

FCC / ISED & Test Report

For:

Telular Corporation

Model#:

ST90M

Marketing Name:

ST90 CAT-M

Product Description:

Tank level monitoring

Applied Rules and Standards:

47 CFR Parts 24, 27

RSS: 130 Issue 2, 133 Issue 6, 139 Issue 4

FCC ID: MTFST90M

IC: 2175D-ST90M

REPORT #: EMC_TELUL_222_24001_FCC_24_27

DATE: 2024-05-28



A2LA Accredited

IC recognized # 3462B-1

CETECOM Inc.

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1 Assessment

The following device as further described in section 3 of this report was evaluated against the applicable criteria specified in the Code of Federal Regulations Title 47 parts 24 and 27, and Industry Canada Standards RSS-GEN issue 5, RSS-130 issue 2, RSS-133 issue 6, and RSS-139 issue 4.

No deficiencies were ascertained.

Company Name Product Description		Model #
Telular Corporation	Tank level monitoring	ST90M

Responsible for the Report:

Cheng Song				
	2024-05-28	Compliance	(EMC Engineer)	
_	Date	Section	Name	Signature
	Date	000000	T Gallio	o ignatar o

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.

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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
EMC Engineer:	Cheng Song
Responsible Project Leader:	Sangeetha Sivaraman

2.2 Identification of the Client

Client's Name:	Telular Corporation
Street Address:	3225 Cumberland Blvd.
City/Zip Code	Suite 300, Atlanta, GA 30339
Country	USA

2.3 Identification of the Manufacturer

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

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3 Equipment Under Test (EUT)

3.1 EUT Specifications

Model No:	ST90M			
Brand:	Tank Monitoring			
HW Version :	A			
SW Version :	2.50			
FCC-ID:	MTFST90M			
IC:	2175D-ST90M			
HVIN:	ST90M			
PMN:	ST90 CAT-M			
Product Description:	Tank level monitoring			
Radio Information as declared:	 Frequency of Cellular: Module: Telit LTE Bands: 2 			-M1)
	LTE ISM US FPC Dual			/
	Feed	ISM	LT	Έ
Antenna Information as	Frequency (MHz)	902 - 928	700 - 900	1710 – 2155
declared:		MHz 50%	MHz 52%	MHz
	Average Efficiency Peak Gain	0.5dBi	0.9dBi	59% 3dBi
	VSWR Match	2.0:1 max	4.5:1 max	3.5:1 max
Power Supply/ Rated Operating Voltage Range:	Vmin: 5 VDC/ Vnom: 6	VDC / Vmax: 6.3 VD0	2	
Operating Temperature Range	-30 °C to 70 °C			
Sample Revision	□Production Unit; ■	■Pre-Production		
EUT Dimensions 100 x 107 x 150mm				
Note: Details about the Equipment Under Test (EUT) are provided by the client or applicant.				

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3.2 EUT Sample details

EUT#	Serial Number	HW Version	SW Version	Comments
1	942106500	А	2.50	-

3.3 Accessory Equipment (AE) details

AE#	Туре	Model	Manufacturer	Serial Number
NA	-	-	-	-

3.4 Test Sample Configuration

Set-up#	EUT / AE used for set-up	Comments
1	EUT#1	The radio of the EUT was configured to a fixed channel transmission with highest possible duty cycle using software that is not available to the end user

3.5 Mode of Operation

Mode of Operation	Description of Operating modes	Additional Information
Ор. 1	Cellular & ISM Co-TX	Cellular functionality was evaluated on LTE CAT-M1 Low, Mid, and High Channels at maximum power, operating simultaneously with ISM. The client supplies a USB cable for device communication, enabling command transmission to configure the Cellular and ISM radios into a designated test mode. This configuration, intended solely for worst-case scenario testing, should not be used in end-user applications. The configuration is detailed as follows: Cellular: Use AT commands to establish a connection with the base station simulator (R&S CMW500). ISM: Enable continuous modulated transmission at the highest output power, maximum duty cycle, and a fixed Mid channel.

3.6 Justification for Worst Case Mode of Operation

During the testing process the cellular radio was tested with transmitter sets to low, mid and high channels at the maximum power in simultaneous transmission mode with the highest output power of radios included in the device (ISM), as it is described in section 3.5 of this document; representing the worst case mode of operation.

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.

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4 Subject of Investigation

The objective of the measurements done by CETECOM Inc. was to evaluate the compliance of the EUT against the relevant requirements specified in section 1.

4.1 Dates of Testing:

03/24/2022 - 04/02/2022

4.2 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=2.

Measurement System	EMC 2
Conducted Emissions (mains port)	0.46 dB
Radiated Emissions	
(<30 MHz)	3.88 dB
(30 MHz – 1 GHz)	3.34 dB
(1 GHz – 3 GHz)	4.45 dB
(> 3 GHz)	4.79 dB

4.3 Environmental Conditions during Testing:

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

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

Deviating test conditions are indicated at individual test description where applicable.

4.4 Decision Rule:

Cetecom advanced follows ILAC G8:2019 chapter 4.2.1 (Simple Acceptance Rule).

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3. The measurement uncertainty is mentioned in this test report, See chapter 9, but is not taken into account – neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong.

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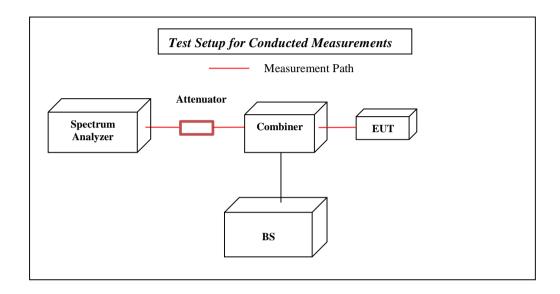
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5 Measurement Procedures

Testing is performed according to the guidelines provided in FCC publication (KDB) 971168 D01 v03r01 – "Measurement Guidance for Certification of Licensed Digital Transmitters" and according to relevant parts of ANSI/TIA-603-D-2010 as detailed below.



5.1 Radiated Measurement

- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions 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.

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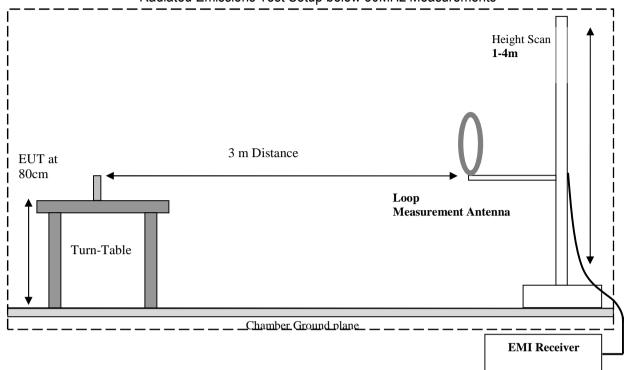
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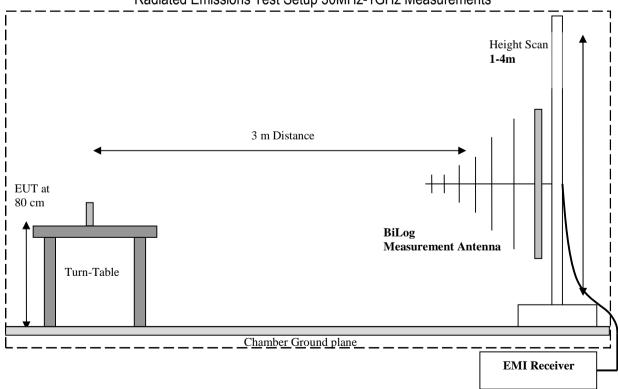
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Radiated Emissions Test Setup below 30MHz Measurements



Radiated Emissions Test Setup 30MHz-1GHz Measurements

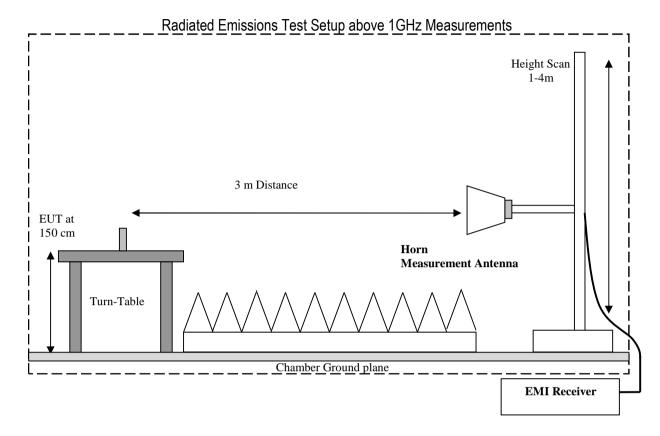


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5.2 Sample Calculations for Field Strength Measurements

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

- Measured reading in dBµV
- Cable Loss between the receiving antenna and SA in dB and
- 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)	• •		Antenna Factor Correction (dB)	Field Strength Result (dBµV/m)
1000	80.5	3.5	14	98.0

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6 Measurement Results Summary

6.1 ISED Leveraged reports

The reports leveraged were generated on 07.08.2019, which is more than one year prior to the evaluation date of the equipment under test (EUT).

Below is the primary difference between the RSS version used in the leveraged reports and the version against which the current equipment under test (EUT) is evaluated.

RSS-139 Issue 4 from Issue 3:

Radio Standards Specification RSS-139, Advanced Wireless Services Equipment Operating in the Bands 1710-1780 MHz and 2110-2200 MHz, issue 4, replaces RSS-139, Advanced Wireless Services (AWS) Equipment Operating in the Bands 1710-1780 MHz and 2110-2180 MHz, issue 3, dated July 16, 2015.

The following are the main changes:

- 1. Added the frequency range 2180-2200 MHz and updated the title accordingly.
- 2. Added definitions to clarify the terms used.
- 3. Removed the requirements related to the mobile equipment identifier and the international mobile equipment identity number as they are no longer required.
- 4. Incorporated some requirements previously contained in Standard Radio System Plan SRSP-513, Technical Requirements for Advanced Wireless Services (AWS) in the Bands 1710-1780 MHz and 2110-2180 MHz, and SRSP-519, Technical Requirements for the Ancillary Terrestrial Component (ATC) of Mobile-Satellite Service (MSS) Systems Operating in the Bands 2000-2020 MHz and 2180-2200 MHz.
- 5. Modernized to reflect the current RSS structure.
- 6. Made editorial changes and clarifications, as appropriate.

The major changes do not affect the manner in which the measurements were conducted or the test results that were leveraged in this report.

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6.2 Part 24 / RSS-133

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Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046; §24.232 (a)	RF Output Power	Nominal	-					Note 1 Note 2
§2.1055; §24.235	Frequency Stability	Extreme Temperature and Voltage	-				•	Note 1 Note 2
§2.1049; §24.238	Occupied Bandwidth	Nominal	-				•	Note 1 Note 2
§2.1051; §24.238	Band Edge Compliance	Nominal	-				•	Note 1 Note 2
§2.1051; §24.238	Conducted Spurious Emissions	Nominal	-					Note 1 Note 2
§2.1053; §24.238(a); RSS-133 Issue 6-6.5.1	Radiated Spurious Emissions	Nominal	Op. 1					Note 3

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Note 1: NA= Not Applicable; NP= Not Performed.

Note 2: The LTE CAT-M test results are leveraged from Report # 50289118 002, corresponding to FCC ID: RI7ME910G1W1, IC: 5131A-ME910G1W1.

Note 3: The testing for LTE Band 2 was performed in accordance with the test specifications outlined in FCC Part 24, and RSS-133.

6.3 Part 27 / RSS-130, RSS-139

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046; §27.50	RF Output Power	Nominal	-					Note 1 Note 2
§2.1055; §27.54	Frequency Stability	Extreme Temperature and Voltage	-					Note 1 Note 2
§2.1049; §27.53	Occupied Bandwidth	Nominal	-					Note 1 Note 2
§2.1051; §27.53	Band Edge Compliance	Nominal	-					Note 1 Note 2
§2.1051; §27.53	Conducted Spurious Emissions	Nominal	-					Note 1 Note 2
§2.1053; §27.539(g), §27.539(h); RSS-130 Issue 2-4.7 RSS-139 Issue 4-5.6	Radiated Spurious Emissions	Nominal	Op. 1					Note 3

Note 1: NA= Not Applicable; NP= Not Performed.

Note 2: The LTE CAT-M test results are leveraged from Report # 50289118 002, corresponding to FCC ID: RI7ME910G1W1, IC: 5131A-ME910G1W1.

Note 3: Testing for LTE Band 4 was conducted according to the test specifications outlined in FCC Part 27 and RSS-139. Testing for LTE Bands 12 and 13 was performed in accordance with the specifications in FCC Part 27 and RSS-130.

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6.4 **Emissions Analysis**

FCC Rule Parts	Frequency Range (MHZ)	Output (Watts)	Frequency Tolerance	Emission Designator
24E	1850.7 - 1909.3	0.138	0.0206 PM	1M12G7D
24E	1850.7 - 1909.3	0.125	0.0168 PM	1M12W7D
27	1710.7 - 1754.3	0.131	0.0299 PM	1M12G7D
27	1710.7 - 1754.3	0.121	0.0291 PM	1M12W7D
27	699.7 - 715.3	0.145	0.0122 PM	1M10G7D
27	699.7 - 715.3	0.132	0.015 PM	1M11W7D
27	779.5 - 784.5	0.138	0.0108 PM	1M10G7D
27	779.5 - 784.5	0.13	0.009 PM	1M10W7D

Note 1: Based on the operational description provided by the client or applicant, only Bands 2, 4, 12, and 13 in CAT M1 mode of the cellular module ME910G1-W1 are utilized during normal operation of the device.

Note 2: The output power of the original module grant aligns with the Total Radiated Power (TRP) measured at CETECOM OTA 4 in Milpitas, as detailed in the table below. For comprehensive measurement results, please refer to the report titled 'Total Radiated Power and Total Isotropic Sensitivity Spherical Pattern Measurement - TELULAR ST90M CTIA REPORT, issued by Cetecom US.

Note 3: The cellular radio of the EUT can still meet the EIRP requirement, based on the conducted output power from the module grant and the antenna information provided by the client or applicant.

LTE Band 2

CTIA Report (RP_LTE-FDD 2 ch18900 4@25 tot)

Test Information

Test Method: Test Condition: EUT Identification: Radio Link:

Radiated Power Mobile Phone FS: Free Space IME: 35861305748236; UE Category: 1 LTE-FDD 2 (Cat. M1); Channel 18900 (1880.360 MHz); UL RBs 4@25. DL RBs 4 (low. NB 0) 0.720 MHz Occupied BW / 10 MHz LTE Channel BW

Start: 3/22/2022 6:45:26 AM: Stop: 3/22/2022 6:53:13 AM In: RF2 COM (25.0 dB), Out: RF1 OUT (20.0 dB) 51.62 dB (NRQ CHB to MA1 PHI, Chamber Cal_MA1 PHI) 51.62 dB (NRQ CHB to MA1 THETA_Link Bypass, Chambe Cal_MA1 THETA) Test Time: CMW500-LTE Connectors:

OTA Evaluation Results

19.60 dBm 23.92 dBm 4.32 dBi 23.92 dBi 17.97 dBm -1.63 dB 68.63 % 16.92 dBm -4.51 dB 35.38 % 15.09 dBm -4.51 dB 37.63 % 17.55 dBm -2.05 dB 62.37 % 17.63 dBm -1.97 dB -1.97 dB -1.97 dB -1.97 dB -1.97 dD -1.97 dD -1.97 dD Total Radiated Power Peak EIRP Total Radiated Powe Peak EIRP Directivity Peak Gain NHPRP 45* / TRP NHPRP 30* / TRP NHPRP 30* / TRP NHPRP 30* / TRP NHPRP 22.5* / TRP NHPRP 22.5* / TRP UHRP / TRP PGRP / TRP Front/Back Ratio PhiBW 207.0 deg 62.6 deg 144.4 deg 92.2 deg 41.5 deg 50.6 deg 300 deg 135 deg 23.92 dBn PhiBW Up PhiBW Down ThetaBW ThetaBW Up ThetaBW Down Boresight Phi Boresight Theta Maximum Power

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7 Test Result Data

7.1 Radiated Spurious Emissions

7.1.1 Measurement utilizing KDB 971168 D01 Power Meas License Digital Systems v03r01, and according to ANSI/TIA-603-D-2010

Spectrum Analyzer Settings for FCC 24, 27

Frequency Range	30MHz – 1 GHz	1 – 2.7 GHz	2.7 – 18 GHz	18 – 19.1 GHz
Resolution Bandwidth	100 kHz	1 MHz	1 MHz	1 MHz
Video Bandwidth	100 kHz	1 MHz	1 MHz	1 MHz
Detector	Peak	Peak	Peak	Peak
Trace Mode	Max Hold	Max Hold	Max Hold	Max Hold
Sweep Time	Auto	Auto	Auto	Auto

7.1.2 Limits:

7.1.2.1 FCC Part 24.238 (a); FCC Part 27.53 (c); FCC Part 27.53 (f); FCC Part 27.53 (g), FCC Part 27.53 (h) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

7.1.2.2 RSS-130 Part 4.7, RSS-133 Part 6.5; RSS-139 Part 5.6 Transmitter Unwanted Emissions Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

i.In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p (watts).

ii.After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

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7.1.3 Test conditions and setup:

Ambient Temperature (C)	EUT Set-Up #	EUT operating mode	Power Input
22	1	Op. 1	Battery

7.1.4 Measurement result:

Date of Report

Plot #	Channel	EUT operating mode	Scan Frequency	Worst Case Spurious Emissions (dBm)	Limit (dBm)	Result
1-3	Low	LTE 2 + ISM	30 MHz – 18 GHz	-24.2	-13	Pass
4-7	Mid	LTE 2 + ISM	30 MHz – 22 GHz	-24.26	-13	Pass
8-10	High	LTE 2 + ISM	30 MHz – 18 GHz	-22.2	-13	Pass
11-13	Low	LTE 4 + ISM	30 MHz – 18 GHz	-20.4	-13	Pass
14-16	Mid	LTE 4 + ISM	30 MHz – 18 GHz	-21.66	-13	Pass
17-19	High	LTE 4 + ISM	30 MHz – 18 GHz	-24.57	-13	Pass
20-22	Low	LTE 12 + ISM	30 MHz – 18 GHz	-37.33	-13	Pass
23-25	Mid	LTE 12 + ISM	30 MHz – 18 GHz	-18.13	-13	Pass
26-28	High	LTE 12 + ISM	30 MHz – 18 GHz	-34.69	-13	Pass
29-31	Mid	LTE 13 + ISM	30 MHz – 18 GHz	-17.54	-13	Pass

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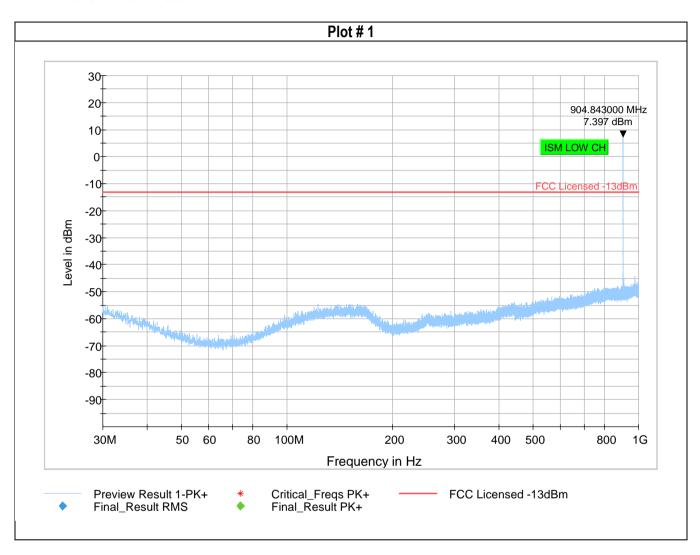
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7.1.5 Measurement Plots:

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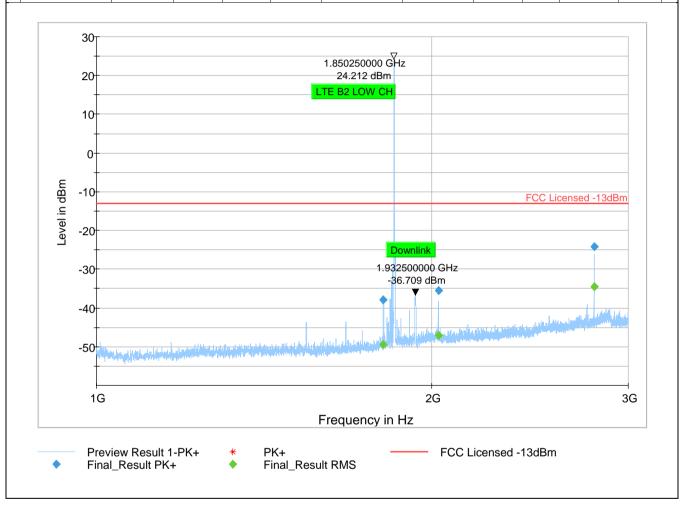
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Plot # 2												
Frequency	MaxPeak	RMS	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.		
(MHz)	(dBm)	(dBm)	(dBm)	(dB)	(ms)	(kHz)	(cm)		(deg)	(dB)		
1809.25	-37.99		-13.00	24.99	500.0	1000.0	100.0	Н	34.0	-64.7		
1809.25		-49.40			500.0	1000.0	100.0	Н	34.0	-64.7		
2027.00	-35.48		-13.00	22.48	500.0	1000.0	142.0	Н	349.0	-63.6		
2027.00		-47.15			500.0	1000.0	142.0	Н	349.0	-63.6		
2796.25	-24.20		-13.00	11.20	500.0	1000.0	151.0	٧	58.0	-61.0		
2796.25		-34.60			500.0	1000.0	151.0	٧	58.0	-61.0		

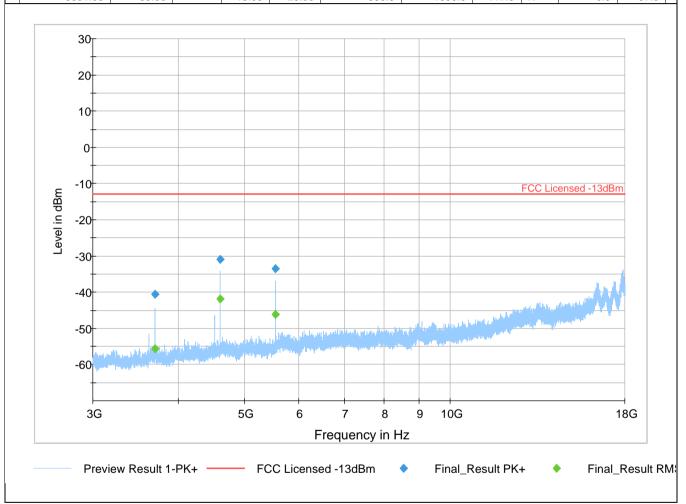


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Plot # 3											
Frequency	MaxPeak	RMS	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.	
(MHz)	(dBm)	(dBm)	(dBm)	(dB)	(ms)	(kHz)	(cm)		(deg)	(dB)	
3701.00		-55.67			500.0	1000.0	167.0	٧	14.0	-100.6	
3701.00	-40.66		-13.00	27.66	500.0	1000.0	167.0	٧	14.0	-100.6	
4605.75		-41.93			500.0	1000.0	142.0	٧	-9.0	-98.6	
4605.75	-30.89		-13.00	17.89	500.0	1000.0	142.0	٧	-9.0	-98.6	
5551.50		-46.16			500.0	1000.0	117.0	Н	-6.0	-97.5	
5551.50	-33.58		-13.00	20.58	500.0	1000.0	117.0	Н	-6.0	-97.5	

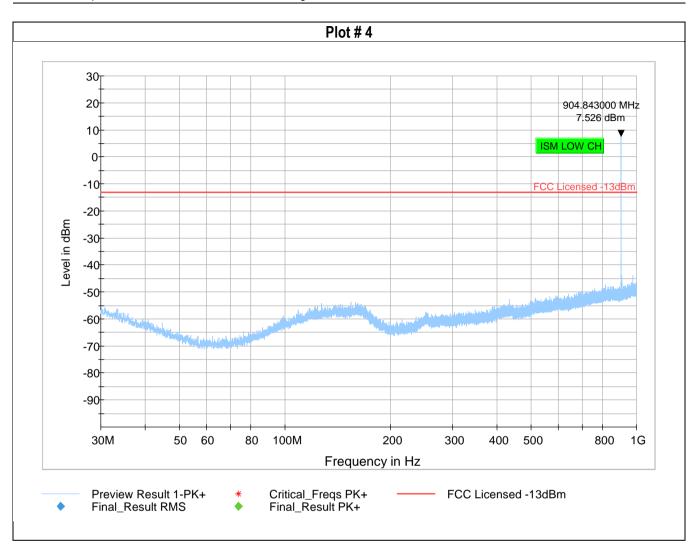


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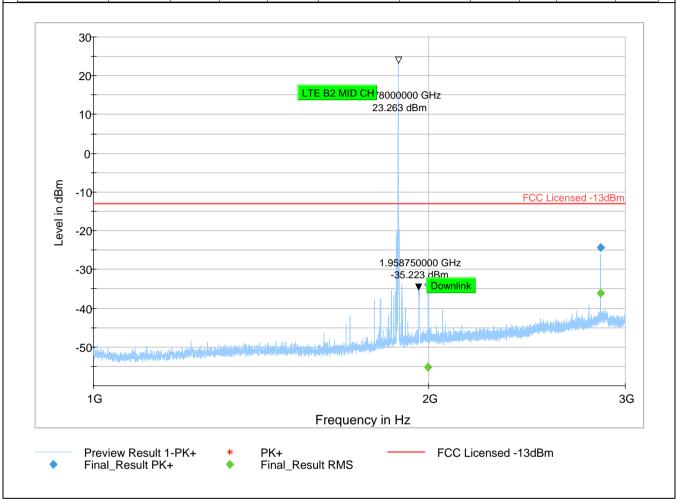


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Plot # 5											
Frequency MaxPeak RMS Limit Margin Meas. Time Bandwidth Height Pol Azimuth Corr.											
(MHz)	(dBm)	(dBm)	(dBm)	(dB)	(ms)	(kHz)	(cm)		(deg)	(dB)	
1997.25	-33.82		-13.00	20.82	500.0	1000.0	127.0	Н	355.0	-63.7	
1997.25		-55.20			500.0	1000.0	127.0	Н	355.0	-63.7	
2851.25	-24.26		-13.00	11.26	500.0	1000.0	168.0	V	52.0	-60.7	
2851.25		-36.09			500.0	1000.0	168.0	٧	52.0	-60.7	



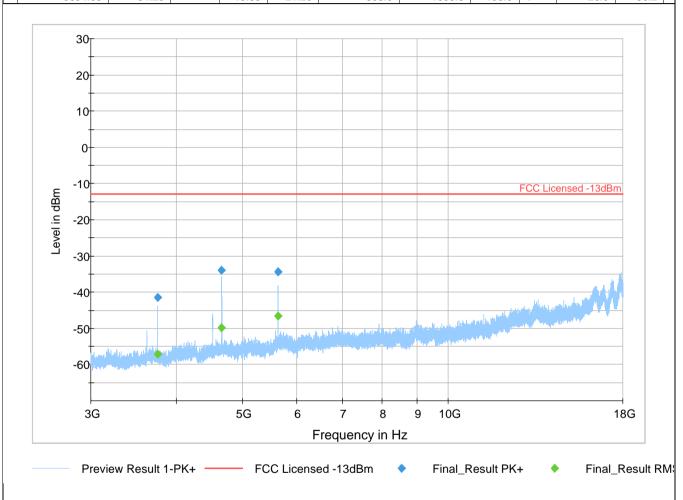
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Plot # 6											
Frequency	MaxPeak	RMS	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.	
(MHz)	(dBm)	(dBm)	(dBm)	(dB)	(ms)	(kHz)	(cm)		(deg)	(dB)	
3755.50		-57.08	-		500.0	1000.0	218.0	٧	5.0	-100.9	
3755.50	-41.52		-13.00	28.52	500.0	1000.0	218.0	٧	5.0	-100.9	
4660.25		-49.81	-		500.0	1000.0	117.0	٧	347.0	-98.3	
4660.25	-33.88		-13.00	20.88	500.0	1000.0	117.0	٧	347.0	-98.3	
5634.00		-46.57	-		500.0	1000.0	186.0	٧	26.0	-96.2	
5634.00	-34.28		-13.00	21.28	500.0	1000.0	186.0	٧	26.0	-96.2	

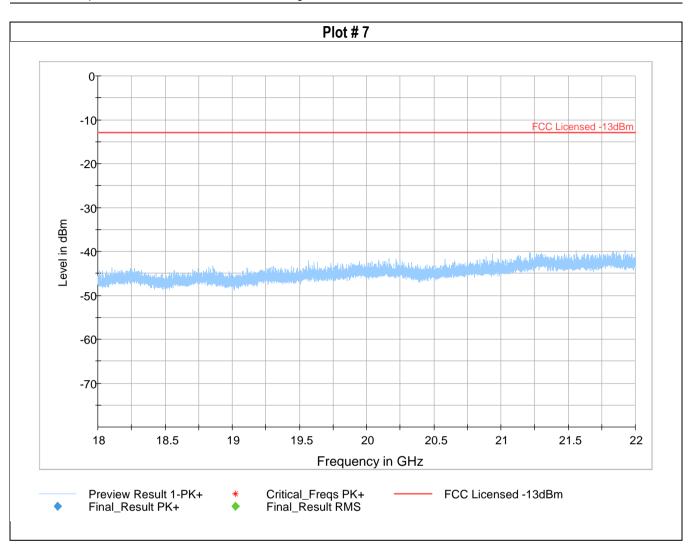


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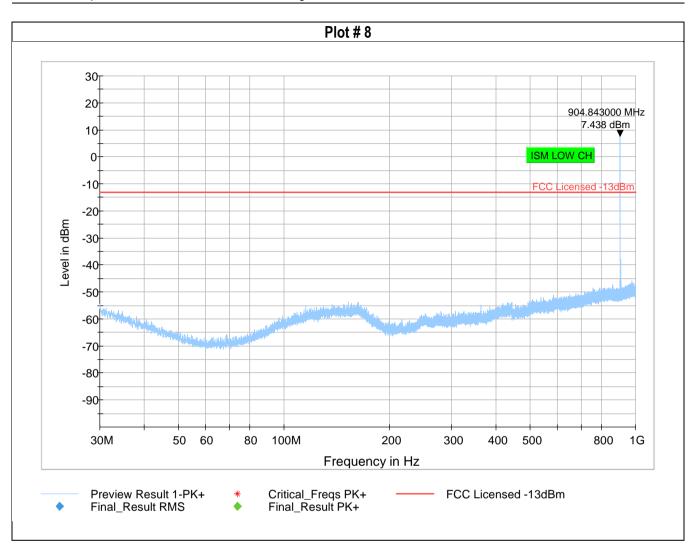


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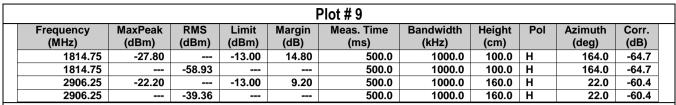


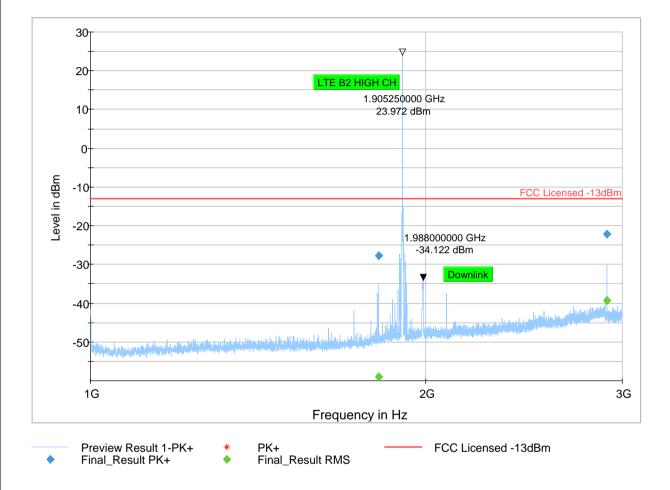
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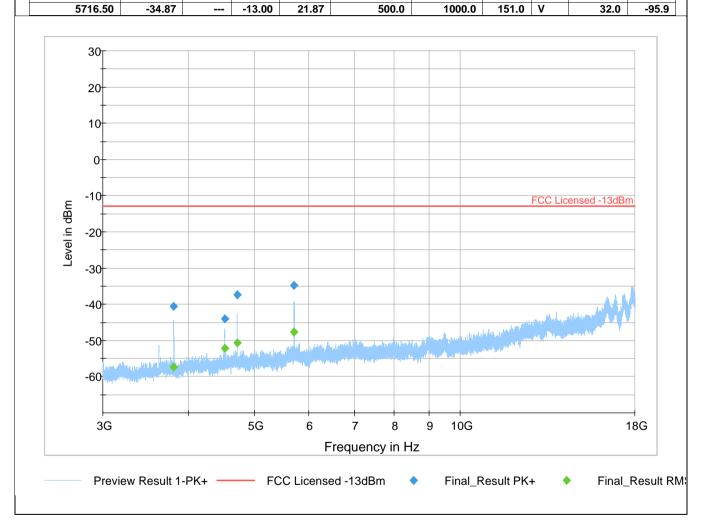


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	Plot # 10												
	Frequency	MaxPeak	RMS	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)	(ms)	(kHz)	(cm)		(deg)	(dB)		
İL	3810.75		-57.28			500.0	1000.0	158.0	V	12.0	-101.5		
	3810.75	-40.69		-13.00	27.69	500.0	1000.0	158.0	٧	12.0	-101.5		
	4523.75		-52.26			500.0	1000.0	151.0	٧	288.0	-99.2		
	4523.75	-44.04		-13.00	31.04	500.0	1000.0	151.0	٧	288.0	-99.2		
	4716.00		-50.64			500.0	1000.0	177.0	V	185.0	-98.1		
	4716.00	-37.29		-13.00	24.29	500.0	1000.0	177.0	٧	185.0	-98.1		
	5716.50		-47.66			500.0	1000.0	151.0	٧	32.0	-95.9		

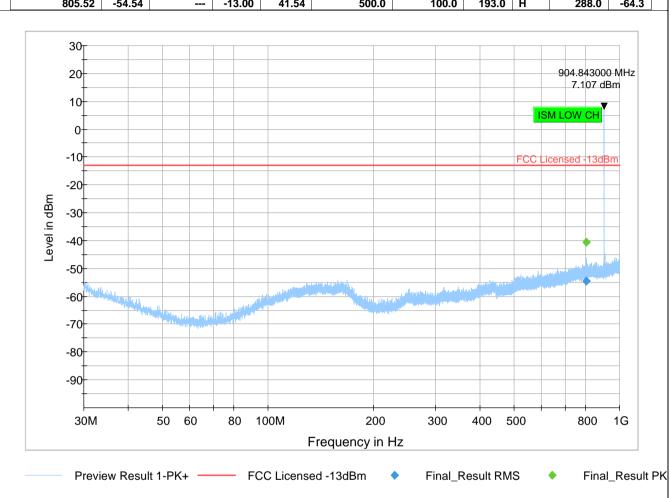


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Plot # 11											
Frequency (MHz)	RMS (dBm)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	
805.52		-40.51			500.0	100.0	193.0	Н	288.0	-64.3	
805.52	-54.54		-13.00	41.54	500.0	100.0	193.0	Н	288.0	-64.3	

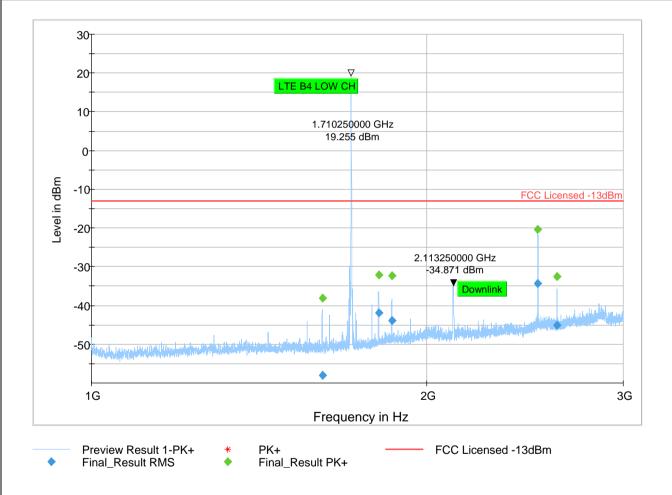


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				Р	lot # 12					
Frequency	RMS	MaxPeak	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.
(MHz)	(dBm)	(dBm)	(dBm)	(dB)	(ms)	(kHz)	(cm)		(deg)	(dB)
1611.25	-57.97		-13.00	44.97	500.0	1000.0	263.0	٧	54.0	-65.7
1611.25	I	-38.05	I		500.0	1000.0	263.0	٧	54.0	-65.7
1809.75	-41.80		-13.00	28.80	500.0	1000.0	125.0	Н	12.0	-64.7
1809.75	1	-32.08	1		500.0	1000.0	125.0	Н	12.0	-64.7
1859.25	-43.84		-13.00	30.84	500.0	1000.0	160.0	Н	23.0	-64.2
1859.25	I	-32.25	I		500.0	1000.0	160.0	Н	23.0	-64.2
2515.50	-34.30		-13.00	21.30	500.0	1000.0	125.0	٧	38.0	-61.7
2515.50	-	-20.40	-		500.0	1000.0	125.0	٧	38.0	-61.7
2615.50	-45.07		-13.00	32.07	500.0	1000.0	186.0	٧	31.0	-61.7
2615.50		-32.52			500.0	1000.0	186.0	٧	31.0	-61.7



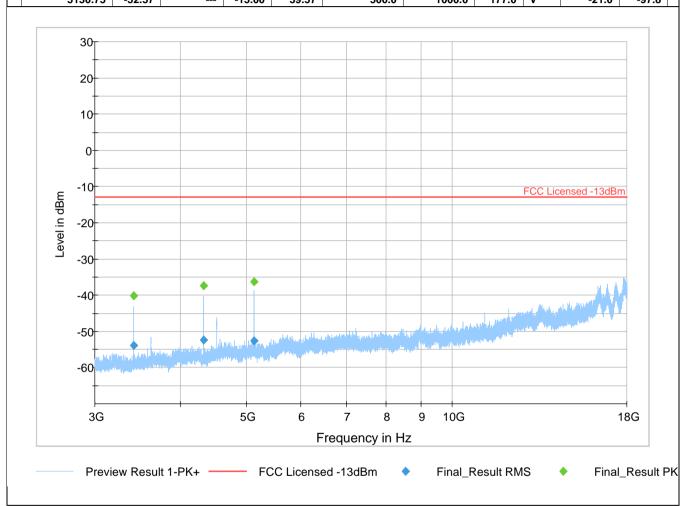
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				P	Plot # 13					
Frequency	RMS	MaxPeak	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.
(MHz)	(dBm)	(dBm)	(dBm)	(dB)	(ms)	(kHz)	(cm)		(deg)	(dB)
3420.50		-40.09			500.0	1000.0	312.0	٧	263.0	-102.4
3420.50	-53.97		-13.00	40.97	500.0	1000.0	312.0	٧	263.0	-102.4
4325.50		-37.30			500.0	1000.0	151.0	٧	-10.0	-99.8
4325.50	-52.34		-13.00	39.34	500.0	1000.0	151.0	٧	-10.0	-99.8
5130.75		-36.39			500.0	1000.0	177.0	٧	-21.0	-97.8
5130.75	-52 57		-13 00	39 57	500.0	1000 0	177 0	V	-21 0	-97.8

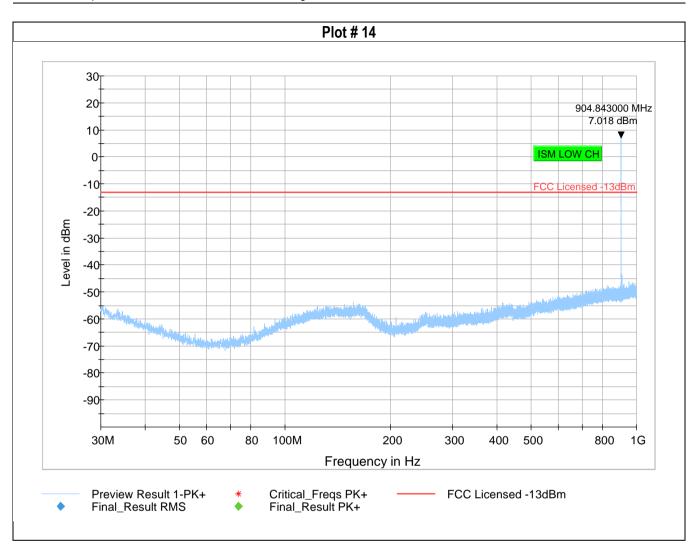


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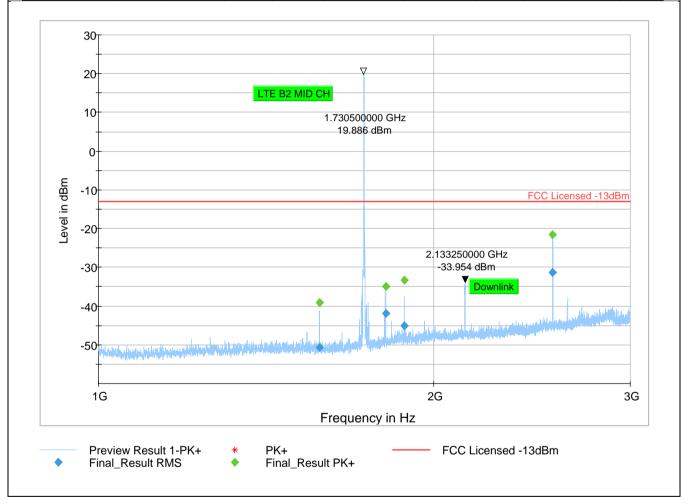
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Plot # 15													
Frequency	RMS	MaxPeak	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.			
(MHz)	(dBm)	(dBm)	(dBm)	(dB)	(ms)	(kHz)	(cm)		(deg)	(dB)			
1580.00	-50.72		-13.00	37.72	500.0	1000.0	237.0	٧	-15.0	-65.8			
1580.00		-39.05			500.0	1000.0	237.0	٧	-15.0	-65.8			
1809.75	-41.93		-13.00	28.93	500.0	1000.0	150.0	Н	344.0	-64.7			
1809.75		-34.82			500.0	1000.0	150.0	Н	344.0	-64.7			
1881.00	-45.08		-13.00	32.08	500.0	1000.0	194.0	Н	-4.0	-64.1			
1881.00		-33.39			500.0	1000.0	194.0	Н	-4.0	-64.1			
2556.00	-31.31		-13.00	18.31	500.0	1000.0	134.0	Н	288.0	-61.7			
2556.00		-21.66			500.0	1000.0	134.0	Н	288.0	-61.7			



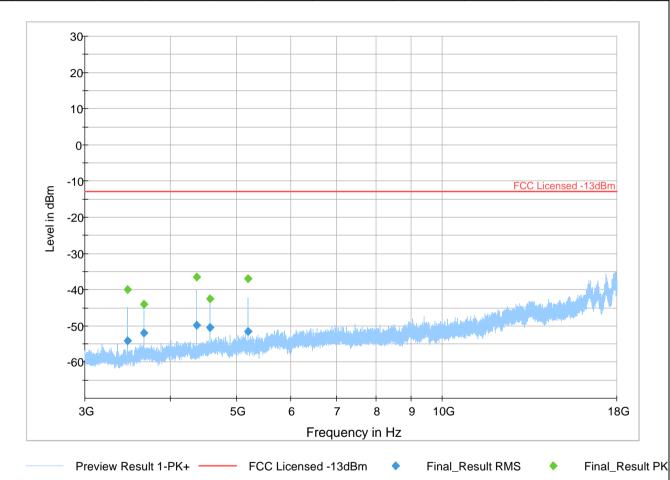
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Plot # 16												
Frequency (MHz)	RMS (dBm)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)		
3460.75		-39.92			500.0	1000.0	294.0	٧	358.0	-102.2		
3460.75	-54.23		-13.00	41.23	500.0	1000.0	294.0	٧	358.0	-102.2		
3660.00	-	-44.10	-		500.0	1000.0	107.0	Н	288.0	-101.0		
3660.00	-52.06		-13.00	39.06	500.0	1000.0	107.0	Н	288.0	-101.0		
4375.75	-	-36.44	-		500.0	1000.0	107.0	٧	342.0	-99.8		
4375.75	-49.84		-13.00	36.84	500.0	1000.0	107.0	٧	342.0	-99.8		
4573.75	-	-42.51	-		500.0	1000.0	168.0	٧	246.0	-98.7		
4573.75	-50.41		-13.00	37.41	500.0	1000.0	168.0	٧	246.0	-98.7		
5191.00	I	-36.86	I		500.0	1000.0	107.0	٧	324.0	-97.8		
5191.00	-51.52		-13.00	38.52	500.0	1000.0	107.0	٧	324.0	-97.8		

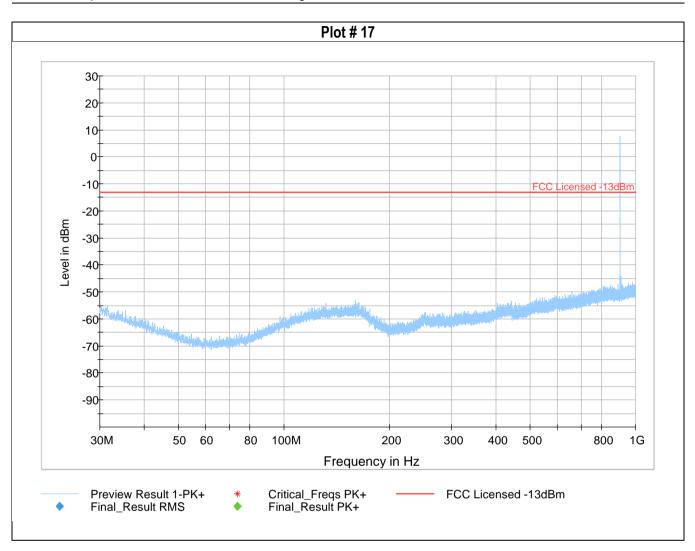


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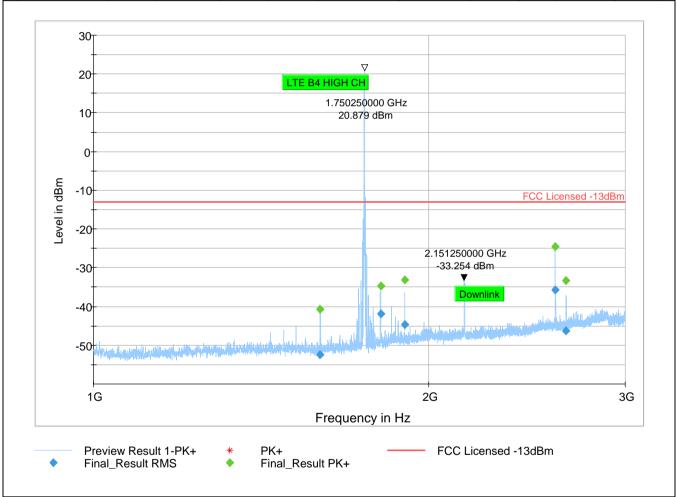
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Plot # 18											
Frequency (MHz)	RMS (dBm)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	
1598.00	-52.49		-13.00	39.49	500.0	1000.0	285.0	٧	-26.0	-65.8	
1598.00	-	-40.61			500.0	1000.0	285.0	٧	-26.0	-65.8	
1809.75	-41.80		-13.00	28.80	500.0	1000.0	150.0	Н	4.0	-64.7	
1809.75		-34.81			500.0	1000.0	150.0	Н	4.0	-64.7	
1902.75	-44.65		-13.00	31.65	500.0	1000.0	159.0	Н	23.0	-64.1	
1902.75		-33.16			500.0	1000.0	159.0	Н	23.0	-64.1	
2596.50	-35.77		-13.00	22.77	500.0	1000.0	142.0	٧	16.0	-61.7	
2596.50	-	-24.57			500.0	1000.0	142.0	٧	16.0	-61.7	
2655.75	-46.22		-13.00	33.22	500.0	1000.0	202.0	٧	30.0	-61.5	
2655.75	-	-33.32			500.0	1000.0	202.0	٧	30.0	-61.5	

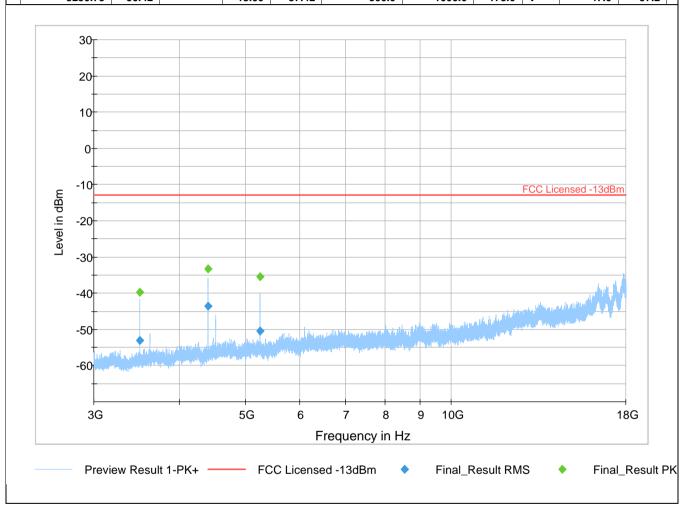


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				P	Plot # 19					
Frequency	RMS	MaxPeak	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.
(MHz)	(dBm)	(dBm)	(dBm)	(dB)	(ms)	(kHz)	(cm)		(deg)	(dB)
3500.75		-39.84			500.0	1000.0	116.0	٧	52.0	-102.2
3500.75	-52.95		-13.00	39.95	500.0	1000.0	116.0	٧	52.0	-102.2
4406.00		-33.31			500.0	1000.0	325.0	٧	-4.0	-99.6
4406.00	-43.66		-13.00	30.66	500.0	1000.0	325.0	٧	-4.0	-99.6
5250.75		-35.41			500.0	1000.0	173.0	٧	47.0	-97.2
5250.75	-50.42		-13.00	37.42	500.0	1000.0	173.0	٧	47.0	-97.2

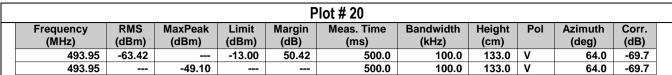


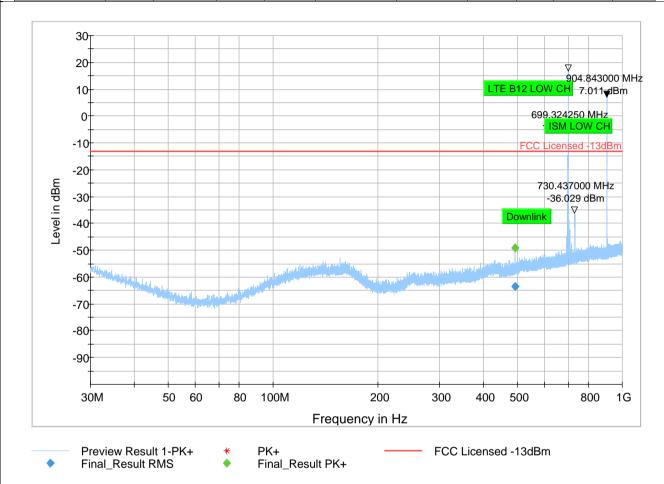
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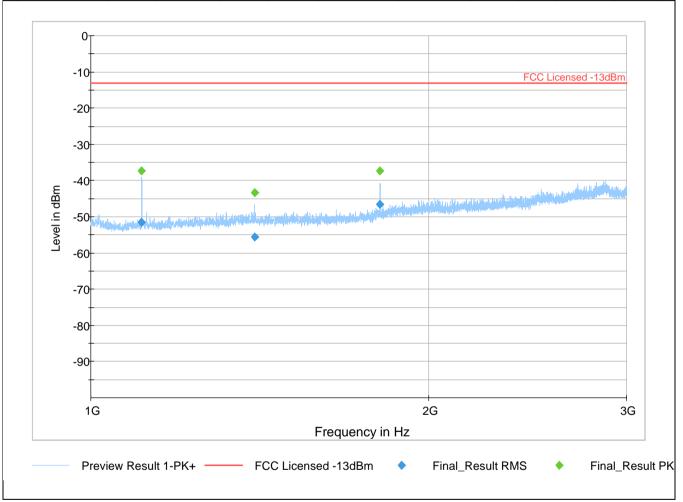
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Plot # 21													
Frequency	RMS	MaxPeak	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.			
(MHz)	(dBm)	(dBm)	(dBm)	(dB)	(ms)	(kHz)	(cm)		(deg)	(dB)			
1109.75	I	-37.33			500.0	1000.0	255.0	V	34.0	-67.4			
1109.75	-51.54		-13.00	38.54	500.0	1000.0	255.0	V	34.0	-67.4			
1398.75		-43.26			500.0	1000.0	286.0	Н	196.0	-66.4			
1398.75	-55.67		-13.00	42.67	500.0	1000.0	286.0	Н	196.0	-66.4			
1809.50		-37.33			500.0	1000.0	175.0	Н	29.0	-64.7			
1809.50	-46.50		-13.00	33.51	500.0	1000.0	175.0	Н	29.0	-64.7			

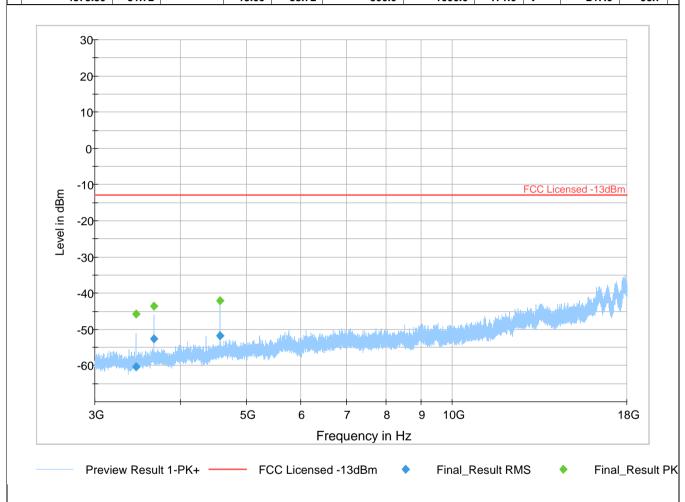


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	Plot # 22									
Frequency	RMS	MaxPeak	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.
(MHz)	(dBm)	(dBm)	(dBm)	(dB)	(ms)	(kHz)	(cm)		(deg)	(dB)
3443.75		-45.68	-		500.0	1000.0	268.0	٧	271.0	-102.2
3443.75	-60.24		-13.00	47.24	500.0	1000.0	268.0	٧	271.0	-102.2
3658.75		-43.70			500.0	1000.0	151.0	Н	290.0	-101.0
3658.75	-52.57		-13.00	39.57	500.0	1000.0	151.0	Н	290.0	-101.0
4573.50		-42.15	-		500.0	1000.0	171.0	٧	247.0	-98.7
4573.50	-51.72		-13.00	38.72	500.0	1000.0	171.0	٧	247.0	-98.7

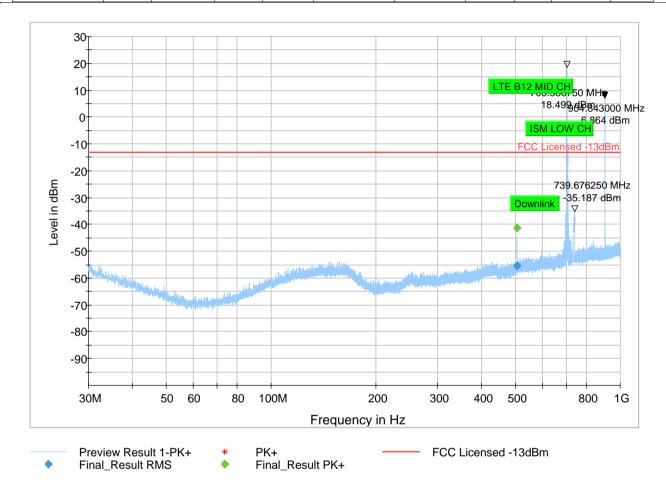


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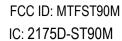
	Plot # 23											
	Frequency (MHz)	RMS (dBm)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	
	505.88	-55.42		-13.00	42.42	500.0	100.0	100.0	٧	-27.0	-69.2	
ı	505.88		-41.38			500.0	100.0	100.0	٧	-27.0	-69.2	



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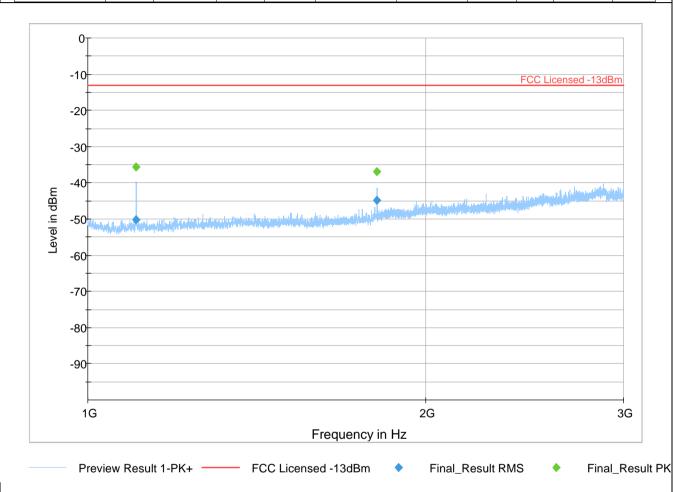
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	Plot # 24										
	Frequency	RMS	MaxPeak	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)	(ms)	(kHz)	(cm)		(deg)	(dB)
	1103.75		-35.69	-		500.0	1000.0	126.0	٧	-38.0	-67.5
	1103.75	-50.19	-	-13.00	37.20	500.0	1000.0	126.0	٧	-38.0	-67.5
	1809.50		-36.82			500.0	1000.0	165.0	٧	225.0	-64.7
l	1809.50	-44.87		-13.00	31.87	500.0	1000.0	165.0	٧	225.0	-64.7

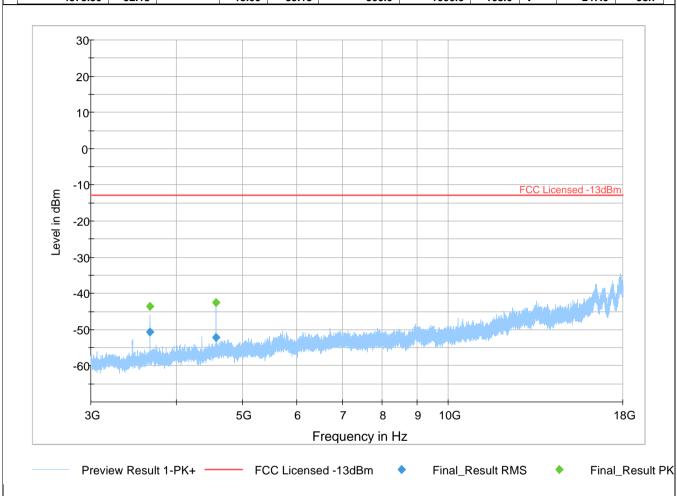


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Plot # 25										
Frequency	RMS	MaxPeak	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.
(MHz)	(dBm)	(dBm)	(dBm)	(dB)	(ms)	(kHz)	(cm)		(deg)	(dB)
3660.50		-43.50			500.0	1000.0	100.0	Н	235.0	-101.0
3660.50	-50.70		-13.00	37.70	500.0	1000.0	100.0	Н	235.0	-101.0
4573.50		-42.50			500.0	1000.0	168.0	٧	247.0	-98.7
4573.50	-52.13		-13.00	39.13	500.0	1000.0	168.0	٧	247.0	-98.7

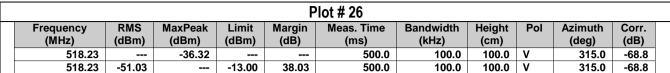


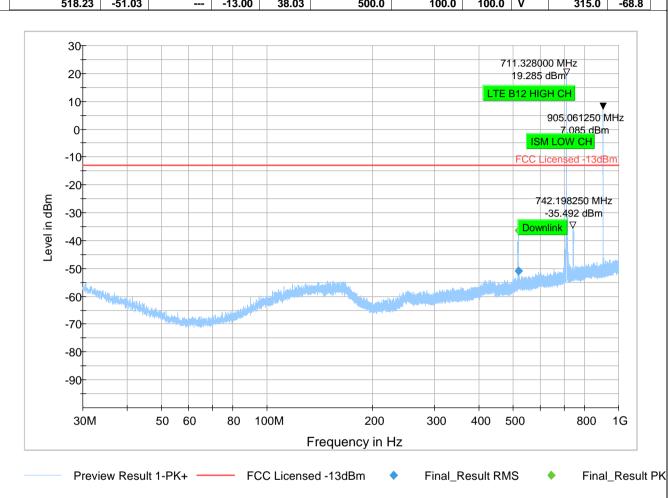
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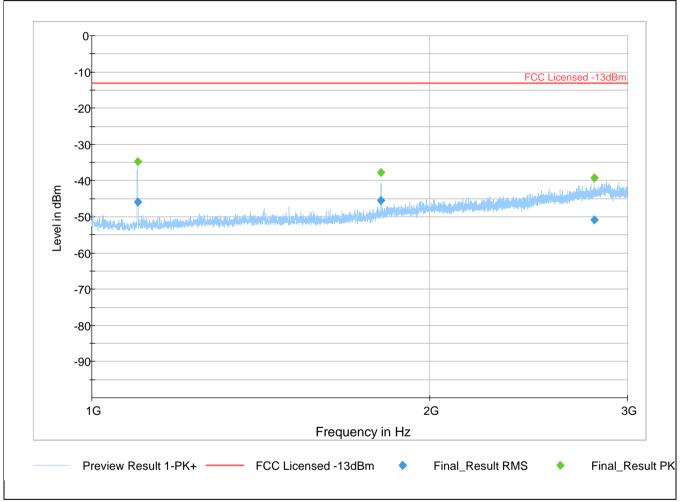
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Plot # 27										
Frequency	RMS	MaxPeak	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.
(MHz)	(dBm)	(dBm)	(dBm)	(dB)	(ms)	(kHz)	(cm)		(deg)	(dB)
1098.50	-	-34.69	-		500.0	1000.0	186.0	٧	16.0	-67.5
1098.50	-45.91		-13.00	32.91	500.0	1000.0	186.0	٧	16.0	-67.5
1809.50	-	-37.81	-		500.0	1000.0	134.0	٧	354.0	-64.7
1809.50	-45.43		-13.00	32.43	500.0	1000.0	134.0	٧	354.0	-64.7
2802.50	-	-39.19	-		500.0	1000.0	325.0	Н	88.0	-60.9
2802.50	-50.95		-13.00	37.95	500.0	1000.0	325.0	Н	88.0	-60.9

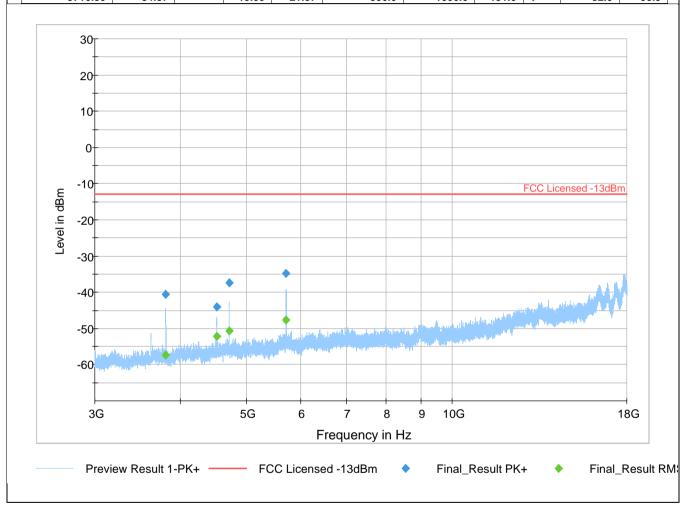


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Plot # 28										
Frequency	MaxPeak	RMS	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.
(MHz)	(dBm)	(dBm)	(dBm)	(dB)	(ms)	(kHz)	(cm)		(deg)	(dB)
3810.75		-57.28			500.0	1000.0	158.0	٧	12.0	-101.5
3810.75	-40.69		-13.00	27.69	500.0	1000.0	158.0	٧	12.0	-101.5
4523.75		-52.26			500.0	1000.0	151.0	٧	288.0	-99.2
4523.75	-44.04		-13.00	31.04	500.0	1000.0	151.0	٧	288.0	-99.2
4716.00		-50.64			500.0	1000.0	177.0	٧	185.0	-98.1
4716.00	-37.29		-13.00	24.29	500.0	1000.0	177.0	٧	185.0	-98.1
5716.50		-47.66			500.0	1000.0	151.0	٧	32.0	-95.9
5716.50	-34.87		-13.00	21.87	500.0	1000.0	151.0	٧	32.0	-95.9

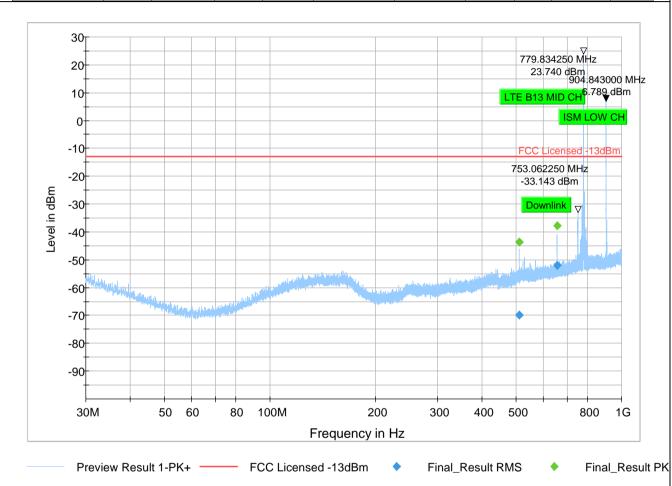


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Plot # 29										
Frequency	RMS	MaxPeak	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.
(MHz)	(dBm)	(dBm)	(dBm)	(dB)	(ms)	(kHz)	(cm)		(deg)	(dB)
511.10	I	-43.56	I		500.0	100.0	100.0	V	219.0	-68.9
511.10	-69.73		-13.00	56.73	500.0	100.0	100.0	V	219.0	-68.9
655.19		-37.79			500.0	100.0	107.0	Н	260.0	-68.0
655.19	-52.14		-13.00	39.14	500.0	100.0	107.0	Н	260.0	-68.0

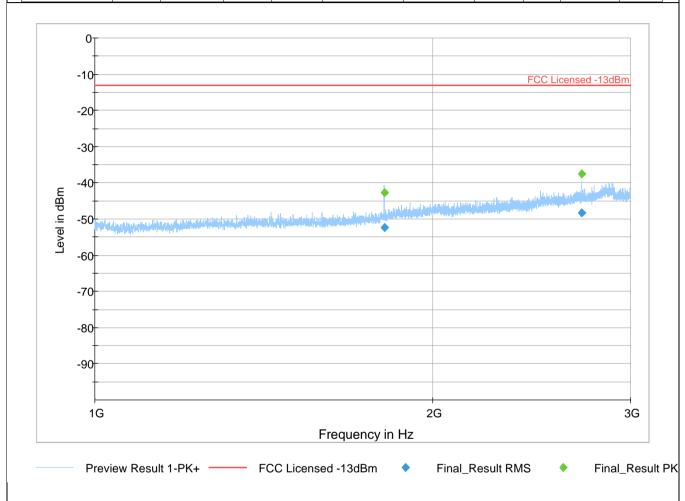


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	Plot # 30											
	Frequency	RMS	MaxPeak	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.	
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)	(ms)	(kHz)	(cm)		(deg)	(dB)	
	1810.00		-42.79			500.0	1000.0	236.0	Н	-30.0	-64.7	
	1810.00	-52.47		-13.00	39.47	500.0	1000.0	236.0	Н	-30.0	-64.7	
	2714.25		-37.46			500.0	1000.0	277.0	Н	84.0	-61.3	
1	2714.25	-48.21		-13.00	35.21	500.0	1000.0	277.0	Н	84.0	-61.3	



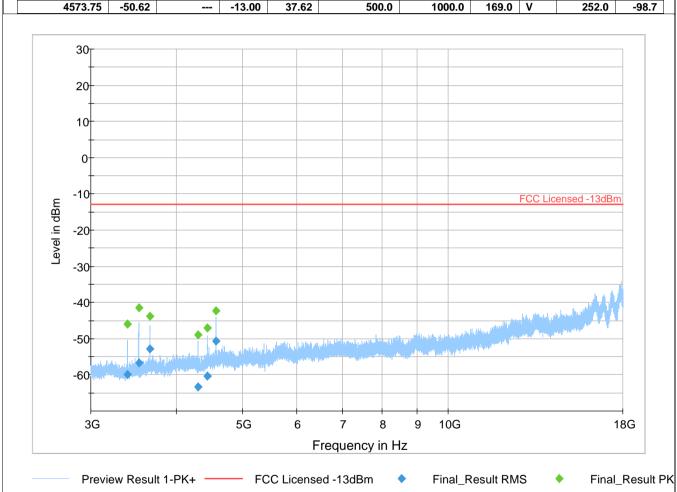
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Plot # 31										
Frequency (MHz)	RMS (dBm)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3389.75		-46.02			500.0	1000.0	210.0	Н	297.0	-102.9
3389.75	-59.97		-13.00	46.97	500.0	1000.0	210.0	Н	297.0	-102.9
3524.00		-41.43			500.0	1000.0	273.0	٧	282.0	-102.2
3524.00	-56.60		-13.00	43.60	500.0	1000.0	273.0	٧	282.0	-102.2
3658.75		-43.80			500.0	1000.0	143.0	Н	299.0	-101.0
3658.75	-52.80		-13.00	39.80	500.0	1000.0	143.0	Н	299.0	-101.0
4304.00		-48.91			500.0	1000.0	221.0	٧	253.0	-99.7
4304.00	-63.39		-13.00	50.39	500.0	1000.0	221.0	٧	253.0	-99.7
4440.00		-47.04			500.0	1000.0	107.0	٧	291.0	-99.1
4440.00	-60.30		-13.00	47.30	500.0	1000.0	107.0	٧	291.0	-99.1
4573.75		-42.28			500.0	1000.0	169.0	٧	252.0	-98.7
4570.75	F0 00		40.00	07.00	F00.0	4000.0	400.0	1/	050.0	^^.



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8 Test setup photos

Setup photos are included in supporting file name: "EMC_TELUL_222_24001_FCC_Setup_Photos"

9 Test Equipment And Ancillaries Used For Testing

Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
ACTIVE LOOP ANTENNA	ETS LINDGREN	6507	00161344	3 YEARS	10/30/2020
BILOG ANTENNA	ETS.LINDGREN	3142E	00166067	3 YEARS	03/12/2020
HORN ANTENNA	EMCO	3115	00035114	3 YEARS	08/10/2020
HORN ANTENNA	ETS.LINDGREN	3117	00215984	3 YEARS	01/31/2021
HORN ANTENNA	ETS.LINDGREN	3116	00070497	3 YEARS	11/23/2020
TEST RECEIVER	R&S	ESU40	100251	3 YEARS	09/13/2021
WIDEBAND COMM. TESTER	R&S	CMW 500	109825	3 YEARS	09/23/2020
COMPACT DIGITAL BAROMETER	CONTROL COMPANY	10510-922	200236891	3 YEARS	04/13/2020
DIGITAL THRMOMETER	CONTROL COMPANY	36934-164	181230565	3 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.

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10 Revision History

Date	Report Name	Changes to report	Prepared by
2024-05-28	EMC TELUL 222 24001 FCC 24 27	Initial Version	Cheng Song

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