FCC Test Report

FOR:
Vara Safety

Marketing name:
Reach 2

Model Number
RCH-2-1

Product Description
Reach is designed to retain and secure firearms and only release with proper authentication from a biometric scan or NFC tag.

FCC ID: 2AV7CRCH-2-1

Applied Rules and Standards
Title 47 CFR: Part 15.225

REPORT #: EMC_VARAS_001_20001_FCC_15.225_NFC_Rev1

DATE: 7/13/2020

A2LA Accredited

IC recognized # 3462B-1

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TABLE OF CONTENTS

1 ASSESSMENT 3
2 ADMINISTRATIVE DATA 4
2.1 IDENTIFICATION OF THE TESTING LABORATORY ISSUING THE EMC TEST REPORT 4
2.2 IDENTIFICATION OF THE CLIENT 4
2.3 IDENTIFICATION OF THE MANUFACTURER 4
3 EQUIPMENT UNDER TEST (EUT) 5
3.1 EUT SPECIFICATIONS 5
3.2 EUT SAMPLE DETAILS 5
3.3 ACCESSORY EQUIPMENT (AE) DETAILS 6
3.4 TEST SAMPLE CONFIGURATION 6
3.5 MODE OF OPERATION DETAILS 6
3.6 JUSTIFICATION FOR WORST CASE MODE OF OPERATION 6
4 SUBJECT OF INVESTIGATION 7
4.1 MEASUREMENT UNCERTAINTY 7
4.2 ENVIRONMENTAL CONDITIONS DURING TESTING: 7
4.3 DATES OF TESTING: 7
5 MEASUREMENT RESULTS SUMMARY 8
6 MEASUREMENT PROCEDURES 9
6.1 RADIATED MEASUREMENT 9
7 TEST RESULT DATA 12
7.1 FIELD STRENGTH 12
7.2 FREQUENCY STABILITY 15
7.3 TRANSMITTER SPURIOUS EMISSIONS AND RESTRICTED BANDS 29
8 TEST SETUP PHOTOS 36
9 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTING 36
10 REVISION HISTORY 37

1 Assessment

The following device as further described in section 3 of this report was evaluated for unlicensed radio according to criteria specified in Code of Federal Regulations Title 47 CFR: Part 15.225.

No deviations were ascertained.

According to section 5 of this report, the overall result is PASS.

Company	Description	Model #
Vara Safety	Reach is designed to retain and secure firearms and only release with proper authentication from a biometric scan or NFC tag.	RCH-2-1

Responsible for Testing Laboratory:

Date	Section	Name	Signature
7/13/2020	Compliance	Li, Cindy (Lab Manager)	Cindy Li Digitally signed by cindy.li@cetecom.com DN: CN=cindy.li@cetecom.com Reason: I am approving this document Location: Date: 2020-07-13 14:01:48

Responsible for the Report:

Date	Section	Name	Signature
7/13/2020	Compliance	Ghanma, Issa (EMC Engineer)	Digitally signed by: Issa W Ghanma DN: CN = Issa W Ghanma email = Issaghanma@cetecom.com C = US O = CETECOM Inc. OU = EMC Date: 2020.07.13 13:48:16 -07'00'

The test results of this test report relate exclusively to the test item specified in Section3.

CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Street Address:	411 Dixon Landing Road
City/Zip Code	Milpitas, CA 95035
Country	USA
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Lab Manager:	Li, Cindy
Responsible Project Leader:	Sivaraman, Sangeetha

2.2 Identification of the Client

Applicant's Name:	Vara Safety
Street Address:	49 4th St. Suite 2424
City/Zip Code	Troy, NY 12180
Country	USA

2.3 Identification of the Manufacturer

Manufacturer's Name:	----Same as Client ----------
Manufacturers Address:	----Same as Client ----------
City/Zip Code	----Same as Client ----------
Country	----Same as Client ----------

3 Equipment Under Test (EUT)

3.1 EUT Specifications

NFC Module Name:	NXP MFRC522
NFC Model Number:	MFRC52202HN1
Frequency Range / number of channels:	13.56 MHz / 1 Channel
Type(s) of Modulation:	ASK
Modes of Operation:	RFID
Antenna Information as declared:	Coil antenna; Gain: 0.03456 dBi
Max. Output Powers as declared:	Target power: 2mW @50ohm impedance Measured power: 1.89mW
Power Supply/ Rated Operating Voltage Range:	AC adapter output: 5 V NFC: Low 1.8 VDC, Nominal 3.3 VDC, High 6.0 VDC
Operating Temperature Range:	Low -20º C, Nominal 20º C, High 45º C
Sample Revision:	☐ Prototype Unit; ☐ Production Unit; ■ Pre-Production
EUT Dimensions [cm]:	16.5 x 8.1 x 2.5
EUT Diameter:	■ < 60 cm ☐ Other _____
Other Radios included in the device:	N/A

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Notes / Comments
1	B1M40098	2.0	2.0	-

3.3 Accessory Equipment (AE) details

AE #	Type	Model	Manufacturer	Serial Number
1	Tag	NTAG213	Shenzhen TopTag Technology	N/A
2	Power Adapter	XYYU-050200	Generic	N/A

3.4 Test Sample Configuration

Set-up #	Combination of AE used for test set up	Comments
1	**EUT #1 + AE #2**	**-**

3.5 Mode of Operation details

Mode of Operation	Description of Operating modes	Additional Information
Op. 1	RFID ASK	Radio was configured by Client to: • Continuous transmit mode. • Highest possible duty cycle. • Maximum output power. Instructions and commands provided by the client will not be available to the end user. The internal antenna was connected.

3.6 Justification for Worst Case Mode of Operation

During the testing process the EUT was tested with transmitter sets the highest duty cycle, maximum output power as a worst case mode of operation supported.

For radiated measurements, all data in this report shows the worst case between horizontal and vertical antenna polarizations and for all orientations of the EUT.

4 Subject of Investigation

The objective of the measurements done by CETECOM Inc. was to assess the performance of the EUT according to the relevant requirements specified in Code of Federal Regulations Title 47 CFR: Part 15.225.

This test report is to support a request for new equipment authorization under the:

- FCC ID: 2AV7CRCH-2-1

4.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus, with 95% confidence interval (in dB delta to result), based on a coverage factor k=1.

Radiated measurement

9 kHz to 30 MHz	±2.5 dB (Magnetic Loop Antenna)
30 MHz to 1000 MHz	±2.0 dB (Biconilog Antenna)
1 GHz to 40 GHz	±2.3 dB (Horn Antenna)

According to TR 102 273 a multiplicative propagation of error is assumed for RF measurement systems. For this reason the RMS method is applied to dB values and not to linear values as appropriate for additive propagation of error. Also used: http://physics.nist.gov/cuu/Uncertainty/typeb.html. The above calculated uncertainties apply to direct application of the Substitution method. The Substitution method is always used when the EUT comes closer than 3 dB to the limit.

4.2 Environmental Conditions During Testing:

The following environmental conditions were maintained during the course of testing:

- Ambient Temperature: 20-25° C
- Relative humidity: 40-60%

4.3 Dates of Testing:

5/4/2020 – 6/19/2020

5 Measurement Results Summary

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	NA	NP	Result
§15.225 (a), (b), (c)	Field Strength (Fundamental)	Nominal	Op.1	■	☐	☐	Complies
§15.225 (d) §15.209 (a)	TX Spurious emissions-Radiated	Nominal	Op.1	■	☐	☐	Complies
§15.225(e)	Frequency stability	Extreme temperature and voltage conditions	Op.1	■	☐	☐	Complies

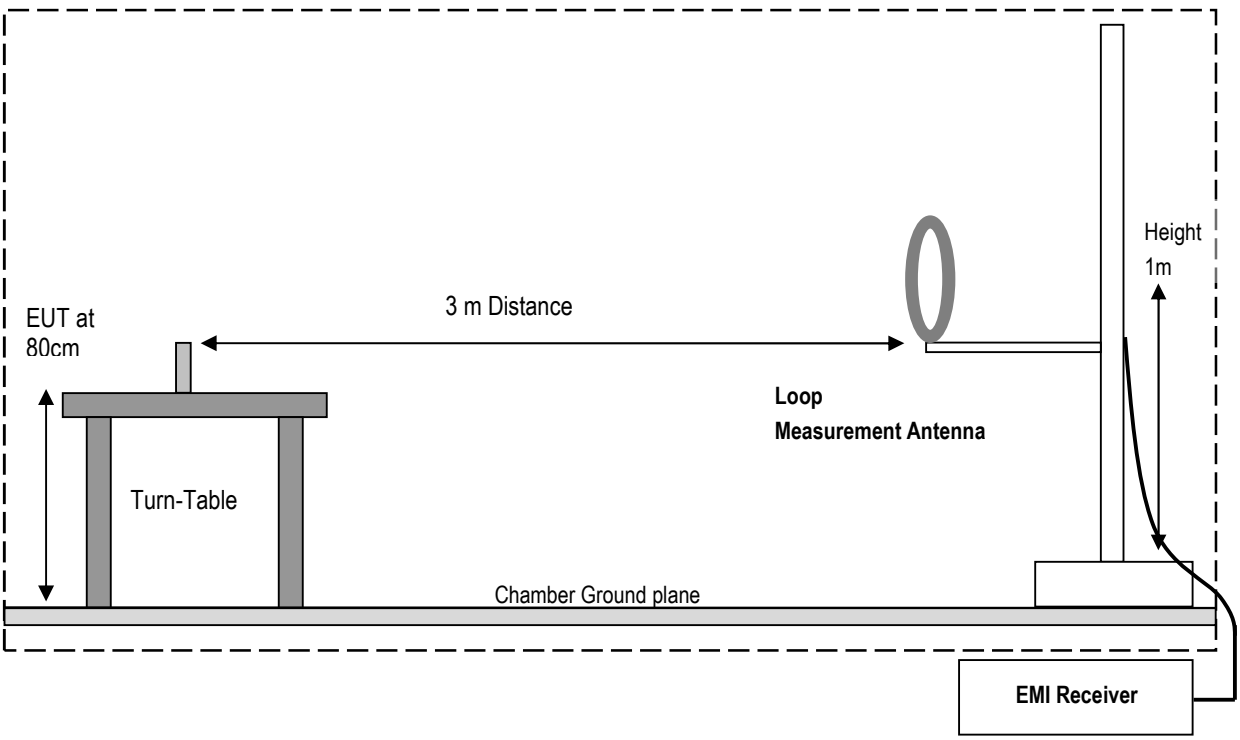
6 Measurement Procedures

6.1 Radiated Measurement

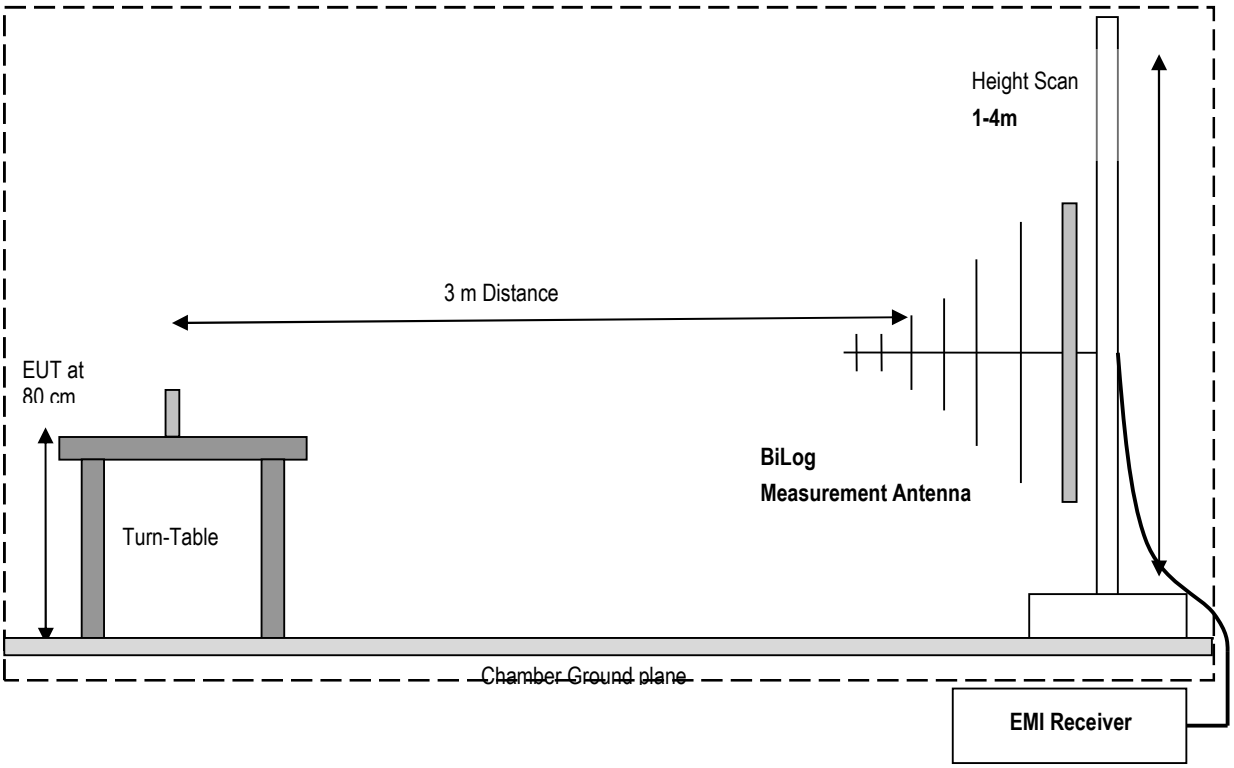
The radiated measurement is performed according to ANSI C63.10 (2013)

- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 360º continuous measurement of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to cover the 3 orthogonal axis of the EUT. A max peak detector is utilized during the exploratory measurement. The Test-SW creates an overall maximum trace for all 12 sweeps and saves the settings for each point of this trace. The maximum trace is part of the test report.
- The 10 highest emissions are selected with an automatic algorithm of EMC32 searching for peaks in the noise floor and ensuring that broadband signals are not selected multiple times.
- The maxima are then put through the final measurement and again maximized in a 90deg range of the turntable, fine search in frequency domain and height scan between 1m and 4m.
- The above procedure is repeated for all possible ways of power supply to EUT and for all supported modulations.
- In case there are no emissions above noise floor level only the maximum trace is reported as described above.
- The results are split up into up to 4 frequency ranges due to antenna bandwidth restrictions. A magnetic loop is used from 9 kHz to 30 MHz, a Biconilog antenna is used from 30 MHz to 1 GHz, and two different horn antennas are used to cover frequencies up to 40 GHz.

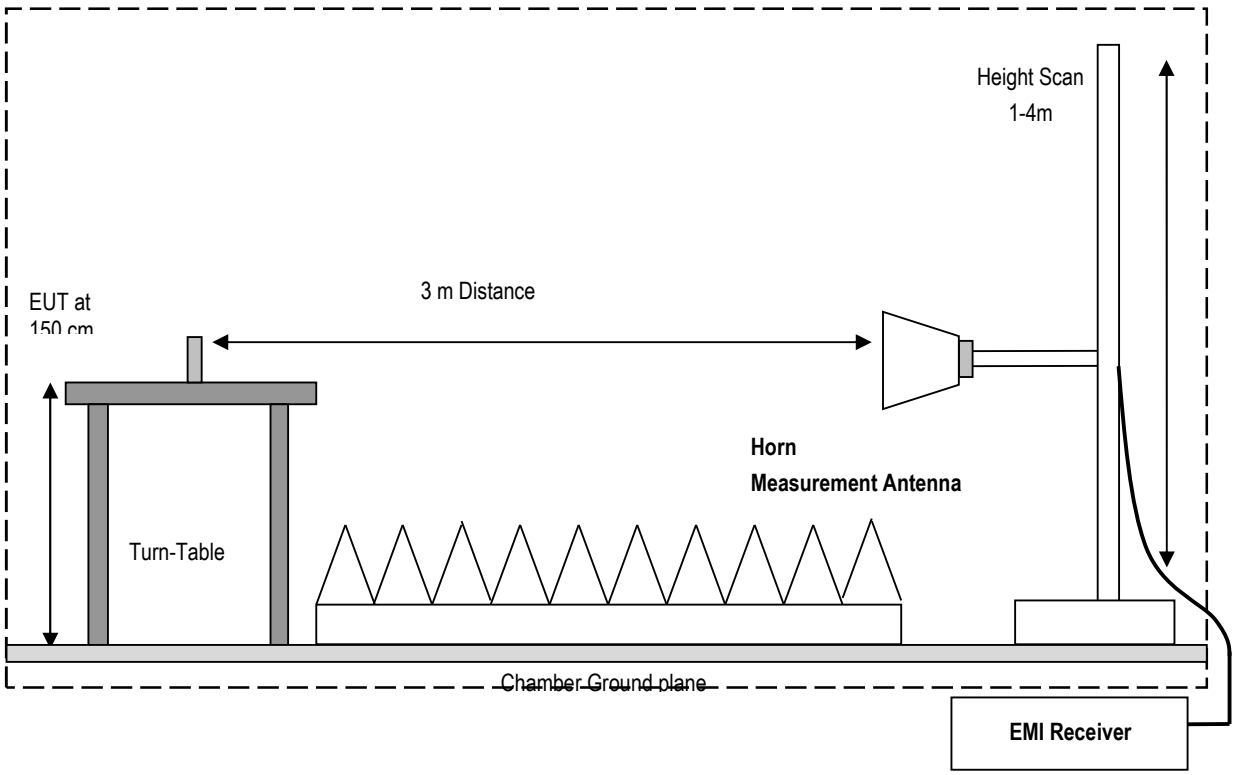
Radiated Emissions Test Setup below 30MHz Measurements



Radiated Emissions Test Setup 30MHz-1GHz Measurements



Radiated Emissions Test Setup above 1GHz Measurements



6.1.1 Sample Calculations for Field Strength Measurements

Field Strength is calculated from the Spectrum Analyzer/ Receiver readings, taking into account the following parameters:

1. Measured reading in dBµV
2. Cable Loss between the receiving antenna and SA in dB and
3. Antenna Factor in dB/m

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the following equation:

FS (dBµV/m) = Measured Value on SA (dBµV) + Cable Loss (dB) + Antenna Factor (dB/m)

Example:

Frequency (MHz)	Measured SA (dBµV)	Cable Loss (dB)	Antenna Factor Correction (dB)	Field Strength Result (dBµV/m)
1000	80.5	3.5	14	98.0

7 Test Result Data

7.1 Field strength

7.1.1 References

- **FCC Part 15 Subpart C-Intentional Radiators**
  §15.225 Operation within the band 13.110-14.010 MHz

(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

7.1.2 Limits

According to ANSI C63.10-2013 Section 6.4.4

- Equation (1):

  $d_{near\ field} = 47.77 / f_{MHz}$

  $d_{near\ field} = 47.77 / 13.56$

  $d_{near\ field} \approx 3.5$ meters

- Equation (2)

  $FS_{limit} = FS_{max} - 40\log(d_{near\ field} / d_{measure}) - 20\log(d_{limit} / d_{near\ field})$

The limit applied to the measurement result, is converted to 3 meters, by using:

- 40 dB/decade extrapolation factor for distance < λ/2π and;
- 20 dB/decade extrapolation factor for distance > λ/2π

Where:

- FS_{limit} : is the calculation of field strength at the limit distance, expressed in dBµV/m
- FS_{max} : is the measured field strength, expressed in dBµV/m ≈ 84 dBµV/m (See note 1)
- $d_{near\ field}$: is the λ/2π distance ≈ 3.5 meters
- $d_{measure}$: is the distance of the measurement point from the EUT = 3 meters
- d_{limit} : is the reference limit distance = 30 meters

Note 1: The maximum allowed field strength; 15.848 mV/m (84 dBµV/m), were used as **FS**max to adjust the mask limit at the measured distance, so equation (2) will be:

FSlimit = **FS**max + 40log (**d**near field / **d**measure) + 20log (**d**limit / **d**near field)

- Within the band 13.553-13.567 MHz

FSlimit = 84 + 18.7 + 2.7
FSlimit = 105.1 dBµV/m at 3 meters

- Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz

FSlimit = 70.47 + 18.7 + 2.7
FSlimit = 91.87 dBµV/m at 3 meters

- Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz

FSlimit = 60.51 + 18.7 + 2.7
FSlimit = 81.91 dBµV/m at 3 meters

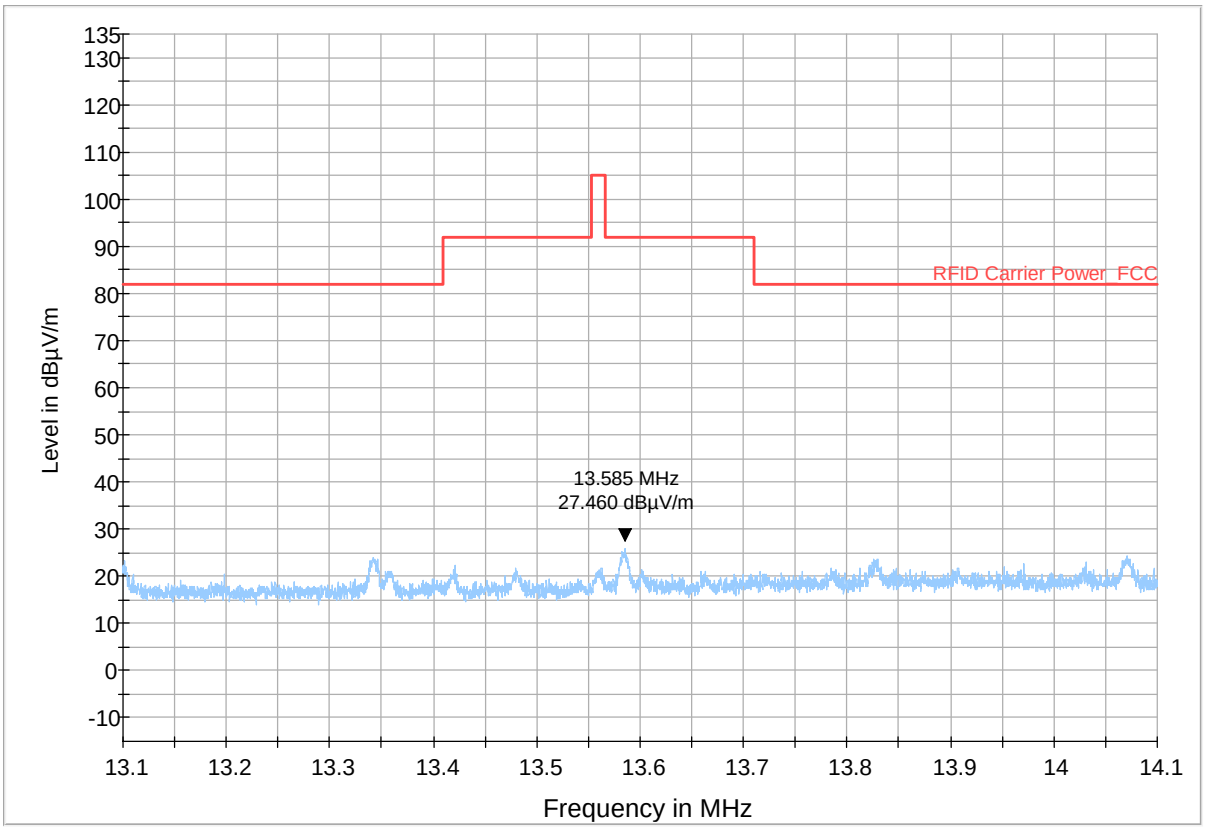
7.1.3 Test conditions and setup:

Ambient Temperature	EUT operating mode	Power Input
23° C	Op.1	5 V

7.1.4 Measurement plots:

Plot # 1 Field strength

NFC 13.56 MHz



Preview Result 1-PK+ Critical_Freqs PK+ RFID Carrier Power_FCC Final_Result F

7.2 Frequency Stability

7.2.1 Measurement according to:

- **FCC: CFR 47 Part 2.1055**

- **ANSI C63.10-2013 6.8**
  - **6.8.1 Frequency stability with respect to ambient temperature.**

a) Supply the EUT with a nominal ac voltage or install a new or fully charged battery in the EUT.
If possible, a dummy load shall be connected to the EUT because an antenna near the metallic walls of an environmental test chamber could affect the output frequency of the EUT. If the EUT is equipped with a permanently attached, adjustable-length antenna, then the EUT shall be placed in the center of the chamber with the antenna adjusted to the shortest length possible.
Turn ON the EUT and tune it to one of the number of frequencies shown in 5.6.

b) Couple the unlicensed wireless device output to the measuring instrument by connecting an antenna to the measuring instrument with a suitable length of coaxial cable and placing the measuring antenna near the EUT (e.g., 15 cm away), or by connecting a dummy load to the measuring instrument, through an attenuator if necessary.

NOTE – An instrument that has an adequate level of accuracy as specified by the procuring or regulatory agency is the recommended measuring instrument.

c) Adjust the location of the measurement antenna and the controls on the measurement instrument to obtain a suitable signal level (i.e., a level that will not overload the measurement instrument but is strong enough to allow measurement of the operating or fundamental frequency of the EUT).

d) Turn the EUT OFF and place it inside the environmental temperature chamber. For devices that have oscillator heaters, energize only the heater circuit.

e) Set the temperature control on the chamber to the highest specified in the regulatory requirements for the type of device and allow the oscillator heater and the chamber temperature to stabilize.

f) While maintaining a constant temperature inside the environmental chamber, turn the EUT ON and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total are made.

g) Measure the frequency at each of frequencies specified in 5.6.

h) Switch OFF the EUT but do not switch OFF the oscillator heater.

i) Lower the chamber temperature by not more than 10 °C, and allow the temperature inside the chamber to stabilize.

j) Repeat step f) through step i) down to the lowest specified temperature.

- Spectrum Analyzer settings:
  - RBW =20 kHz
  - VBW ≥ 50 KHz
  - Set span = 1 MHz
  - Sweep time = auto couple
  - Detector = Pk
  - Trace mode = MaxHold
  - Sweep Points = 10000 points
  - Use N dB Down function to set the low and high frequency.

7.2.1.1 Test conditions and setup:

EUT Set-Up #	EUT operating mode	Power Input (VDC)
1	Op. 1	3.3

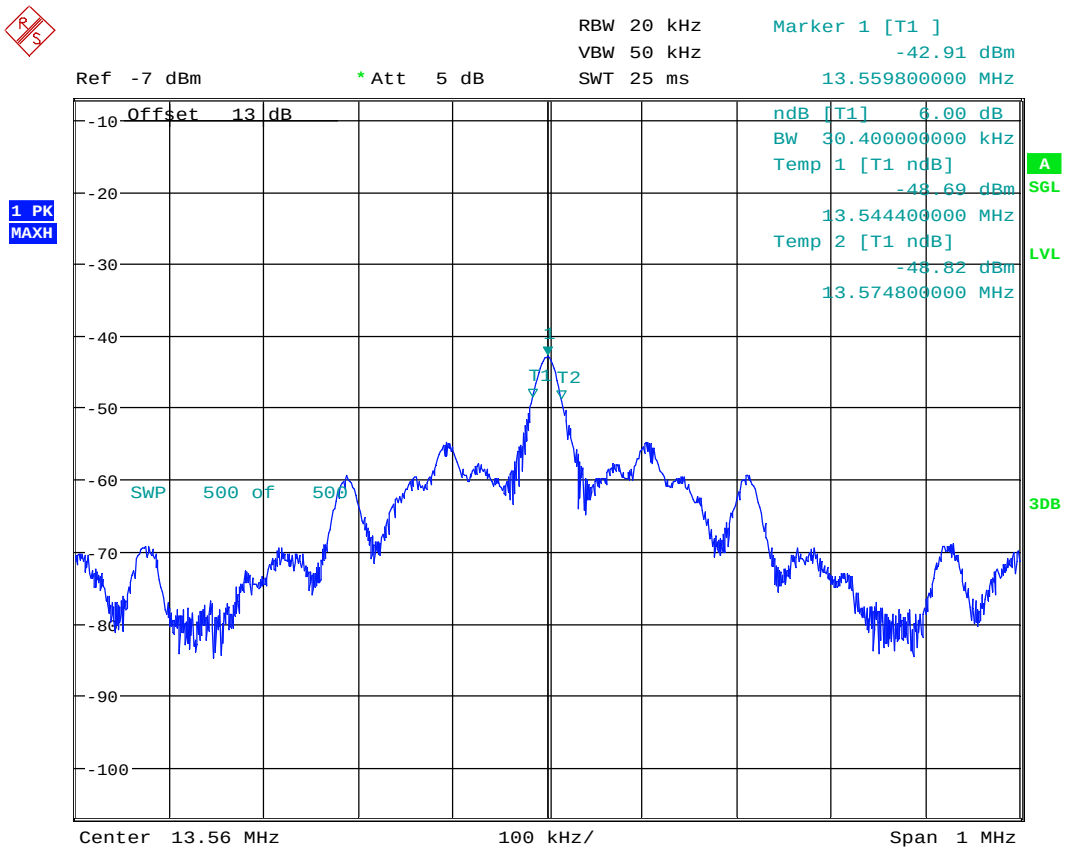
7.2.1.2 Measurement result:

*1 RCF: Reference Center Frequency.
*2 F low: Low frequency; -6 dB
*3 F high: High frequency; +6 dB
*4 CCF: Calculated Center Frequency; CCF = F low + (F high – F low)/2
*5 Variation = RCF - CCF
*6 PPM: [(CCF/RCF)-1] * 10^6

Plot #	Measurement Time (Minutes)	Temperature (°C)	RCF *1 (MHz)	F Low *2 (MHz)	F High *3 (MHz)	CCF *4 (MHz)	Variation *5 [MHz]	PPM *6 (+-)100
2	-	23	13.5596	-	-	-	-	-
3	0	45	13.5596	13.5448	13.5754	13.5601	-0.0005	36.8742
4	2	45		13.5448	13.5754	13.5601	-0.0005	36.8742
5	5	45		13.5440	13.5758	13.5599	-0.0003	22.1245
6	10	45		13.5442	13.5758	13.5600	-0.0004	29.4994
7	0	35	13.5596	13.5446	13.5758	13.5602	-0.0006	44.2491
8	2	35		13.5450	13.5750	13.5600	-0.0004	29.4994
9	5	35		13.5440	13.5746	13.5593	0.0003	-22.1245
10	10	35		13.5432	13.5746	13.5589	0.0007	**-51.6239**
11	0	25	13.5596	13.5448	13.5750	13.5599	-0.0003	22.1245
12	2	25		13.5434	13.5750	13.5592	0.0004	-29.4994
13	5	25		13.5442	13.5760	13.5601	-0.0005	36.8742
14	10	25		13.5446	13.5750	13.5598	-0.0002	14.7497
15	0	15	13.5596	13.5433	13.5756	13.5594	0.0002	-12.5372
16	2	15		13.5438	13.5750	13.5594	0.0002	-14.7497
17	5	15		13.5440	13.5752	13.5596	0.0000	0.0000
18	10	15		13.5436	13.5756	13.5596	0.0000	0.0000
19	0	5	13.5596	13.5442	13.5756	13.5599	-0.0003	22.1245
20	2	5		13.5438	13.5750	13.5594	0.0002	-14.7497
21	5	5		13.5450	13.5746	13.5598	-0.0002	14.7497
22	10	5		13.5450	13.5760	13.5605	-0.0009	**66.3736**
23	0	-5	13.5596	13.5450	13.5746	13.5598	-0.0002	14.7497
24	2	-5		13.5440	13.5754	13.5597	-0.0001	7.3748
25	5	-5		13.5436	13.5756	13.5596	0.0000	0.0000
26	10	-5		13.5442	13.5752	13.5597	-0.0001	7.3748
27	0	-20	13.5596	13.5434	13.5756	13.5595	0.0001	-7.3748
28	2	-20		13.5446	13.5756	13.5601	-0.0005	36.8742
29	5	-20		13.5434	13.5758	13.5596	0.0000	0.0000
30	10	-20		13.5438	13.5756	13.5597	-0.0001	7.3748

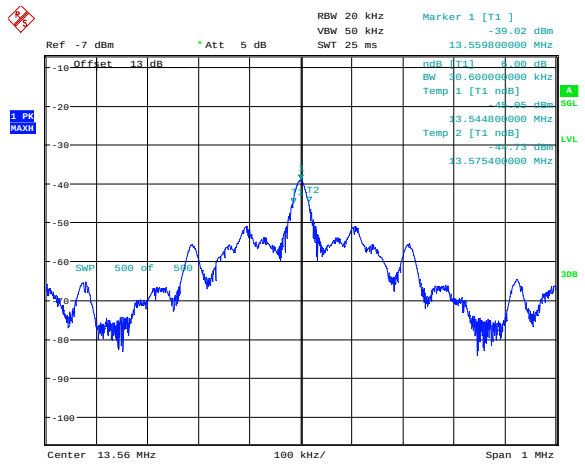
7.2.1.3 Measurement plots:

Plot #2		
13.56 MHz	Reference Measurement	Temperature: 23°C



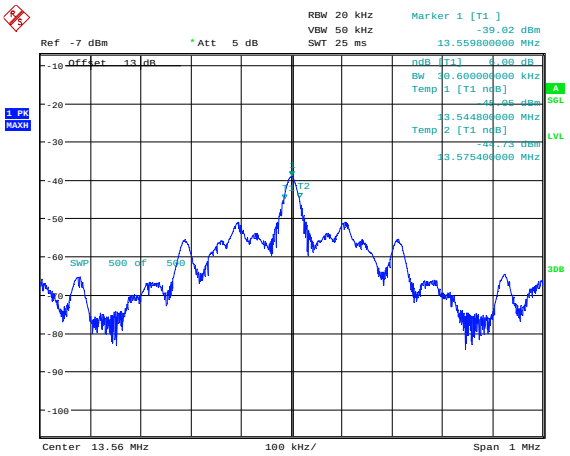
Date: 5.MAY.2020 15:12:54

Plot #3		
13.56 MHz	Measurement time: 0 min	Temperature: 45°C



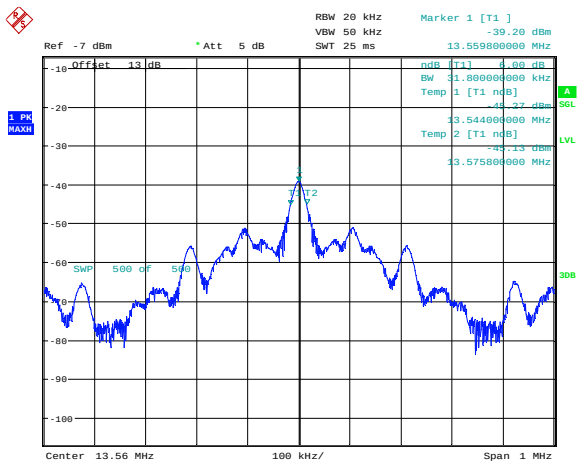
Date: 5.MAY.2020 15:42:52

Plot #4		
13.56 MHz	Measurement time: 2 min	Temperature: 45°C



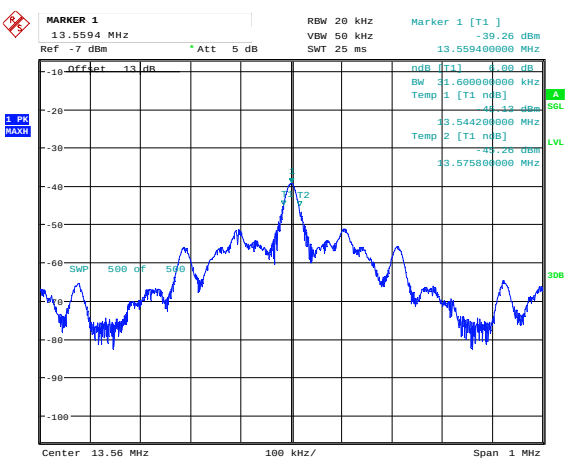
Date: 5.MAY.2020 15:45:00

Plot #5		
13.56 MHz	Measurement time: 5 min	Temperature: 45°C



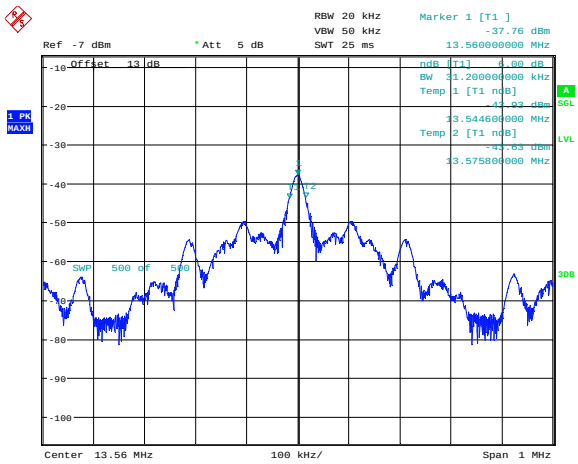
Date: 5.MAY.2020 15:49:12

Plot #6		
13.56 MHz	Measurement time: 10 min	Temperature: 45°C



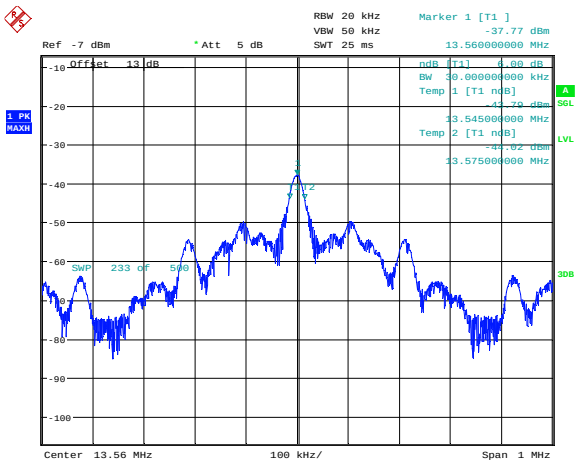
Date: 5.MAY.2020 15:55:42

Plot #7		
13.56 MHz	Measurement time: 0 min	Temperature: 35°C



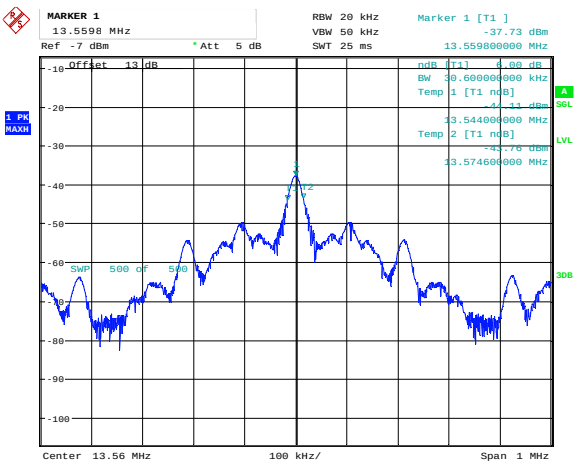
Date: 5.MAY.2020 16:36:25

Plot #8		
13.56 MHz	Measurement time: 2 min	Temperature: 35°C



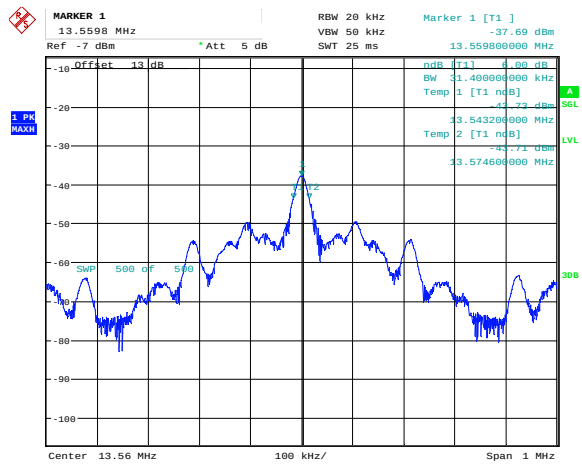
Date: 5.MAY.2020 16:41:22

Plot #9		
13.56 MHz	Measurement time: 5 min	Temperature: 35°C



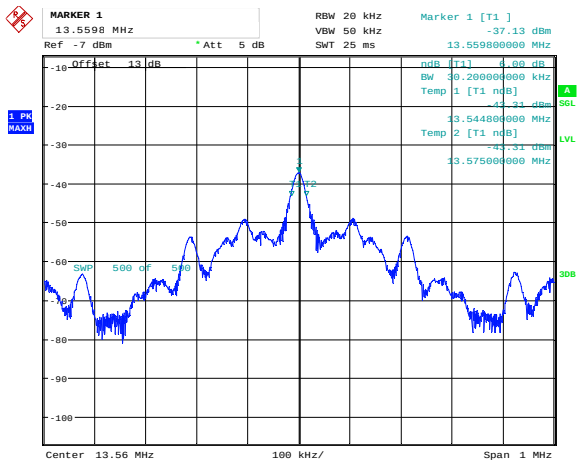
Date: 5.MAY.2020 16:44:40

Plot #10		
13.56 MHz	Measurement time: 10 min	Temperature: 35°C



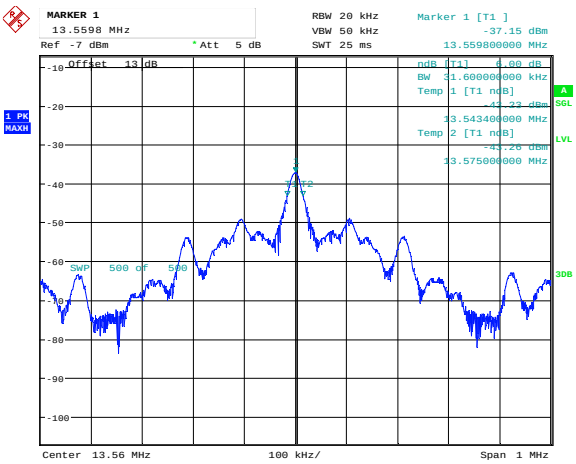
Date: 5.MAY.2020 16:50:57

Plot #11		
13.56 MHz	Measurement time: 0 min	Temperature: 25°C



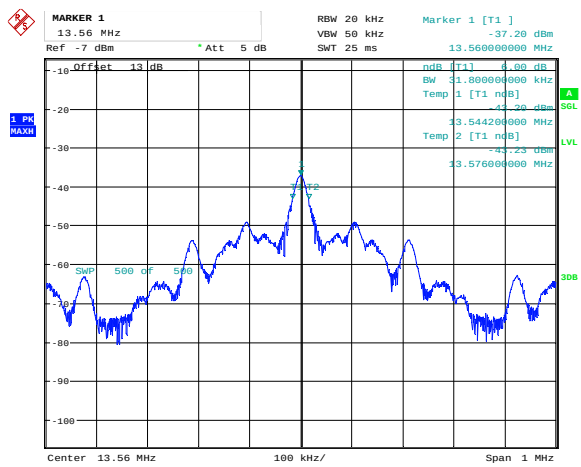
Date: 5.MAY.2020 16:58:53

Plot #12		
13.56 MHz	Measurement time: 2 min	Temperature: 25°C



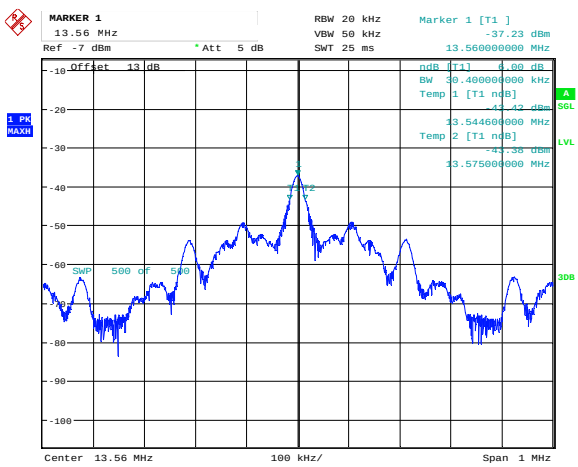
Date: 5.MAY.2020 17:02:05

Plot #13		
13.56 MHz	Measurement time: 5 min	Temperature: 25°C



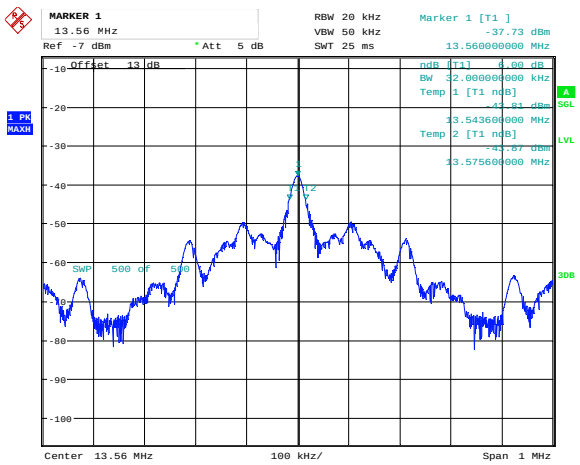
Date: 5.MAY.2020 17:07:16

Plot #14		
13.56 MHz	Measurement time: 10 min	Temperature: 25°C



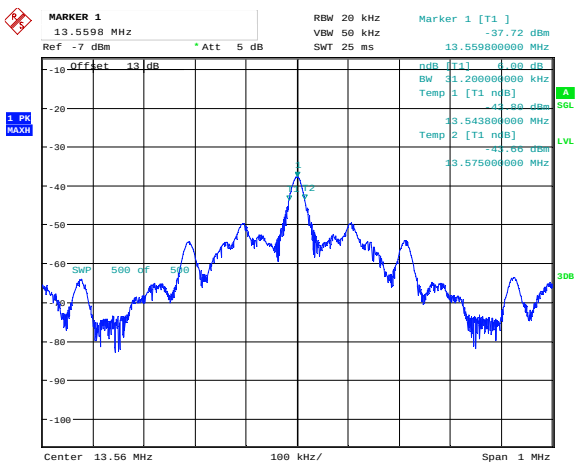
Date: 5.MAY.2020 17:13:00

Plot #15		
13.56 MHz	Measurement time: 0 min	Temperature: 15°C



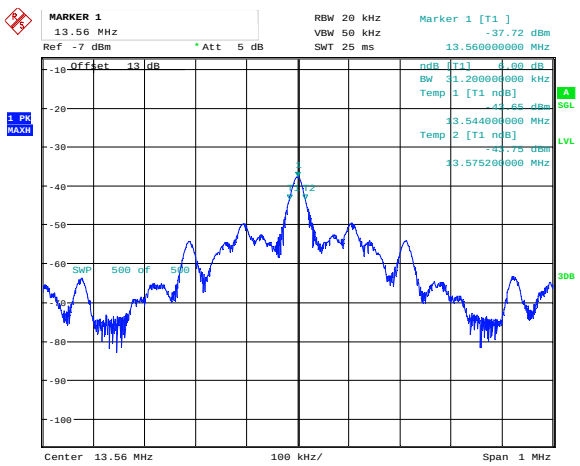
Date: 5.MAY.2020 17:34:10

Plot #16		
13.56 MHz	Measurement time: 2 min	Temperature: 15°C



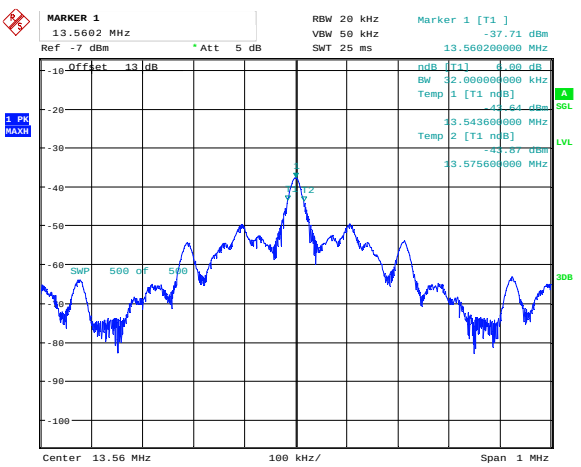
Date: 5.MAY.2020 17:37:14

Plot #17		
13.56 MHz	Measurement time: 5 min	Temperature: 15°C



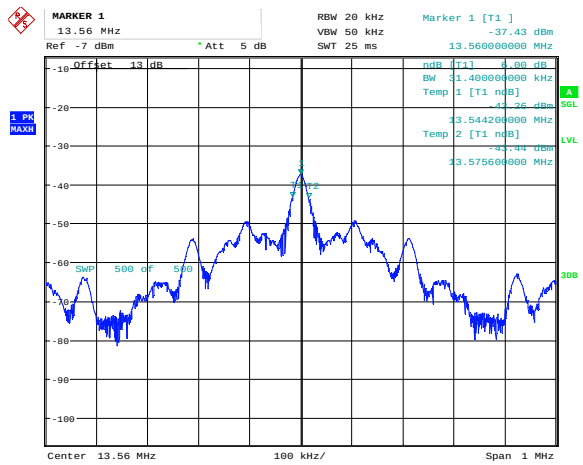
Date: 5.MAY.2020 17:41:33

Plot #18		
13.56 MHz	Measurement time: 10 min	Temperature: 15°C

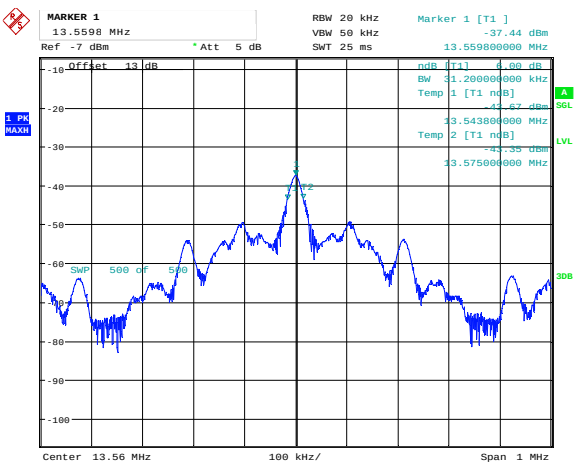


Date: 5.MAY.2020 17:46:39

Plot #19			Plot #20		
13.56 MHz	Measurement time: 0 min	Temperature: 5°C	13.56 MHz	Measurement time: 2 min	Temperature: 5°C

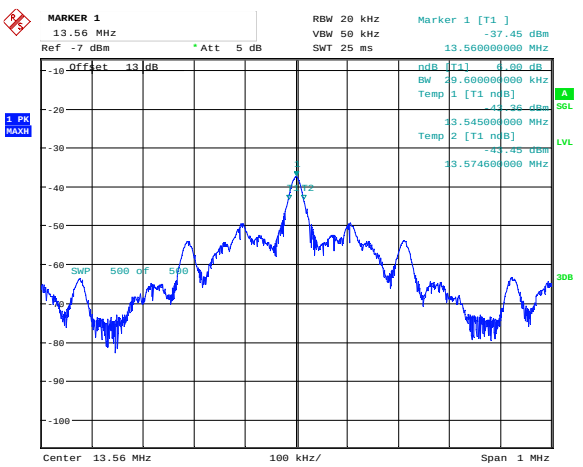


Date: 5.MAY.2020 17:59:40

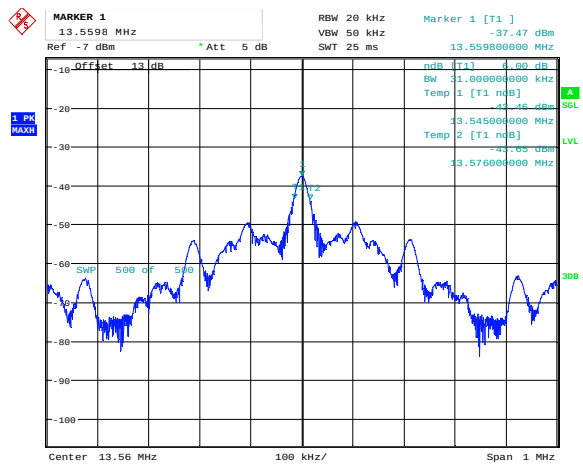


Date: 5.MAY.2020 18:02:10

Plot #21			Plot #22		
13.56 MHz	Measurement time: 5 min	Temperature: 5°C	13.56 MHz	Measurement time: 10 min	Temperature: 5°C

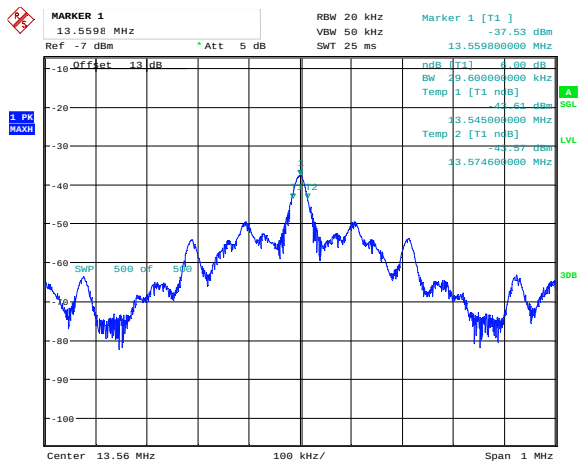


Date: 5.MAY.2020 18:05:15



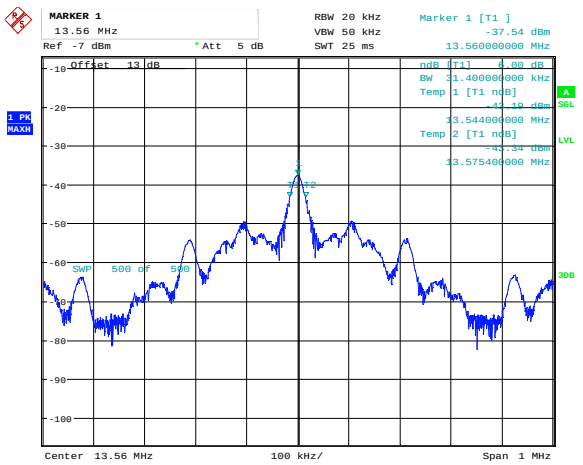
Date: 5.MAY.2020 18:10:46

Plot #23		
13.56 MHz	Measurement time: 0 min	Temperature: -5°C



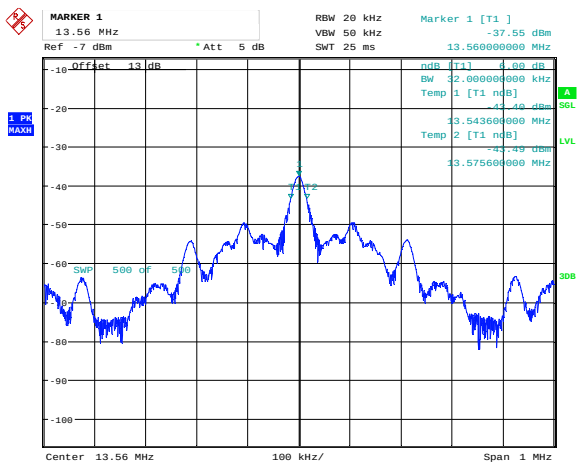
Date: 5.MAY.2020 18:19:42

Plot #24		
13.56 MHz	Measurement time: 2 min	Temperature: -5°C



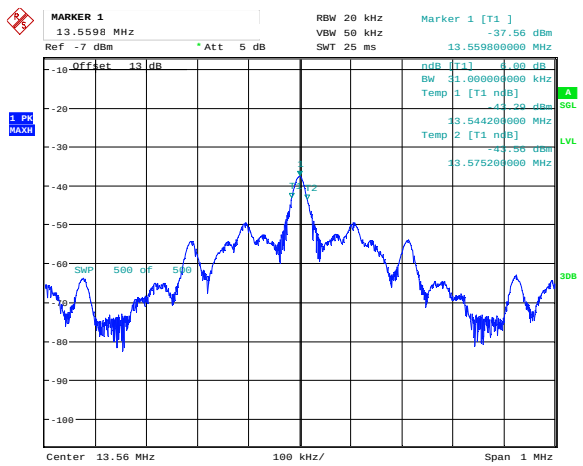
Date: 5.MAY.2020 18:21:55

Plot #25		
13.56 MHz	Measurement time: 5 min	Temperature: -5°C



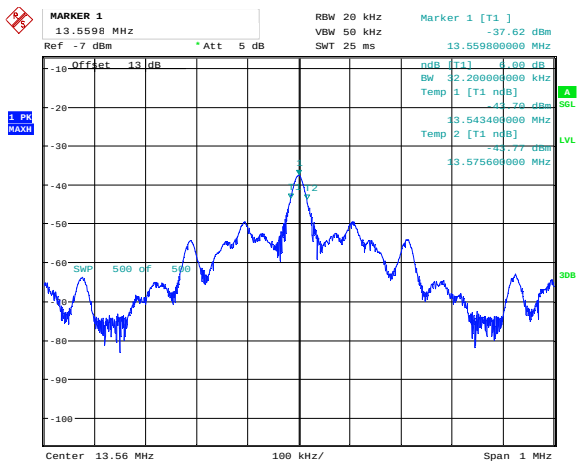
Date: 5.MAY.2020 18:24:56

Plot #26		
13.56 MHz	Measurement time: 10 min	Temperature: -5°C



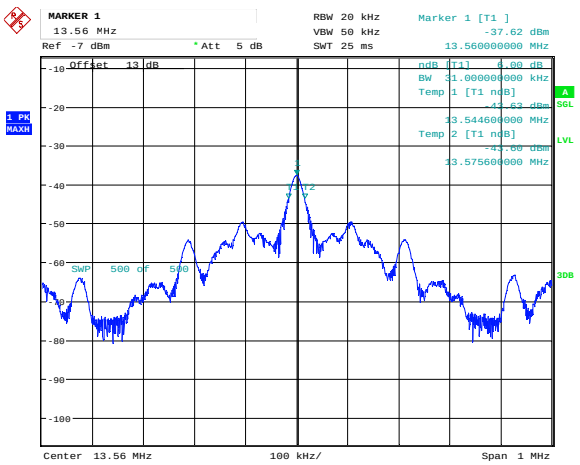
Date: 5.MAY.2020 18:30:49

Plot #27		
13.56 MHz	Measurement time: 0 min	Temperature: -20°C



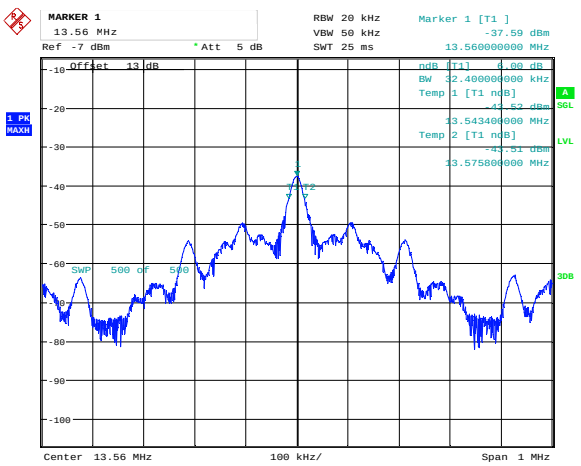
Date: 5.MAY.2020 18:46:47

Plot #28		
13.56 MHz	Measurement time: 2 min	Temperature: -20°C



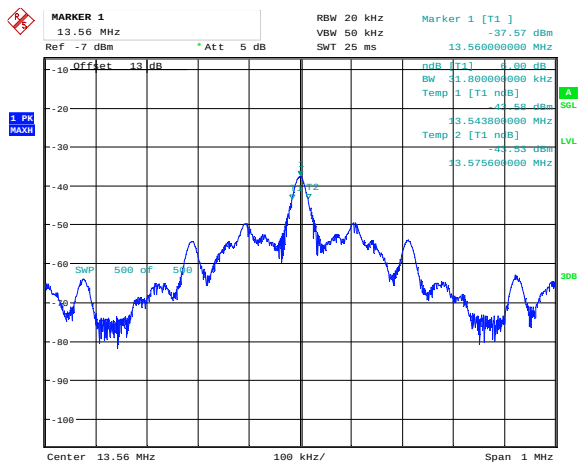
Date: 5.MAY.2020 18:48:59

Plot #29		
13.56 MHz	Measurement time: 5 min	Temperature: -20°C



Date: 5.MAY.2020 18:53:39

Plot #30		
13.56 MHz	Measurement time: 10 min	Temperature: -20°C



Date: 5.MAY.2020 18:59:42

7.2.2 Measurement according to:

- **FCC: CFR 47 Part 2.1055**

- **ANSI C63.10-2013 6.8**
  - **6.8.2 Frequency stability when varying supply voltage.**

Unless otherwise specified, these tests shall be made at ambient room temperature (+15 °C to +25 °C). An antenna shall be connected to the antenna output terminals of the EUT if possible. If the EUT is equipped with or uses an adjustable-length antenna, then it shall be fully extended.

a) Supply the EUT with nominal voltage or install a new or fully charged battery in the EUT. Turn ON the EUT and couple its output to a frequency counter or other frequency-measuring instrument.
b) Tune the EUT to one of the number of frequencies required in 5.6. Adjust the location of the measurement antenna and the controls on the measurement instrument to obtain a suitable signal level.
c) Measure the frequency at each of the frequencies specified in 5.6.
d) Repeat the above procedure at 85% and 115% of the nominal supply voltage as described in 5.13.

- Spectrum Analyzer settings:
  - RBW =20 kHz
  - VBW ≥ 50 KHz
  - Set span = 1 MHz
  - Sweep time = auto couple
  - Detector = Pk
  - Trace mode = MaxHold
  - Sweep Points = 10000 points
  - Use N dB Down function to set the low and high frequency.

7.2.2.1 <u>Test conditions and setup:</u>

EUT Set-Up #	EUT operating mode	Ambient Temperature
1	Op. 1	22° C

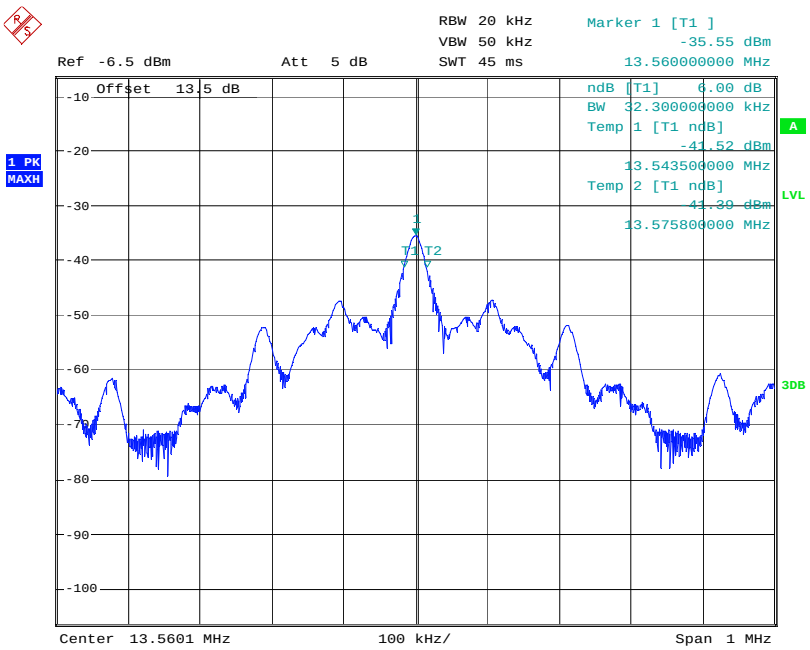
7.2.2.2 Measurement result:

*1 RCF: Reference Center Frequency.
*2 F low: Low frequency; -6 dB
*3 F high: High frequency; +6 dB
*4 CCF: Calculated Center Frequency; CCF = F low + (F high – F low)/2
*5 Variation = RCF - CCF
*6 PPM: [(CCF/RCF)-1] * 10^6

Plot #	Voltage (DC)	RCF *1 (MHz)	F Low *2 (MHz)	F High *3 (MHz)	CCF *4 (MHz)	Variation *5 [MHz]	PPM *6 (+-)100
31	5.0	13.5597	-	-	-	-	-
32	5.75	13.5597	13.5443	13.5754	13.5599	+0.0002	+14.7496
33	4.25		13.5444	13.5745	13.5595	-0.0002	-14.7496

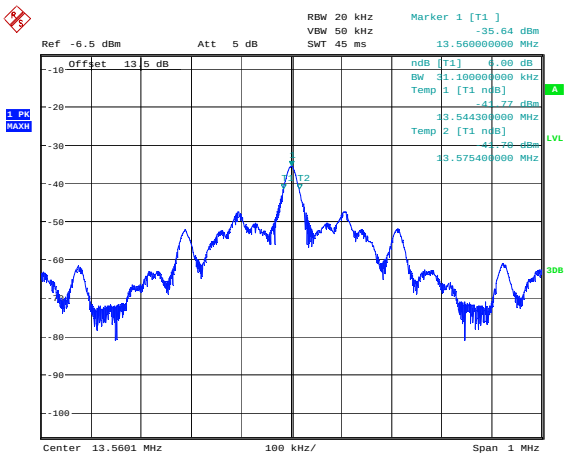
7.2.2.3 Measurement Plots:

Plot #31



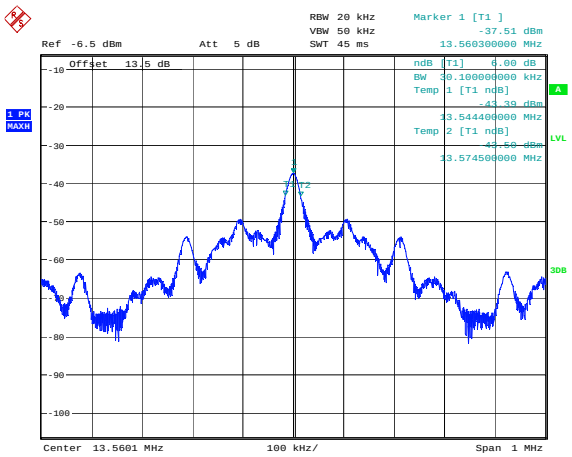
Date: 19.JUN.2020 13:02:11

Plot #32



Date: 19.JUN.2020 13:05:13

Plot #33



Date: 19.JUN.2020 13:09:44

7.3 Transmitter Spurious Emissions and Restricted Bands

7.3.1 Measurement according to ANSI C63.10

Analyzer Settings:

- Frequency = 9 KHz – 30 MHz
- RBW = 9 KHz
- Detector = Peak

- Frequency = 30 MHz – 1 GHz
- Detector = Peak / Quasi-Peak
- RBW = 120 KHz (<1 GHz)

- Frequency > 1 GHz
- Detector = Peak / Average
- RBW = 1MHz

Plots reported here represent the worst case emissions for horizontal and vertical antenna polarizations and for three orientations of the EUT. Unless mentioned otherwise, the emissions outside the limit lines in the plots are from the transmit signal.

7.3.2 Limits: FCC 15.247(d)/15.209(a)

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

- 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)).
- PEAK LIMIT= 74dB µV/m
- AVG. LIMIT= 54dB µV/m

- Except as shown in CFR 47 Part 15.205 paragraph (d), only spurious emissions are permitted in any of the frequency bands listed below

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

Radiated spurious emissions shall be measured for the transmit frequencies, transmit power, and data rate for the lowest, middle and highest channel in each frequency band of operation and for the highest gain antenna for each antenna type, and using the appropriate parameters and test requirements described in 5.4.

The highest (or worst-case) data rate shall be recorded for each measurement.

For testing at distance other than the specified in the standard, the limit conversion is calculated by using 40 dB/decade extrapolation as follow:

Conversion factor (CF) = 40 log (D/d) = 40 log (300 m / 3 m) = 80 dB

7.3.3 Test conditions and setup:

Ambient Temperature	EUT operating mode	Power Input
22° C	Op.1	5 V

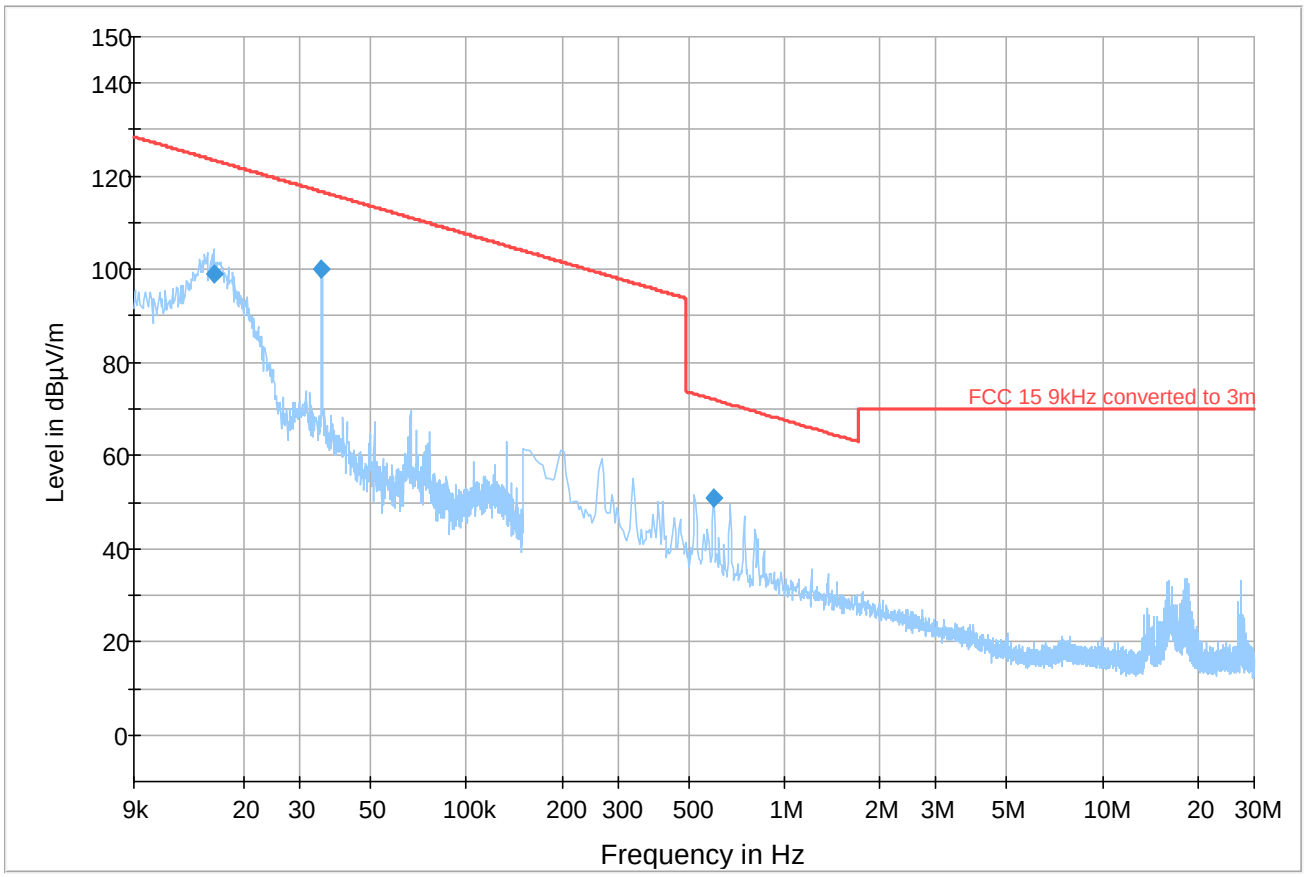
7.3.4 Measurement Plots:

Plot # 34 Radiated Emissions: 9KHz – 30MHz

NFC 13.56 MHz

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
0.016	98.98	123.44	24.46	700.0	0.200	209.0	V	90.0	45.9
0.035	99.98	116.69	16.71	700.0	0.200	240.0	V	90.0	40.0
0.602	50.94	72.02	21.07	500.0	9.000	240.0	V	60.0	16.5



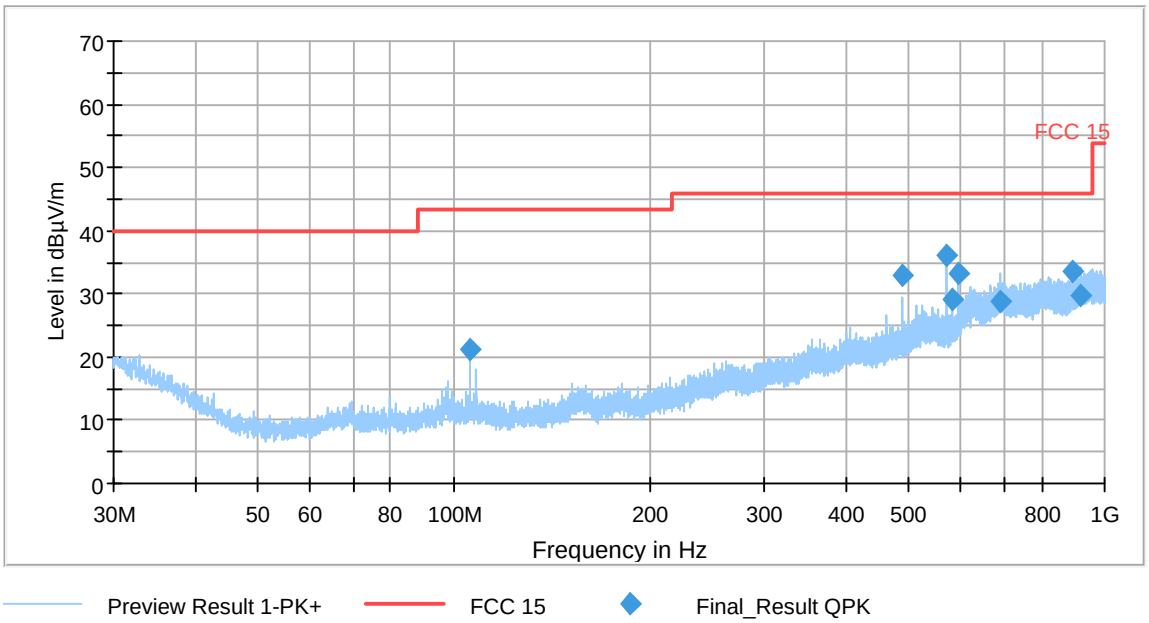
Preview Result 2-RMS
FCC 15 9kHz converted to 3m
Preview Result 1-PK+
Final_Result QPK

Plot # 35 Radiated Emissions: 30MHz – 1GHz

NFC 13.56 MHz

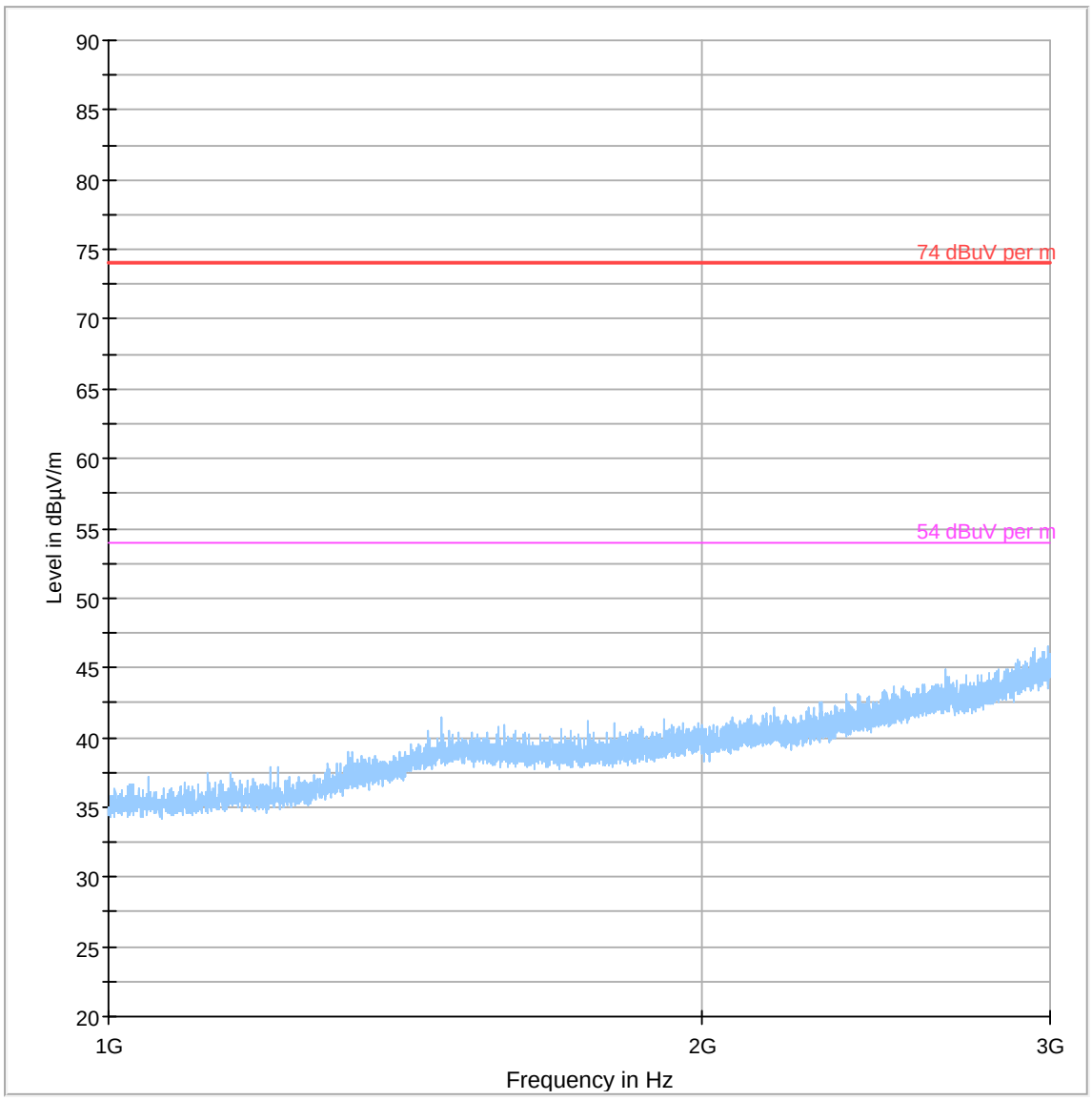
Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
105.678	21.13	43.52	22.39	200.0	120.000	185.0	H	271.0	13.2
488.158	32.95	46.02	13.07	200.0	120.000	225.0	V	10.0	23.4
569.527	36.27	46.02	9.75	200.0	120.000	193.0	V	255.0	24.9
583.078	28.99	46.02	17.03	200.0	120.000	164.0	V	235.0	25.2
596.631	33.21	46.02	12.81	200.0	120.000	176.0	V	237.0	25.8
693.484	28.73	46.02	17.29	200.0	120.000	319.0	V	-15.0	29.1
894.970	33.72	46.02	12.30	200.0	120.000	266.0	V	-50.0	29.7
918.898	29.89	46.02	16.13	200.0	120.000	167.0	V	139.0	30.1



Plot # 36 Radiated Emissions: 1 – 3GHz

NFC 13.56 MHz



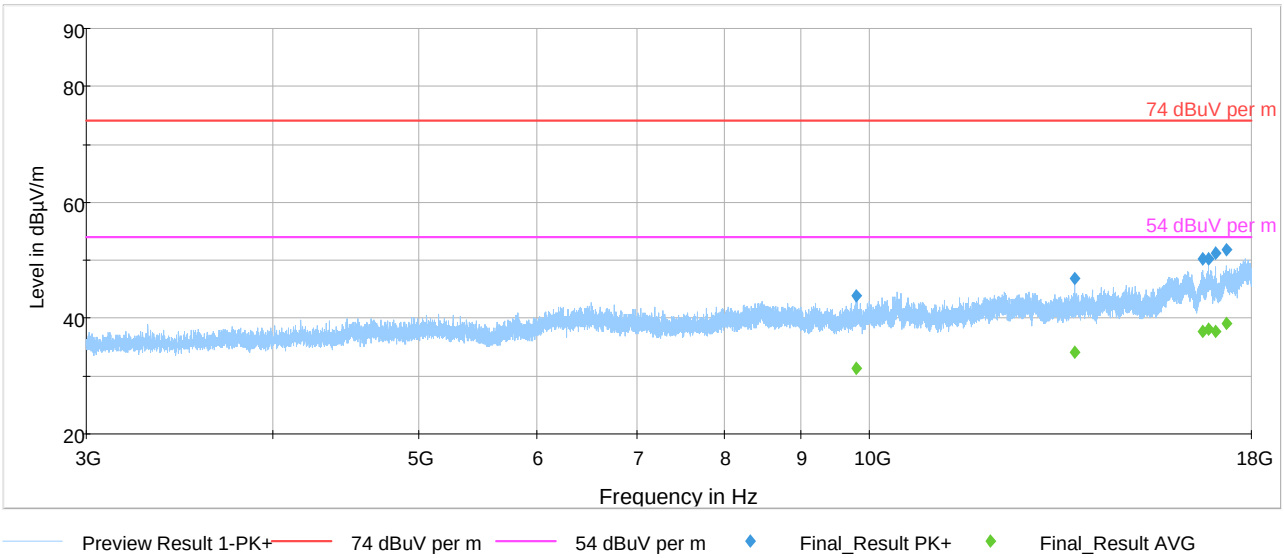
Preview Result 1-PK+
Final_Result PK+
74 dBuV per m
Final_Result AVG
54 dBuV per m

Plot # 37 Radiated Emissions: 3 – 18GHz

NFC 13.56 MHz

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
9811.000	---	31.42	54.00	22.58	500.0	1000.000	252.0	H	29.0	1.6
9811.000	43.86	---	74.00	30.14	500.0	1000.000	252.0	H	29.0	1.6
13713.000	---	34.15	54.00	19.85	500.0	1000.000	300.0	H	89.0	6.1
13713.000	46.79	---	74.00	27.21	500.0	1000.000	300.0	H	89.0	6.1
16696.500	---	37.64	54.00	16.36	500.0	1000.000	300.0	H	13.0	11.3
16696.500	50.26	---	74.00	23.74	500.0	1000.000	300.0	H	13.0	11.3
16847.000	---	38.06	54.00	15.94	500.0	1000.000	166.0	H	41.0	12.2
16847.000	50.26	---	74.00	23.74	500.0	1000.000	166.0	H	41.0	12.2
17042.000	---	37.70	54.00	16.30	500.0	1000.000	180.0	H	54.0	11.4
17042.000	51.19	---	74.00	22.81	500.0	1000.000	180.0	H	54.0	11.4
17323.500	---	39.12	54.00	14.88	500.0	1000.000	300.0	H	101.0	13.0
17323.500	51.77	---	74.00	22.23	500.0	1000.000	300.0	H	101.0	13.0



8 Test setup photos

Setup photos are included in supporting file name: "EMC_VARAS_01_20001_FCC_Setup_Photos_Rev1.pdf"

9 Test Equipment And Ancillaries Used For Testing

Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
PASSIVE LOOP ANTENNA	ETS LINDGREN	6512	49838	3 YEARS	10/28/2017
BICONILOG ANTENNA	EMCO	3142E	166067	3 YEARS	6/27/2017
HORN ANTENNA	ETS.LINDGREN	3115	00035114	3 YEARS	07/31/2017
HORN ANTENNA	ETS.LINDGREN	3117	00245984	3 YEARS	01/26/2018
EMI RECEIVER / ANALYZER	ROHDE&SCHWARZ	ESU 40	100251	3 YEARS	1/31/2018
VWR THERMOMETER	CONTROL COMPANY	36934-164	191871994	2 YEARS	01/10/2019

Note: Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels.
Calibration due dates, unless defined specifically, falls on the last day of the month. Items indicated "N/A" for cal status either do not specifically require calibration or is internally characterized before use.

10 Revision History

Date	Report Name	Changes to report	Report prepared by
6/1/2020	EMC_VARAS_001_20001_FCC_15.225_NFC	Initial Version	Ghanma, Issa
7/13/2020	EMC_VARAS_001_20001_FCC_15.225_NFC_Rev1	• EUT voltage correction, from 3.3 to 5 V DC • Add section 7.2.2	Ghanma, Issa

<<< The End >>>