Strength ($\text{dB}\mu\text{V/m}$) at 10m	Field Strength ($\text{dB}\mu\text{V/m}$) at 3m
1.705~13.110	30	29.5	48.58	69.5
13.110~13.410	106	40.5	59.58	80.5
13.410~13.553	334	50.5	69.58	90.5
13.553~13.567	15848	84.0	103.08	124.0
13.567~13.710	334	50.5	69.58	90.5
13.710~14.010	106	40.5	59.58	80.5
14.010~30.000	30	29.5	48.58	69.5

3.3.2 Measuring Instruments

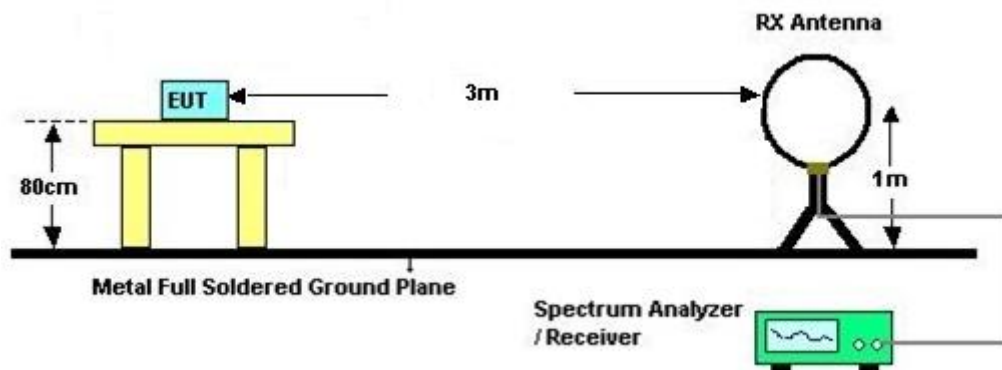
See list of measuring instruments of this test report.

3.3.3 Test Procedures

1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the loop receiving antenna mounted antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the receiving antenna was fixed at one meter above ground to find the maximum emissions field strength.
4. For Fundamental emissions, use the receiver to measure QP reading.
5. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.
6. Compliance with the spectrum mask is tested with RBW set to 9kHz.
Note: Emission level (dB μ V/m) = 20 log Emission level (μ V/m).

3.3.4 Test Setup

For radiated emissions below 30MHz



3.3.5 Test Result of Field Strength of Fundamental Emissions and Mask

Please refer to Appendix B.



3.4 Radiated Emissions Measurement

3.4.1 Limit

The field strength of any emissions which appear outside of 13.110 ~14.010MHz band shall not exceed the general radiated emissions limits.

Frequencies (MHz)	Field Strength (μV/m)	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

3.4.2 Measuring Instruments

See list of measuring instruments of this test report.

3.4.3 Measuring Instrument Setting

The following table is the setting of receiver:

Receiver Parameter	Setting
Attenuation	Auto
Frequency Range: 9kHz~150kHz	RBW 200Hz for QP
Frequency Range: 150kHz~30MHz	RBW 9kHz for QP
Frequency Range: 30MHz~1000MHz	RBW 120kHz for Peak

Note: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz and 110-490 kHz. Radiated emission limits in these two bands are based on measurements employing an average detector.

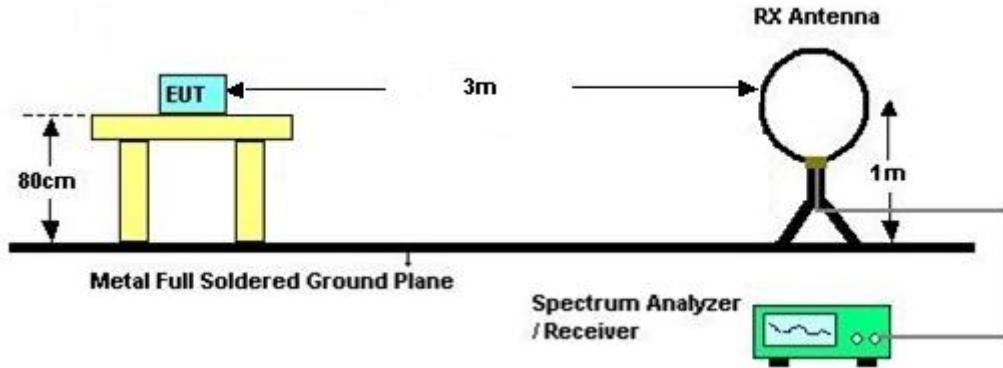


3.4.4 Test Procedures

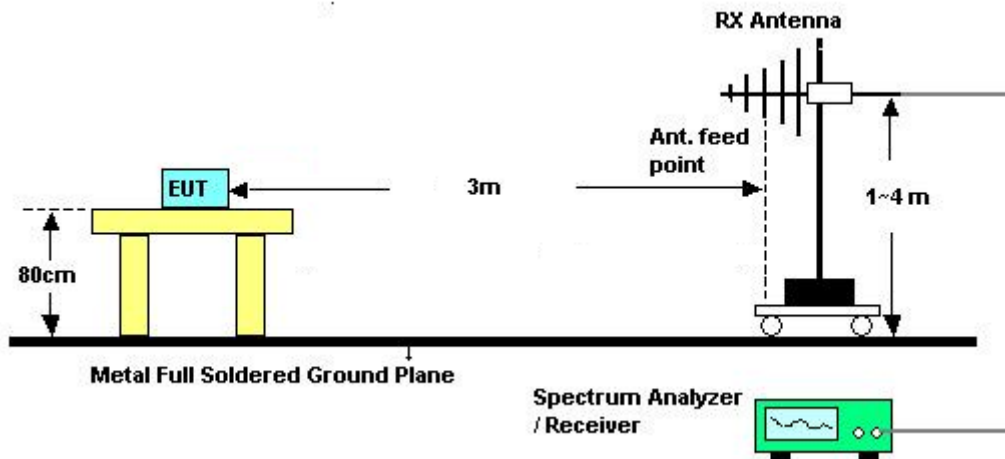
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.
7. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver.

3.4.5 Test Setup

For radiated emissions below 30MHz



For radiated emissions above 30MHz



3.4.6 Test Result of Radiated Emissions Measurement

Please refer to Appendix B.

Remark: There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.



3.5 Antenna Requirements

3.5.1 Standard Applicable

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. 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 the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited.

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 rule.

3.5.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.



4. List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
AC Power Source	AC POWER	AFC-500W	F10407001 1	50Hz~60Hz	Apr. 09, 2020	Apr. 28, 2020~ May 18, 2020	Apr. 08, 2021	Conducted (TH03-HY)
Hygrometer	Testo	608-H1	34893241	N/A	Mar. 26, 2020	Apr. 28, 2020~ May 18, 2020	Mar. 25, 2021	Conducted (TH03-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP30	101329	9kHz~30GHz	Sep. 04, 2019	Apr. 28, 2020~ May 18, 2020	Sep. 03, 2020	Conducted (TH03-HY)
Temperature Chamber	ESPEC	SU-641	92013721	-30℃ ~70℃	Nov. 26, 2019	Apr. 28, 2020~ May 18, 2020	Nov. 25, 2020	Conducted (TH03-HY)
Software	Audix	E3 6.2009-8-24	RK-001053	N/A	N/A	Apr. 24, 2020~ May 30, 2020	N/A	Radiation (03CH11-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Dec. 03, 2019	Apr. 24, 2020~ May 30, 2020	Dec. 02, 2020	Radiation (03CH11-HY)
Bilog Antenna	TESEQ	CBL 6111D & N-6-06	35414 & AT-N0602	30MHz~1GHz	Oct. 12, 2019	Apr. 24, 2020~ May 30, 2020	Oct. 11, 2020	Radiation (03CH11-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Jan. 09, 2020	Apr. 24, 2020~ May 30, 2020	Jan. 08, 2021	Radiation (03CH11-HY)
Controller	EMEC	EM 1000	N/A	Control Turn table & Ant Mast	N/A	Apr. 24, 2020~ May 30, 2020	N/A	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	Apr. 24, 2020~ May 30, 2020	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Apr. 24, 2020~ May 30, 2020	N/A	Radiation (03CH11-HY)
EMI Test Receiver	Agilent	N9038A(MXE)	MY532900 53	20Hz~26.5GHz	Jan. 18, 2020	Apr. 24, 2020~ May 30, 2020	Jan. 17, 2021	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY542004 86	10Hz~44GHz	Oct. 28, 2019	Apr. 24, 2020~ May 30, 2020	Oct. 27, 2020	Radiation (03CH11-HY)
Filter	Wainwright	WHK20/1000C 7/40SS	SN2	20M High Pass	Sep. 15, 2019	Apr. 24, 2020~ May 30, 2020	Sep. 14, 2021	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24971/4 , MY28655/4	9kHz-30MHz	Feb. 25, 2020	Apr. 24, 2020~ May 30, 2020	Feb. 24, 2021	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY15539/4	30M-18G	Feb. 25, 2020	Apr. 24, 2020~ May 30, 2020	Feb. 24, 2021	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30MHz-40GHz	Feb. 25, 2020	Apr. 24, 2020~ May 30, 2020	Feb. 24, 2021	Radiation (03CH11-HY)
Hygrometer	TECPEL	DTN-303B	TP140325	N/A	Nov. 07, 2019	Apr. 24, 2020~ May 30, 2020	Nov. 06, 2020	Radiation (03CH11-HY)
Hygrometer	TECPEL	DTN-303B	TP161237	N/A	Oct. 25, 2019	Apr. 24, 2020~ May 30, 2020	Oct. 24, 2020	Radiation (03CH11-HY)



5. Uncertainty of Evaluation

Uncertainty of Radiated Emission Measurement (9 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.12
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.20
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Appendix A. Test Results of Conducted Test Items

A1. Test Result of 20dB Spectrum Bandwidth

Test mode	NFC Tx	Test Frequency (MHz)	13.56
20dB Bandwidth (kHz)	2.64	99% OccupiedBW(kHz)	2.26
Frequency range (MHz)	$f_L > 13.553$	13.55810	Test Result
	$f_H < 13.567$	13.56074	Complies

Remark: Because the measured signal is CW adjusting the RBW per C63.10 would not be practical since measured bandwidth will always follow the RBW and the result will be approximately twice the RBW.



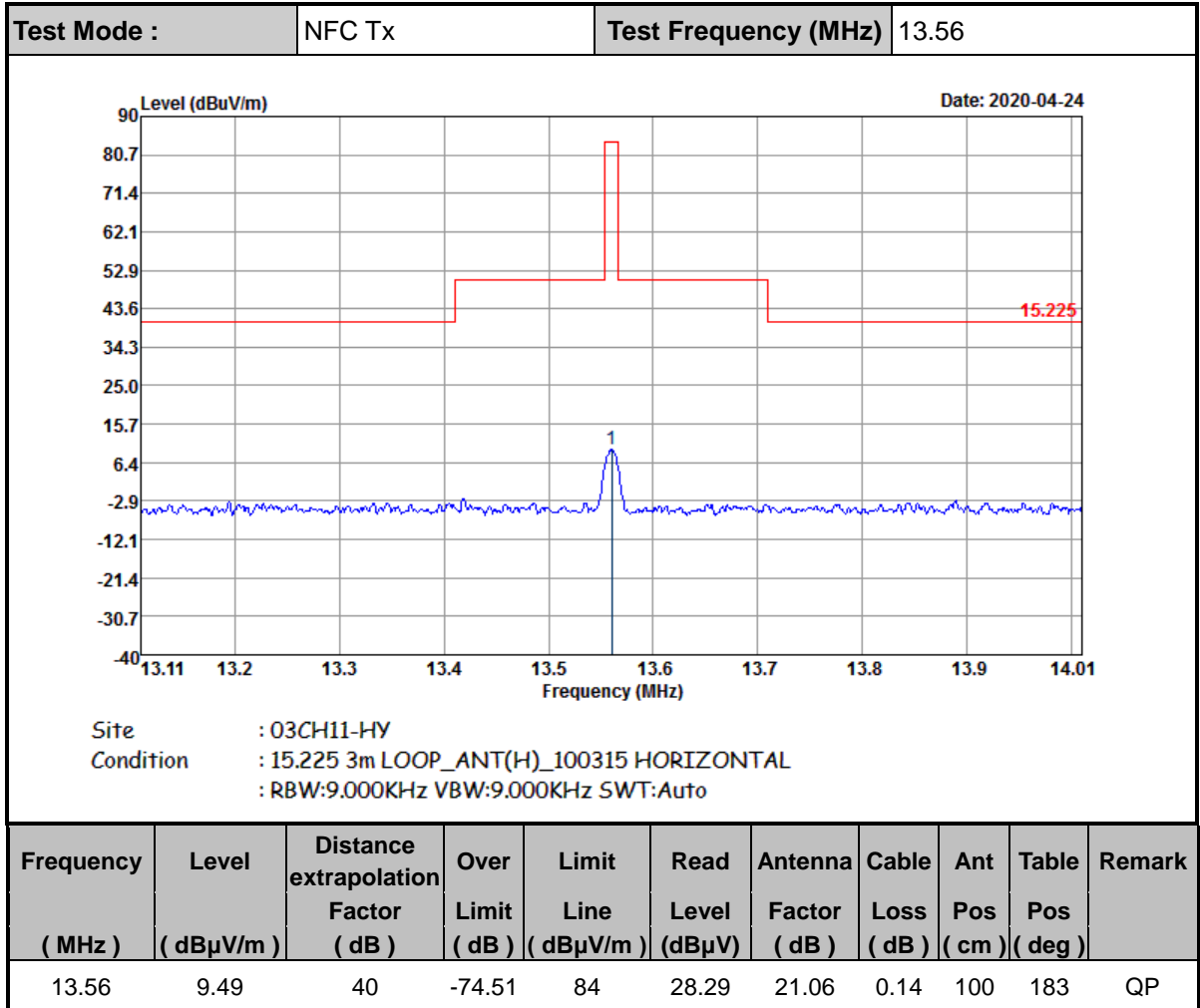
A2. Test Result of Frequency Stability

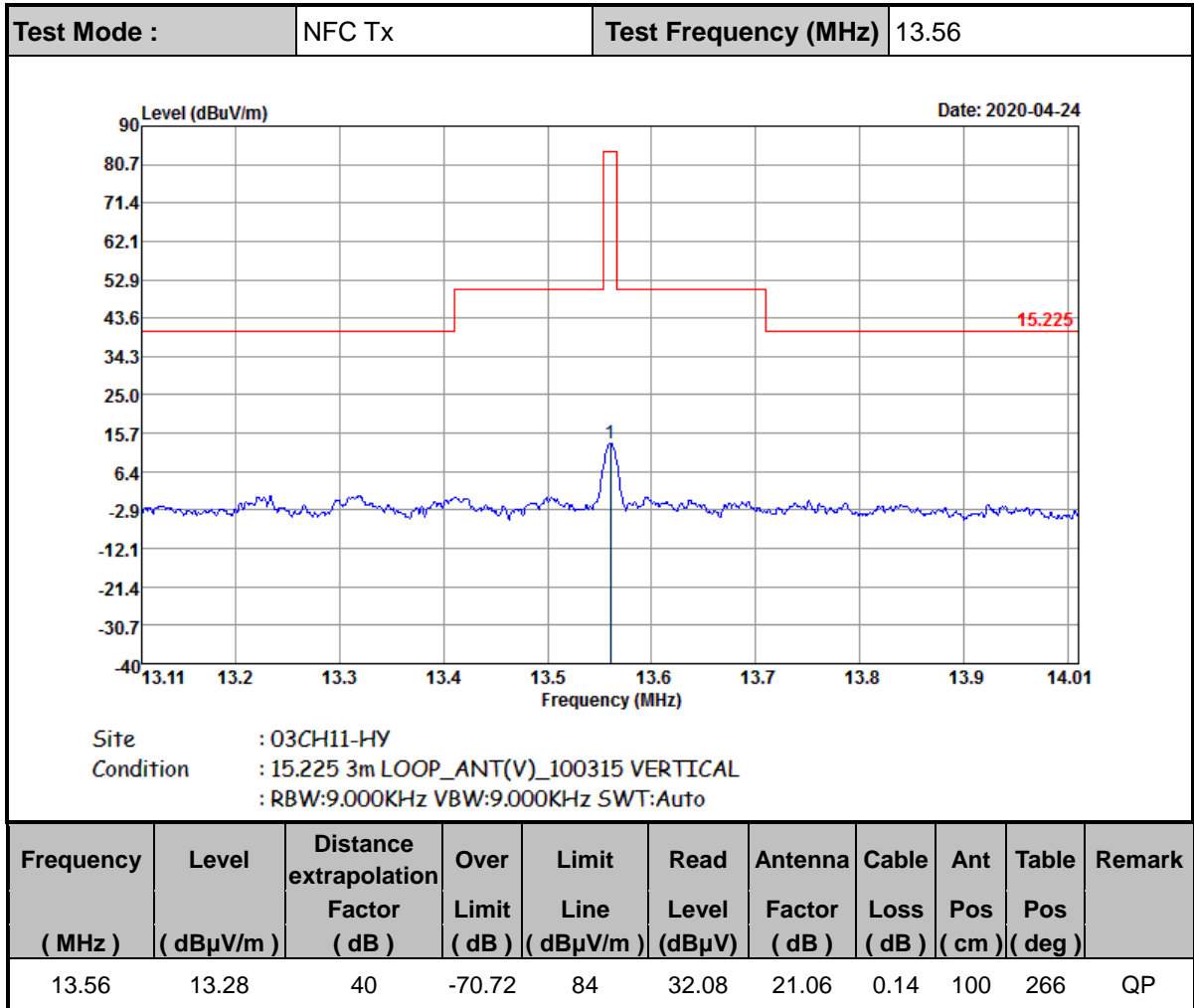
Voltage vs. Frequency Stability		Temperature vs. Frequency Stability		
Voltage (Vac)	Measurement Frequency (MHz)	Temperature (°C)	Time	Measurement Frequency (MHz)
4.4	13.559420	-10	0	13.559550
3.85	13.559440		2	13.559550
3.6	13.559420		5	13.559550
			10	13.559550
		0	0	13.559530
			2	13.559530
			5	13.559530
			10	13.559520
		10	0	13.559510
			2	13.559510
			5	13.559500
			10	13.559520
		20	0	13.559420
			2	13.559450
			5	13.559410
			10	13.559430
		30	0	13.559490
			2	13.559470
			5	13.559450
			10	13.559440
		40	0	13.559440
			2	13.559460
			5	13.559440
			10	13.559430
		45	0	13.559490
			2	13.559490
			5	13.559500
			10	13.559490
Max.Deviation (MHz)	-0.000580	Max.Deviation (MHz)		-0.000590
Max.Deviation (ppm)	-42.7729	Max.Deviation (ppm)		-43.5103
Limit	FS < ±100 ppm	Limit		FS < ±100 ppm
Test Result	PASS	Test Result		PASS



Appendix B. Test Results of Radiated Test Items

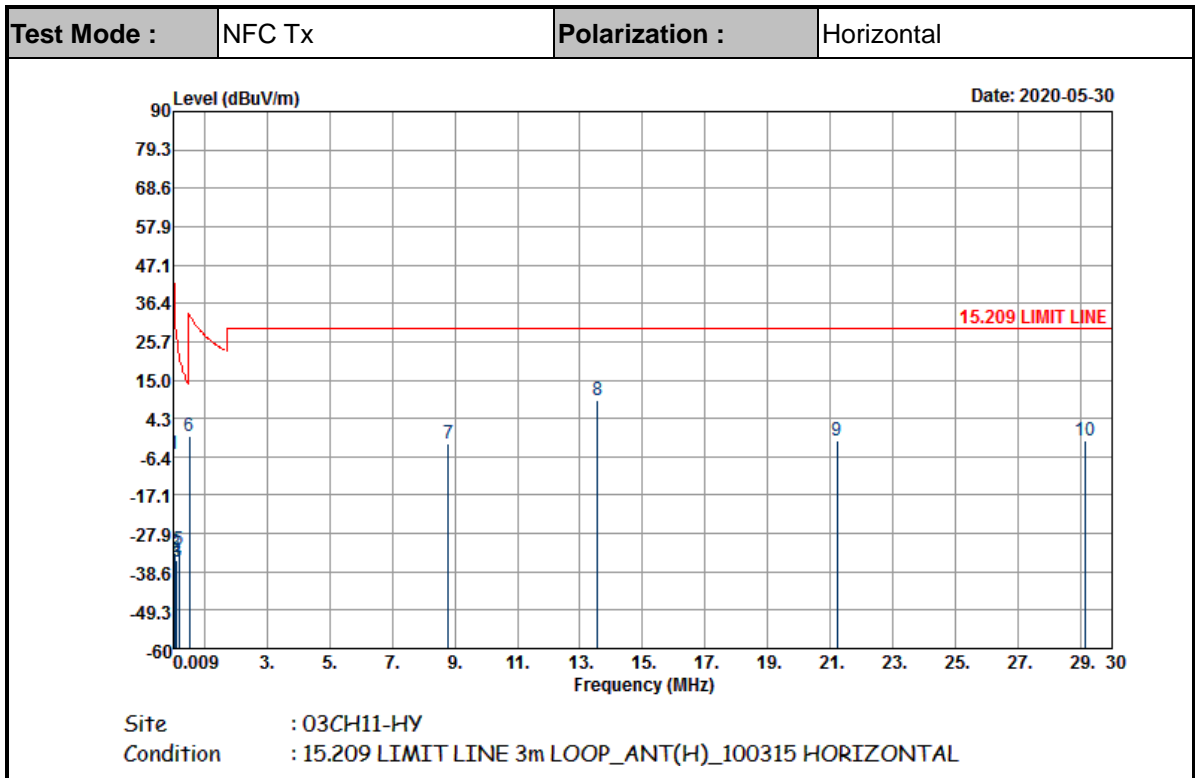
B1. Test Result of Field Strength of Fundamental Emissions



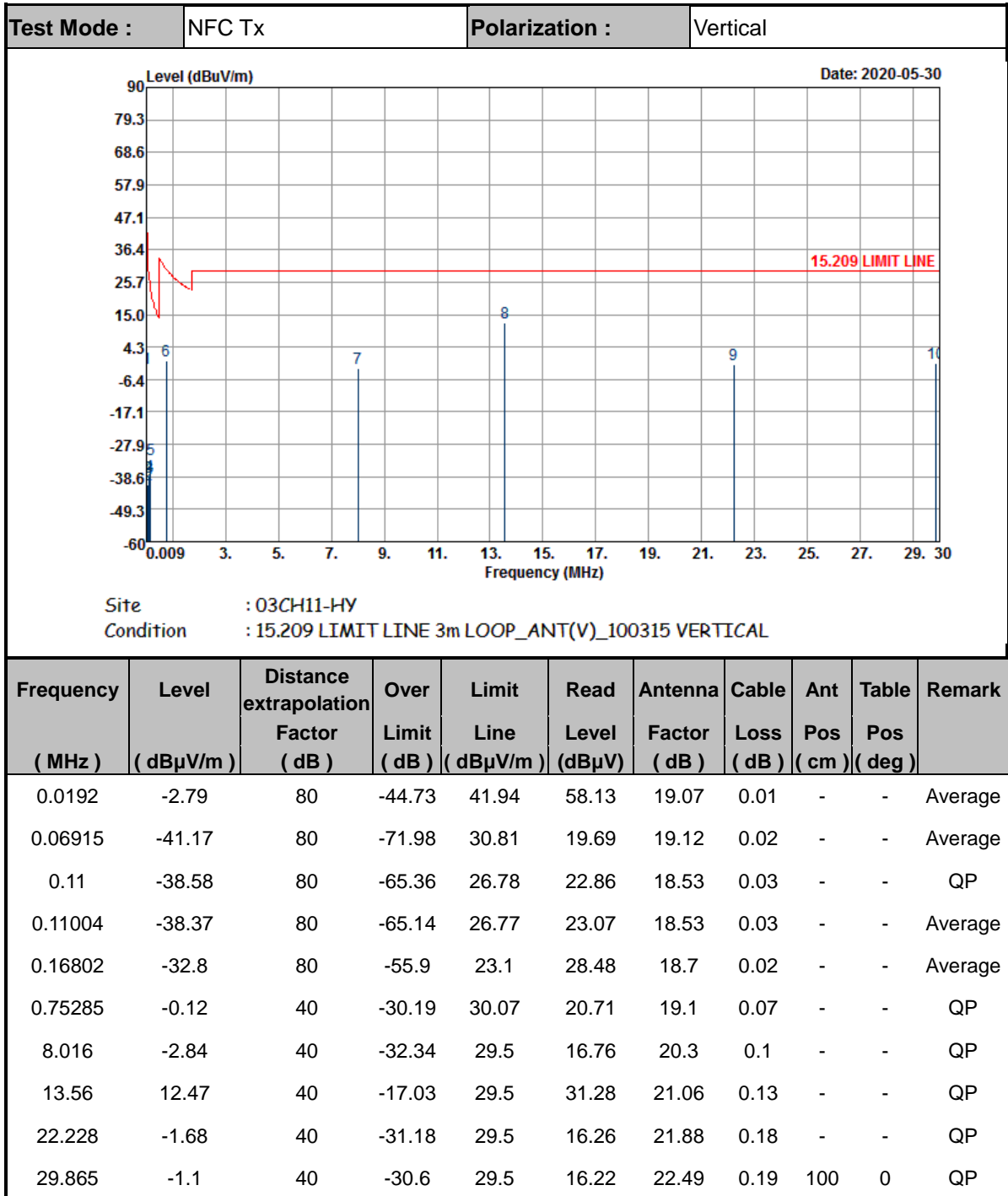




B2. Results of Radiated Spurious Emissions (9 kHz~30MHz)



Frequency (MHz)	Level (dBμV/m)	Distance extrapolation Factor (dB)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
0.0192	-5.74	80	-47.68	41.94	55.18	19.07	0.01	-	-	Average
0.06912	-33.19	80	-64	30.81	27.67	19.12	0.02	-	-	Average
0.11	-35.95	80	-62.73	26.78	25.49	18.53	0.03	-	-	QP
0.11004	-35.26	80	-62.03	26.77	26.18	18.53	0.03	-	-	Average
0.1789	-32.23	80	-54.78	22.55	29.02	18.74	0.01	-	-	Average
0.51253	-0.71	40	-34.12	33.41	20.06	19.19	0.04	-	-	QP
8.792	-2.94	40	-32.44	29.5	16.49	20.46	0.11	-	-	QP
13.56	9.16	40	-20.34	29.5	27.97	21.06	0.13	-	-	QP
21.22	-1.81	40	-31.31	29.5	16.22	21.8	0.17	-	-	QP
29.155	-1.74	40	-31.24	29.5	15.64	22.43	0.19	100	0	QP

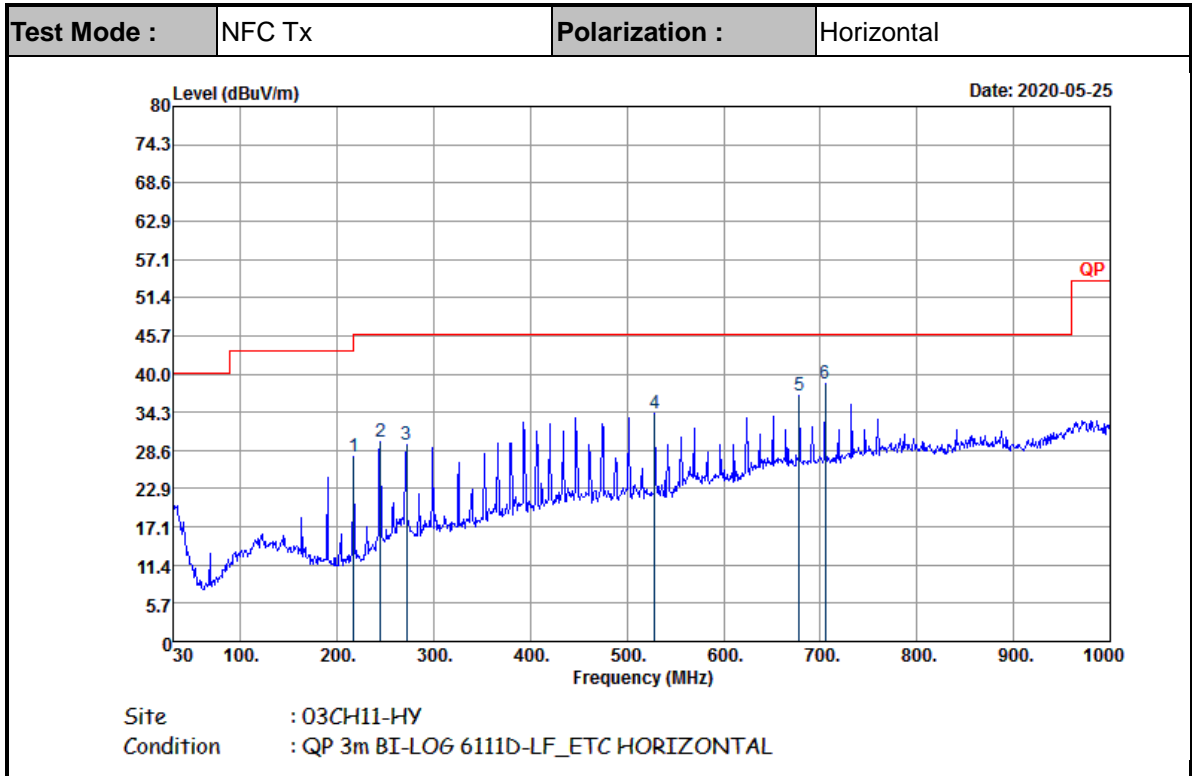


Note:

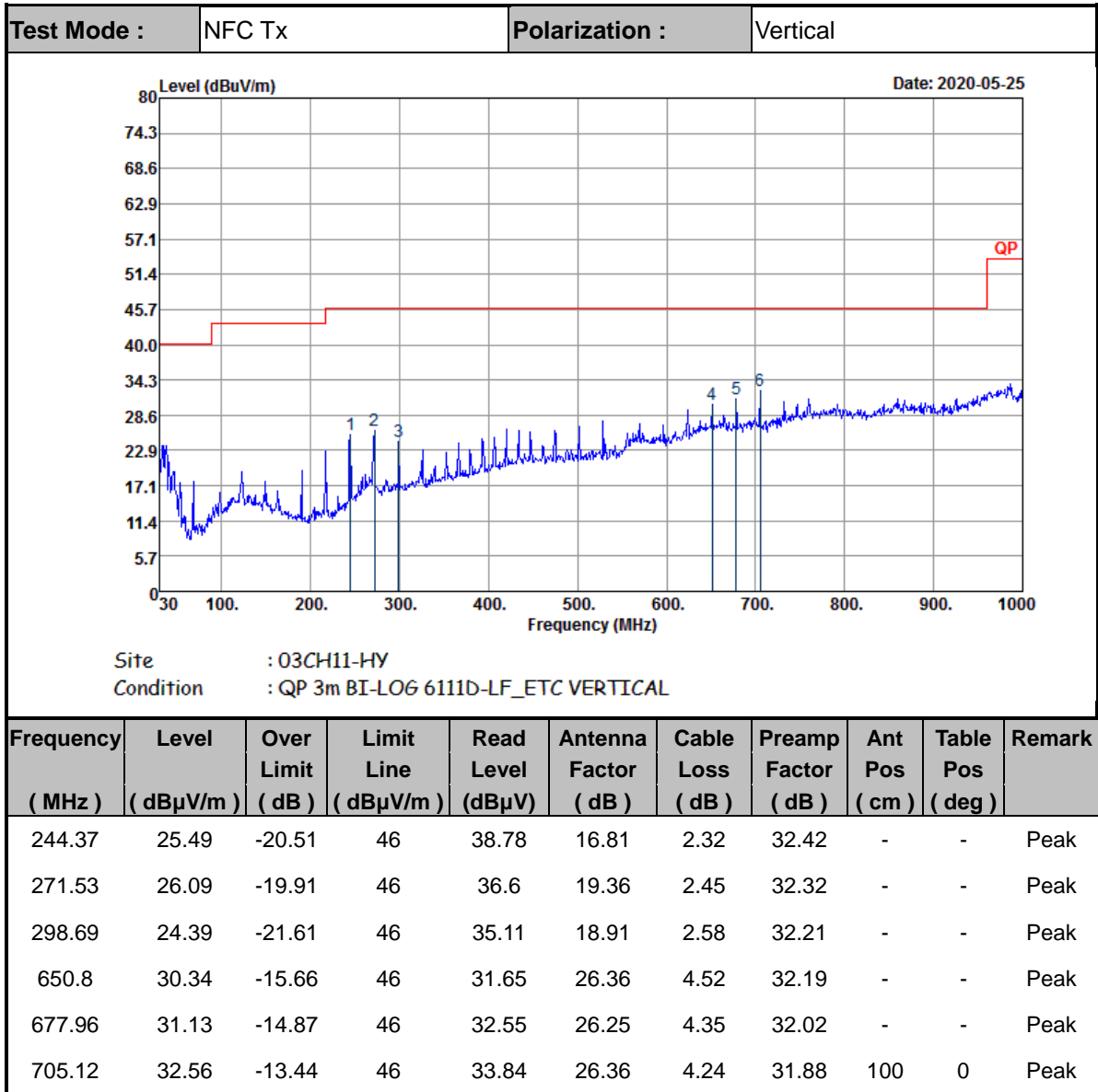
1. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
2. Distance extrapolation factor = 40 log (specific distance / test distance) (dB)
3. Limit line = specific limits (dBμV) + distance extrapolation factor
4. 13.56 MHz is fundamental signal which can be ignored



B3. Results of Radiated Spurious Emissions (30MHz~1GHz)



Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
217.21	27.72	-18.28	46	43.24	14.82	2.18	32.52	-	-	Peak
244.37	29.96	-16.04	46	43.25	16.81	2.32	32.42	-	-	Peak
271.53	29.45	-16.55	46	39.96	19.36	2.45	32.32	-	-	Peak
528.58	34.03	-11.97	46	39.46	23.83	3.45	32.71	-	-	Peak
677.96	36.79	-9.21	46	38.21	26.25	4.35	32.02	-	-	Peak
705.12	38.46	-7.54	46	39.74	26.36	4.24	31.88	100	0	Peak



Note:

1. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
2. Emission level (dBμV/m) = 20 log Emission level (μV/m).
3. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor= Level.

—————THE END—————