



FCC Test Report

FOR:

**Model Name: Edge Control Node 7000 Series
Utility Control Network Device**

FCC ID: IZP70101-0002

47 CFR Part 2, 22, 24

**TEST REPORT #: EMC_ECHEL_002_10001_FCC22_24_Rev1
DATE: 2010-12-09**



FCC listed:
A2LA Accredited

IC recognized #
3462B-1

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1 Assessment

The following device was tested against the applicable criteria specified in FCC rules Parts 2, 22 and 24 of Title 47 of the Code of Federal Regulations and no deviations were ascertained during the course of the tests performed.

Company	Description	Model #
Echelon Corporation	Utility Control Network Device	Edge Control Node 700 Series 701010-XXXX

Responsible for Testing Laboratory:

2010-12-09	Compliance	Heiko Strehlow (Director)	
Date	Section	Name	Signature

Responsible for the Report:

2010-12-09	Compliance	Sajay Jose (EMC Engineer)	
Date	Section	Name	Signature

The test results of this test report relate exclusively to the test item specified in Section 3. 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
Address:	411 Dixon Landing Road Milpitas, CA 95035 U.S.A.
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Test Lab Director:	Heiko Strehlow
Responsible Project Leader:	Marc Douat

2.2 Identification of the Client

Applicant's Name:	Echelon Corporation
Street Address:	550 Meridian Ave.
City/Zip Code	San Jose, CA 95126
Country	USA
Contact Person:	Yaqoob Bhimla
Phone No.	408-938-5353
e-mail:	ybhimla@echelon.com

2.3 Identification of the Manufacturer

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

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name:	Edge Control Node 7000 Series
Model No:	70101-XXXX
Product Type/Description:	Utility Control Network Device/ 7000 Series provides an open, secure, and extensible hardware platform ruggedized and purpose-built for the smart grid. To support AMR and AMI system integration, the ECN was designed from the ground up to support wireless transceivers and antennas commonly used in these systems
Hardware Revision :	FTU1
Software Revision :	FTU1
Module Information:	Module: Sierra MC5728V HW Ver: 1.0 SW Ver: p2811301 FCC ID: N7N-MC5728
FCC-ID:	IZP70101-0002
Frequency:	Cellular US CDMA: 824.70-848.31 MHz PCS CDMA: 1851.25- 1908.75 MHz
Modes of operation:	1xRTT, EV-DO Rev0, EV-DO Rev A
Output Power Summary (Max):	Cellular Band: EV-DO Rev A- Conducted: 29.82 dBm PCS Band: EV-DO Rev A- Conducted: 29.1 dBm Cellular Band: EV-DO Rev A- Radiated ERP: 30.7 dBm PCS Band: EV-DO Rev A- Radiated EIRP: 31.45 dBm
Antenna Type:	Ceramic Patch Antenna
Power Supply:	Switching
Voltage:	Single Phase 3-wire 120/240 -/+20%, 60Hz -/+2%, 50Watts
Temperature Range:	-40 degree C to +70 degree C
EUT Condition:	Prototype

3.2 Identification of the Equipment Under Test (EUT)

EUT #	Serial Number	HW Version	SW Version	Notes
1	001	FTU1	FTU1	Prototype sample

3.3 Identification of Accessory equipment

AE #	Type	Manufacturer	Model	Serial Number	Notes
1	Laptop	Lenovo	T510	R8-333TF 10/03	OS: Linux Establish communication over ethernet.
2	Isolation Transformer	Echelon	VPS230- 760	N/A	N/A
3	Ethernet Cable	N/A	N/A	N/A	Includes Ferrite cores at laptop end 1.Lard 28A0807-0A2 2.WE 742-727-33 3.Lard 28A5776-0A2
4	Shielded Enclosure	Ramsey	STE3600	1233	To isolate laptop emissions.

4 Subject of Investigation

The objective of the measurements done by Cetecom Inc. was to measure the performance of the EUT as specified by requirements listed in the following test standards:

- 47 CFR Part 2: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission Frequency allocations and radio treaty matters; general rules and regulations.
- 47 CFR Part 22: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission subchapter B- common carrier services; Part 22- Public mobile services
- 47 CFR Part 24: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission subchapter B- common carrier services; Part 24- Personal communication services

This test report is to support a request for new equipment authorization under the FCC ID **IZP70101-0002**.

All testing was performed on the product referred to in Section 3 as EUT.

The PLC A-Band transceiver installed in the Unit Under Test (UUT) is transmitting a modulated carrier at 86KHz on the Power Lines (Mains).

The laptop connected to the UUT via Ethernet was used to perform 2 functions:

- 1) generate Ethernet traffic: ping flood
- 2) generate PLC traffic: "dcxtestlon" command (similar to ping flood but for PLC)

So Ethernet and PLC were both transmitting during the tests.

5 Summary of Measurement Results

850 Band:

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046 §22.913 (a)	RF Output Power	Nominal	CDMA 850	☐	☐	☐	■	-
			EVDO 850	■	☐	☐	☐	Complies
§2.1055 §22.355	Frequency Stability	Nominal	CDMA 850	☐	☐	☐	■	-
			EVDO 850	☐	☐	☐	■	-
§2.1049 §22.917(b)	Occupied Bandwidth	Nominal	CDMA 850	☐	☐	☐	■	-
			EVDO 850	☐	☐	☐	■	-
§2.1051 §22.917	Band Edge Compliance	Nominal	CDMA 850	☐	☐	☐	■	-
			EVDO 850	☐	☐	☐	■	-
§2.1051 §22.917	Conducted Spurious Emissions	Nominal	CDMA 850	☐	☐	☐	■	-
			EVDO 850	☐	☐	☐	■	-
§2.1053 §22.917	Radiated Spurious Emissions	Nominal	CDMA 850	☐	☐	☐	■	-
			EVDO 850	■	☐	☐	☐	Complies
§15.107 §15.207	Line Conducted Emissions	Nominal	CDMA 850	☐	☐	☐	■	-
			EVDO 850	■	☐	☐	☐	Complies
§2.1053 §15.109	Receiver Emissions-Radiated	Nominal	RX Mode	■	☐	☐	☐	Complies

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

1. All radiated measurements performed only in EVDO mode since it was determined that this was the highest power configuration.
2. Conducted measurement data for Frequency Stability, Occupied Bandwidth, BandEdge compliance and Conducted spurious emissions are leveraged from Module (FCC ID: N7N-MC5728) test report # 08U12326-1 Rev B issued by CCS Lab on Feb 23, 2009.

1900 Band:

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046 §24.232 (a)	RF Output Power	Nominal	CDMA 1900	☐	☐	☐	☒	-
			EVDO 1900	☒	☐	☐	☐	Complies
§2.1055 §24.235	Frequency Stability	Nominal	CDMA 1900	☐	☐	☐	☒	-
			EVDO 1900	☐	☐	☐	☒	-
§2.1049 §24.238(b)	Occupied Bandwidth	Nominal	CDMA 1900	☐	☐	☐	☒	-
			EVDO 1900	☐	☐	☐	☒	-
§2.1051 §24.238	Band Edge Compliance	Nominal	CDMA 1900	☐	☐	☐	☒	-
			EVDO 1900	☐	☐	☐	☒	-
§2.1051 §24.238	Conducted Spurious Emissions	Nominal	CDMA 1900	☐	☐	☐	☒	-
			EVDO 1900	☐	☐	☐	☒	-
§2.1053 §24.238	Radiated Spurious Emissions	Nominal	CDMA 1900	☐	☐	☐	☒	-
			EVDO 1900	☒	☐	☐	☐	Complies
§15.107 §15.207	Line conducted Emissions	Nominal	CDMA 1900	☐	☐	☐	☒	-
			EVDO 1900	☒	☐	☐	☐	Complies
§2.1053 §15.109	Receiver Emissions-Radiated	Nominal	RX Mode	☒	☐	☐	☐	Complies

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

1. All radiated measurements performed only in EVDO mode since it was determined that this was the highest power configuration.
2. Conducted measurement data for Frequency Stability, Occupied Bandwidth, BandEdge compliance and Conducted spurious emissions are leveraged from Module (FCC ID: N7N-MC5728) test report # 08U12326-1 Rev B issued by CCS Lab on Feb 23, 2009.

6 Measurements

6.1 RF Power Output

6.1.1 References

FCC: CFR Part 2.1046, CFR Part 22.913, CFR Part 24.232

6.1.2 Measurement requirements:

6.1.2.1 FCC 2.1046: RF power output.

Power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on circuit elements as specified. The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

6.1.3 Limits:

6.1.3.1 FCC 22.913 (a) Effective radiated power limits.

The effective radiated power (ERP) of mobile transmitters must not exceed 7 Watts.

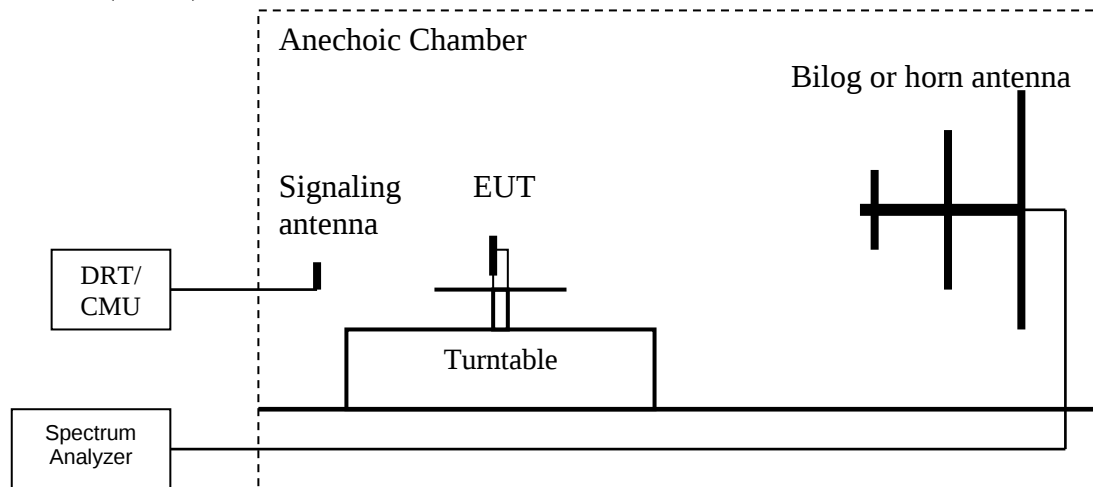
6.1.3.2 FCC 24.232 (b)(c) Power limits.

(b) Mobile/portable stations are limited to 2 Watts effective isotropic radiated power (EIRP).

(c) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms equivalent voltage. The measurement results shall be properly adjusted for any limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement over the full bandwidth of the channel.

6.1.4 Radiated Output Power Measurement procedure

Ref: TIA-603C 2004 -2.2.17.2 Effective Radiated Power (ERP) or Effective Isotropic Radiated Power (EIRP)



1. Connect the equipment as shown in the above diagram with the EUT's antenna in center of the turn table.
2. Adjust the settings of the Digital Radio Communication Tester (DRT) to set the EUT to its maximum power at the required channel.
3. Set the spectrum analyzer to the channel frequency. Set the analyzer to measure peak hold with the required settings.
4. Rotate the EUT 360°. Record the peak level in dBm (**LVL**).
5. Replace the EUT with a vertically polarized half wave dipole or known gain antenna. The center of the antenna should be at the same location as the center of the EUT's antenna.
6. Connect the antenna to a signal generator with known output power and record the path loss in dB (**LOSS**). **LOSS** = Generator Output Power (dBm) – Analyzer reading (dBm).
7. Determine the ERP using the following equation:
ERP (dBm) = LVL (dBm) + LOSS (dB)
8. Determine the EIRP using the following equation:
EIRP (dBm) = ERP (dBm) + 2.14 (dB)
9. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.

Spectrum analyzer settings: RBW=VBW=5MHz

(**Note:** Steps 5 and 6 above are performed prior to testing and **LOSS** is recorded by test software. Steps 3, 4, 7 and 8 above are performed with test software.)

6.1.5 RF Power Output 850MHz band**Limit: FCC: Nominal Peak Output Power < 38.45 dBm (7W)****Measurement Uncertainty (Radiated): ±3.0 dB**

Frequency (MHz)	Radiated Power- ERP (dBm) 1x EV-DO Rev A
824.70	30.76
836.52	29.52
848.31	29.70

6.1.5.1 Measurement Result

Pass.

6.1.6 RF Power Output 1900MHz band**Limit: Nominal Peak Output Power < 33 dBm (2W)****PAR many not exceed 13dB****Measurement Uncertainty (Radiated): ±3.0 dB**

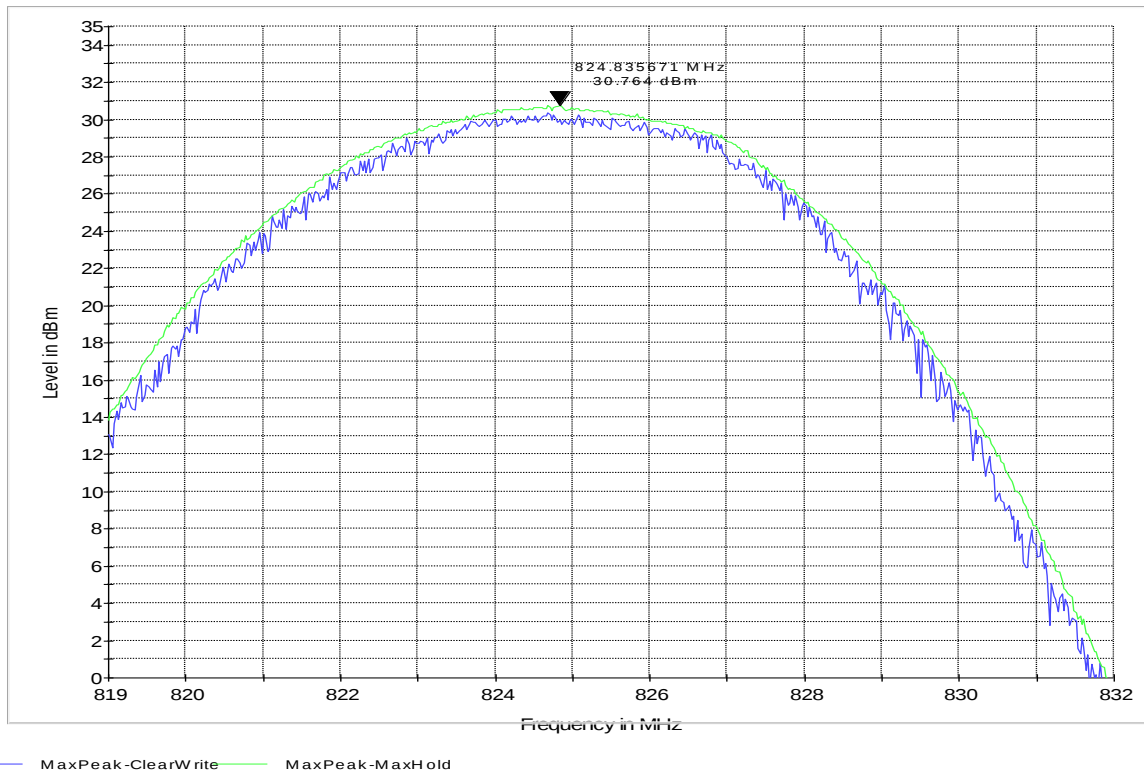
Frequency (MHz)	Radiated Power- EIRP (dBm) 1x EV-DO Rev A
1851.21	31.45
1880.0	30.02
1908.75	31.41

6.1.6.1 Measurement Result

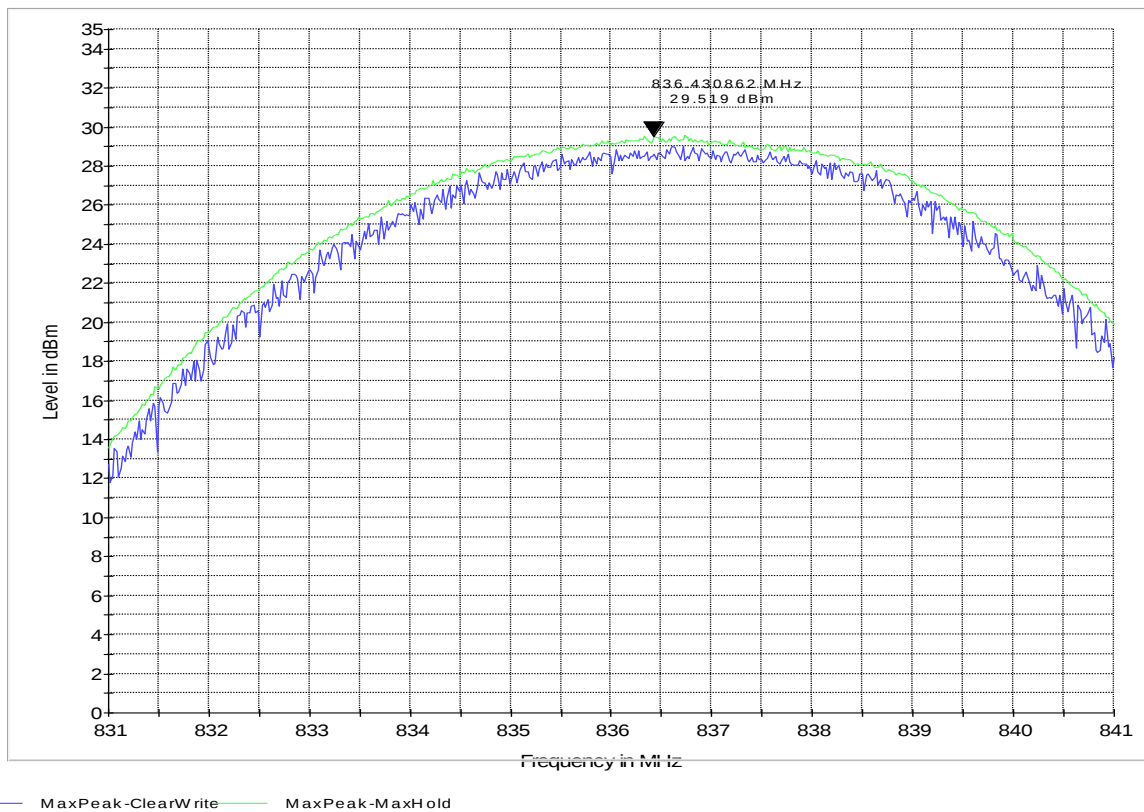
Pass.

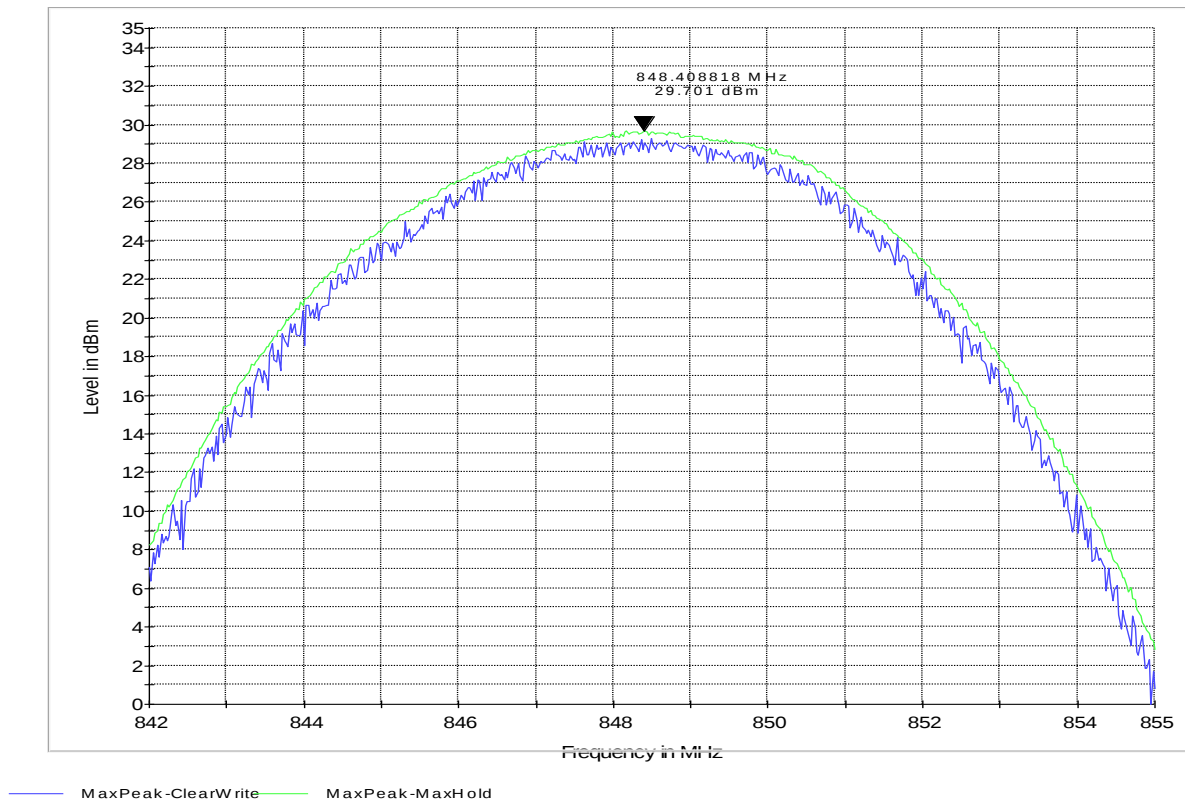
6.1.7 Results

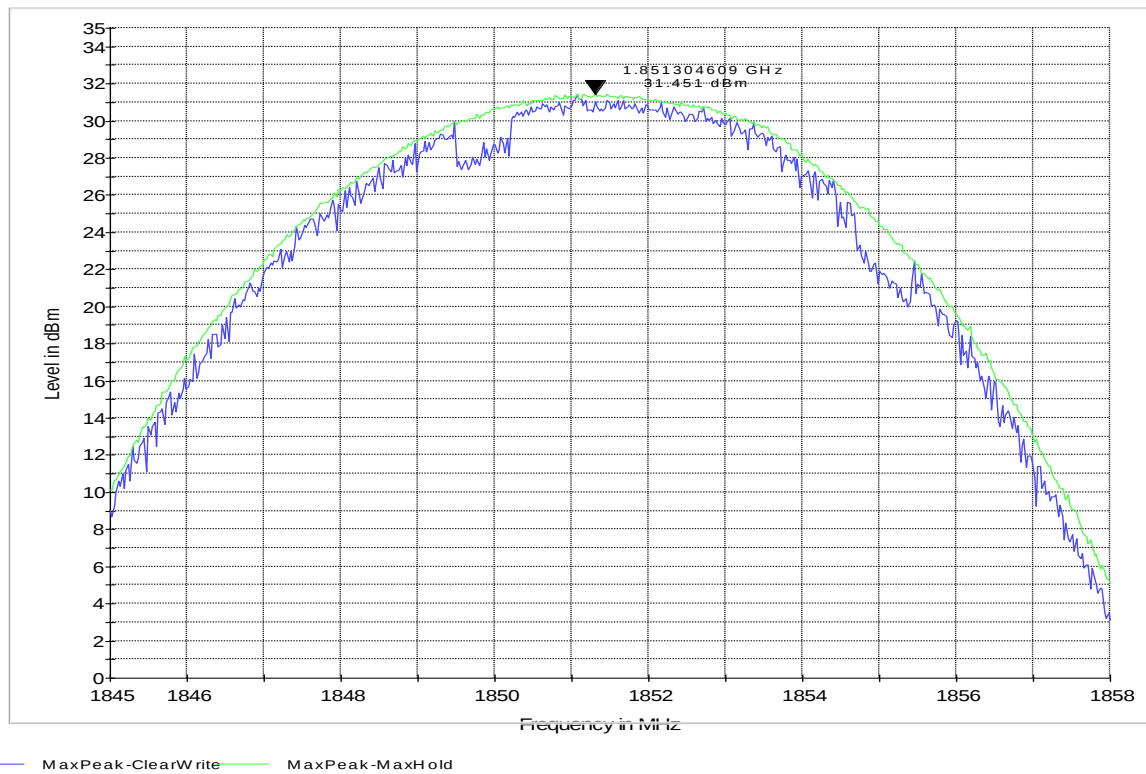
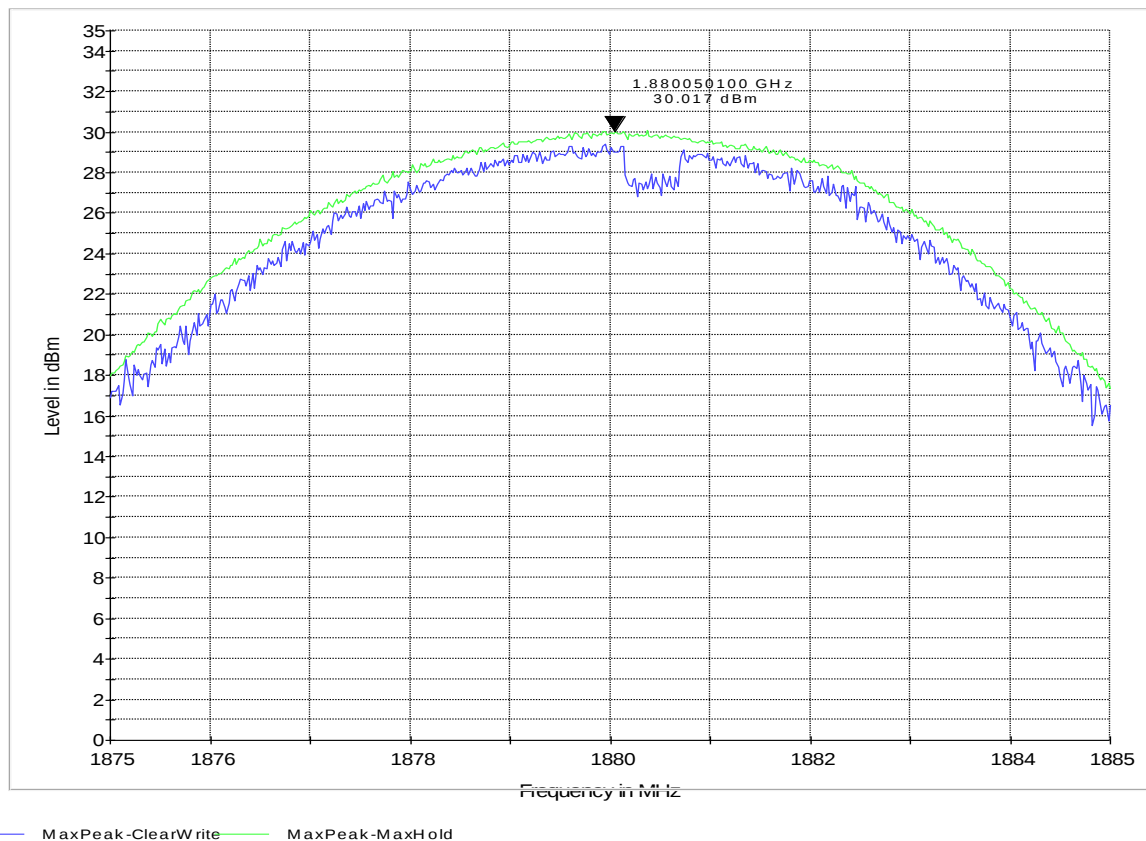
ERP (CDMA 850) CHANNEL 1013

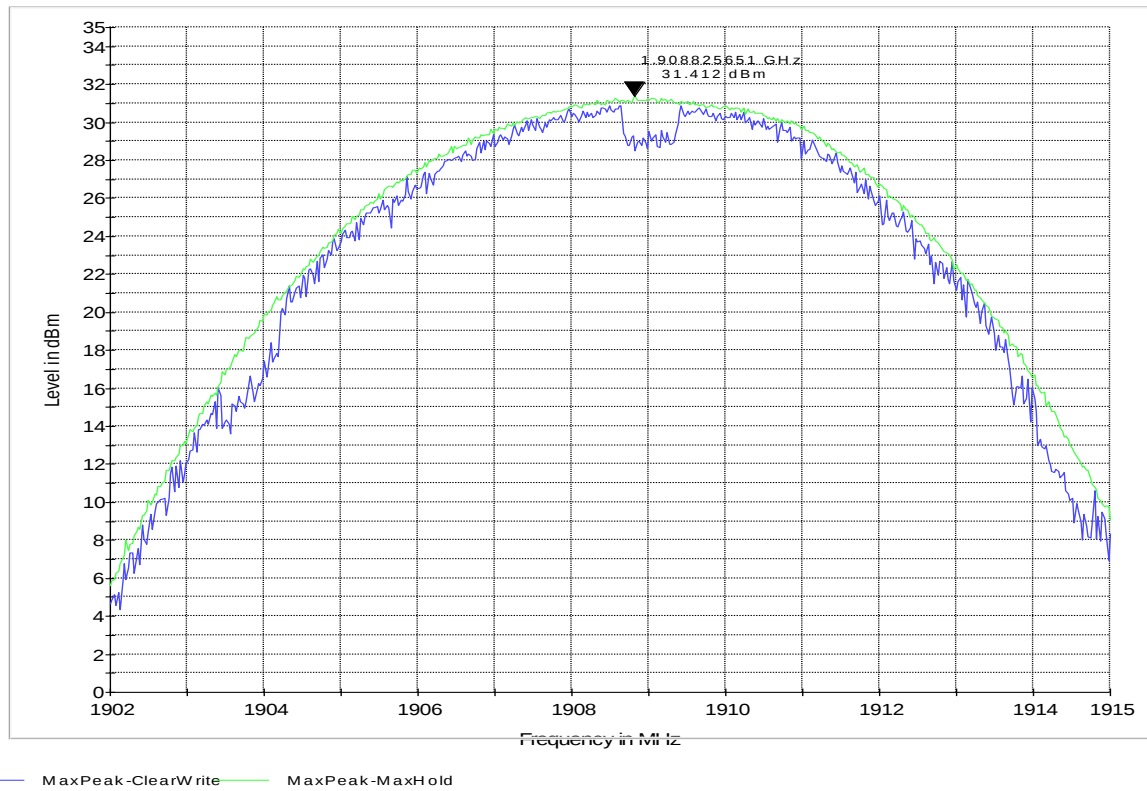


ERP (CDMA 850) CHANNEL 384



ERP (CDMA 850) CHANNEL 777

EIRP (CDMA-1900) CHANNEL 25**EIRP (CDMA-1900) CHANNEL 600**

EIRP (CDMA-1900) CHANNEL 1175

6.2 Spurious Emissions Radiated

6.2.1 References

6.2.2 References

FCC: CFR Part 2.1053, CFR Part 22.917, CFR Part 24.238

6.2.3 Measurement requirements:

6.2.3.1 FCC 2.1053: Field strength of spurious radiation.

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission.

6.2.4 Limits:

(a) *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.

For all power levels +30dBm to 0dBm, this becomes a constant specification of -13dBm.

6.2.4.1 FCC 22.917 Emission limitations for cellular equipment.

The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.

(b) *Measurement procedure.* Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 100 kHz of 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

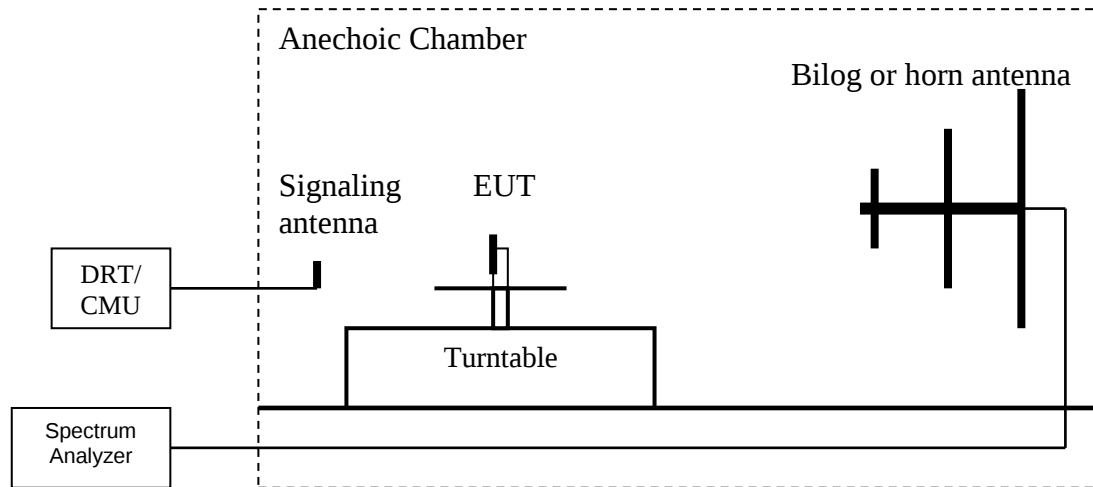
6.2.4.2 FCC 24.238 Emission limitations for Broadband PCS equipment.

The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

(b) *Measurement procedure.* Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 100 kHz of 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

6.2.5 Radiated out of band measurement procedure:

Ref: TIA-603C 2004- 2.2.12 Unwanted emissions: Radiated Spurious



1. Connect the equipment as shown in the above diagram with the EUT's antenna in a horizontal orientation.
2. Adjust the settings of the Digital RadioCommunication Tester (DRT) to set the EUT to its maximum power at the required channel.
3. Set the spectrum analyzer to measure peak hold with the required settings.
4. Place the measurement antenna in a horizontal orientation. Rotate the EUT 360°. Raise the measurement antenna up to 4 meters in 0.5 meters increments and rotate the EUT 360° at each height to maximize all emissions. Measure and record all spurious emissions (**LVL**) up to the tenth harmonic of the carrier frequency.
5. Replace the EUT with a horizontally polarized half wave dipole or known gain antenna. The center of the antenna should be at the same location as the center of the EUT's antenna.
6. Connect the antenna to a signal generator with known output power and record the path loss in dB (**LOSS**). **LOSS** = Generator Output Power (dBm) – Analyzer reading (dBm).
7. Determine the level of spurious emissions using the following equation:
Spurious (dBm) = **LVL** (dBm) + **LOSS** (dB):
8. Repeat steps 4, 5 and 6 with all antennas vertically polarized.
9. Determine the level of spurious emissions using the following equation:
Spurious (dBm) = **LVL** (dBm) + **LOSS** (dB):
10. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.
(**Note:** Steps 5 and 6 above are performed prior to testing and **LOSS** is recorded by test software. Steps 3, 4 and 7 above are performed with test software.)

Spectrum analyzer settings: RBW=VBW=1MHz

Measurement Survey:

The site is constructed in accordance with ANSI C63.4 requirements and is recognized by the FCC to be in compliance for a 3m site. The spectrum is scanned from 30MHz to the 10th harmonic of the highest frequency generated by the EUT.

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the 850 & 1900 bands. It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the 850 & 1900 band into any of the other blocks respectively. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

All measurements are done in horizontal and vertical antenna polarization; and on three orientations of the EUT. The plots show the worst case where it is not indicated otherwise. Unless mentioned otherwise, the peaks in the plots are from the carrier frequency.

6.2.6 Radiated out of band emissions results on EUT- Transmit Mode:

6.2.6.1 Test Results Transmitter Spurious Emission CDMA 850:

Harmonic	Tx ch-1013 Freq. (MHz)	Level (dBm)	Tx ch-384 Freq. (MHz)	Level (dBm)	Tx ch-777 Freq. (MHz)	Level (dBm)
1	824.7	-	836.52	-	848.31	-
2	1649.4	NF	1673.04	NF	1696.62	NF
3	2474.1	NF	2509.56	NF	2544.93	NF
4	3298.8	NF	3346.08	NF	3393.24	NF
5	4123.5	NF	4182.6	NF	4241.55	NF
6	4948.2	NF	5019.12	NF	5089.86	NF
7	5772.9	NF	5855.64	NF	5938.17	NF
8	6597.6	NF	6692.16	NF	6786.48	NF
9	7422.3	NF	7528.68	NF	7634.79	NF
10	8247	NF	8365.2	NF	8483.1	NF
NF = Noise Floor Measurement Uncertainty: ± 3 dB						

6.2.6.2 Measurement Result

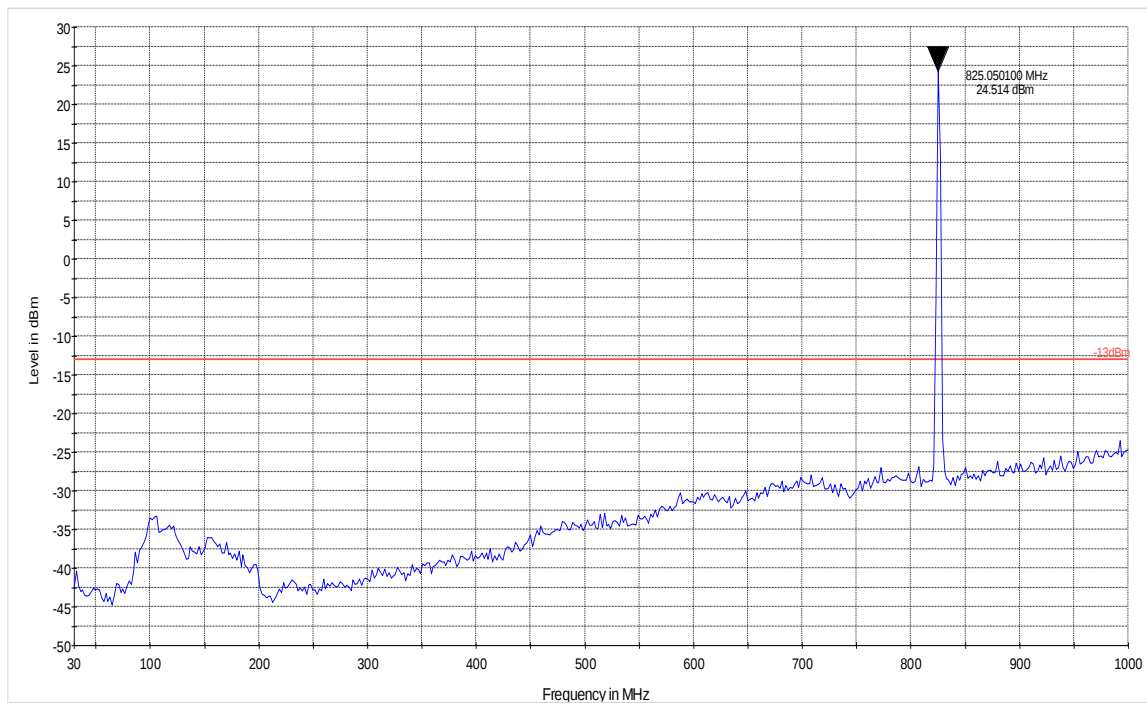
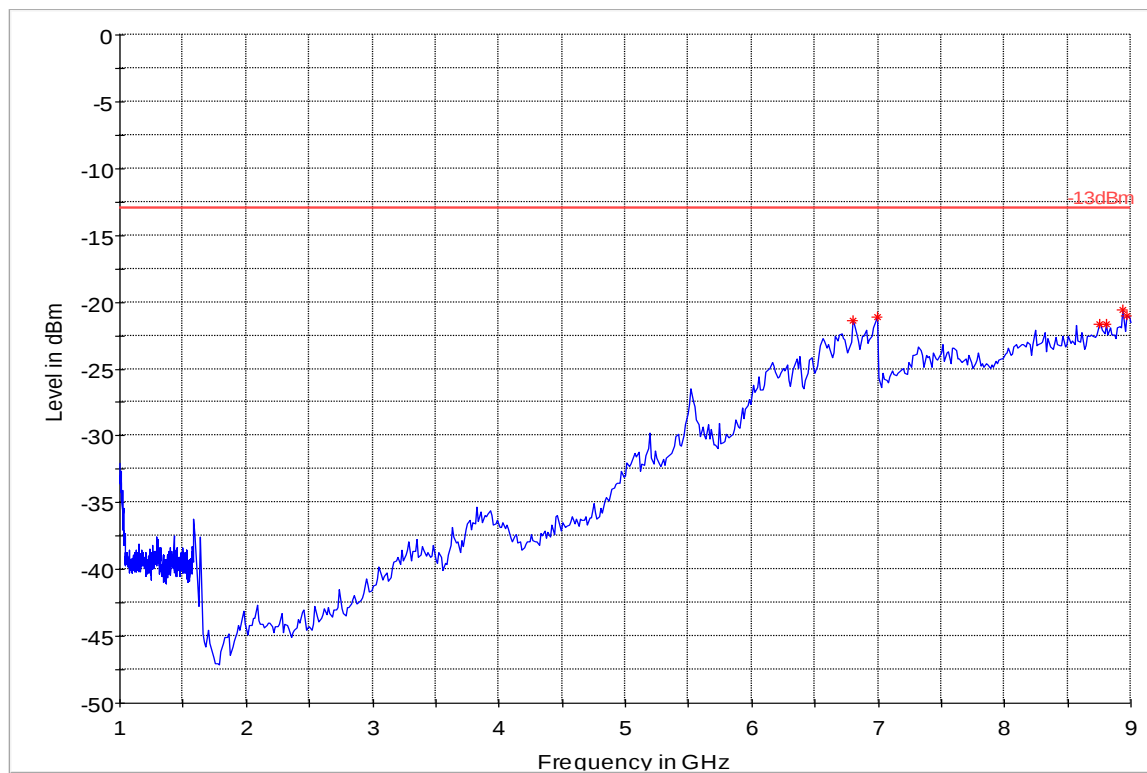
Pass.

Legend for the plots:

-  -13dBm.LimitLine
-  Preview Result
-  Data Reduction Result
-  Final Measurement Result

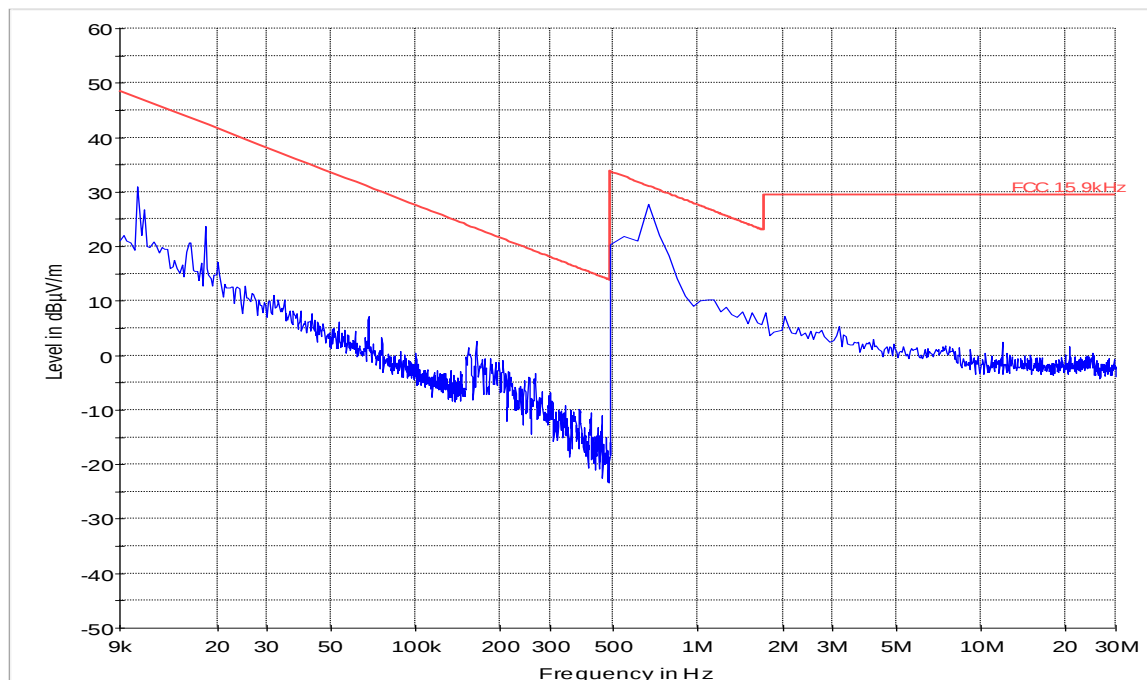
Radiated Spurious Emissions (CDMA-850) Tx: Low Channel
30MHz-1GHz

Marker placed at the Transmit signal

**1GHz-9GHz**

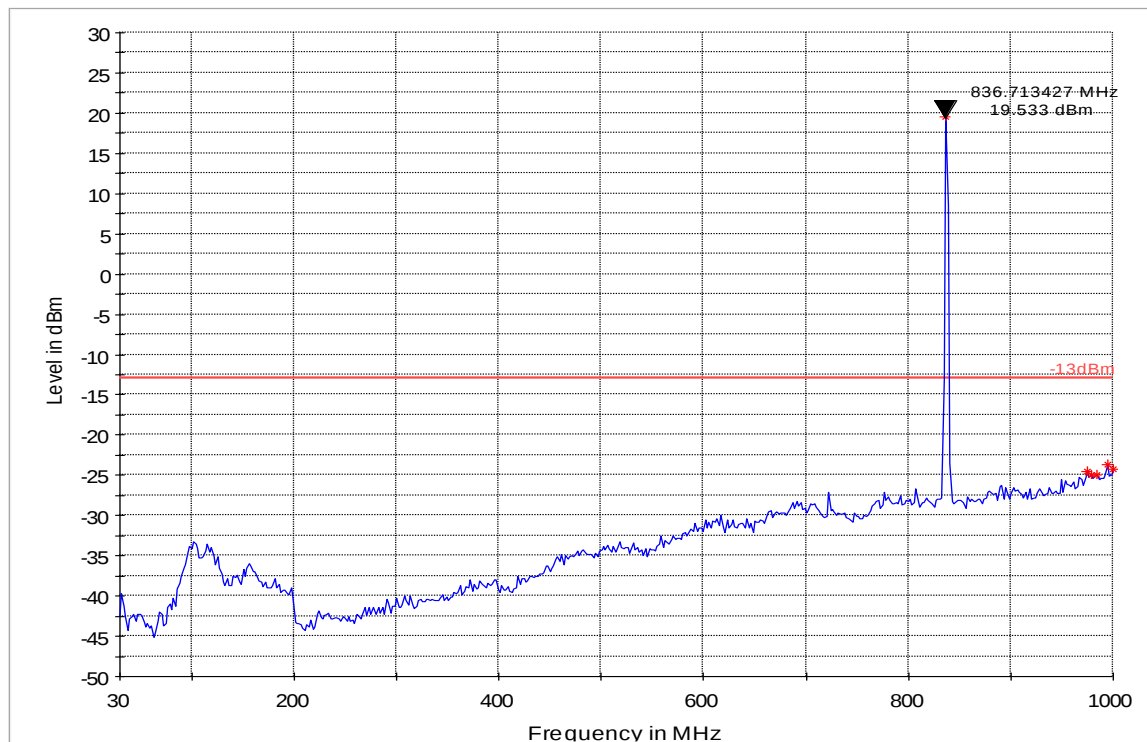
Radiated Spurious Emissions (CDMA-850) Tx: Mid Channel **Below 30MHz**

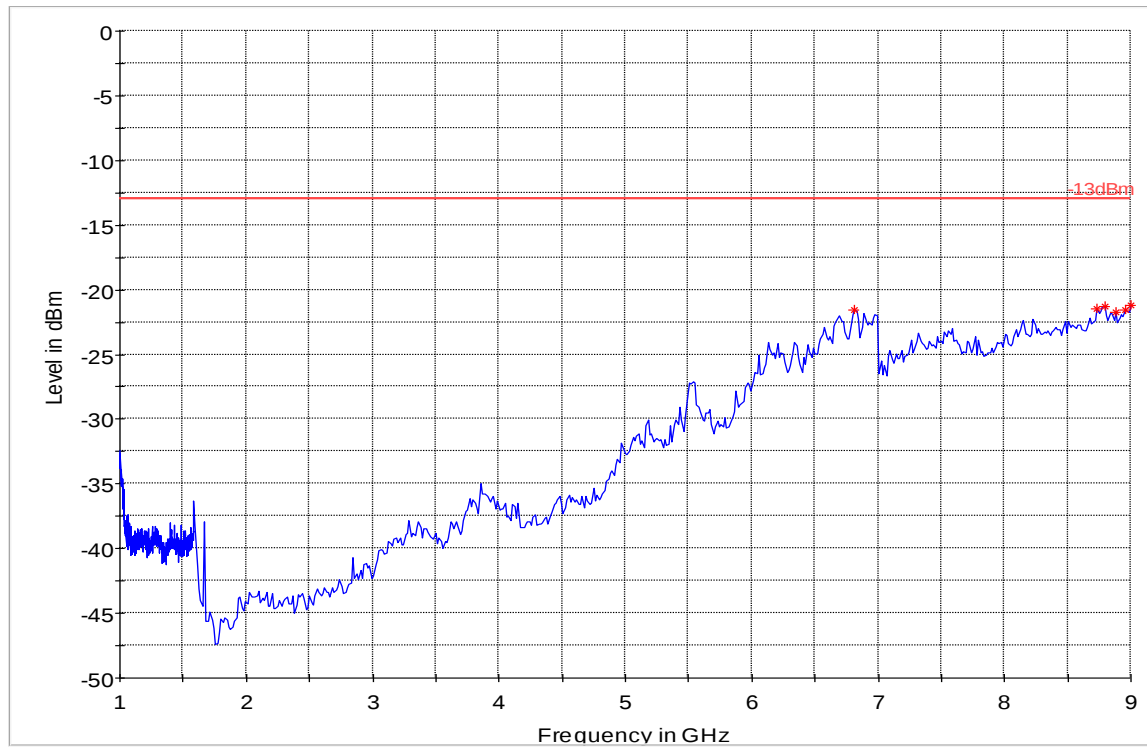
Worst case representation for all channels



30MHz-1GHz

Marker placed at the Transmit signal

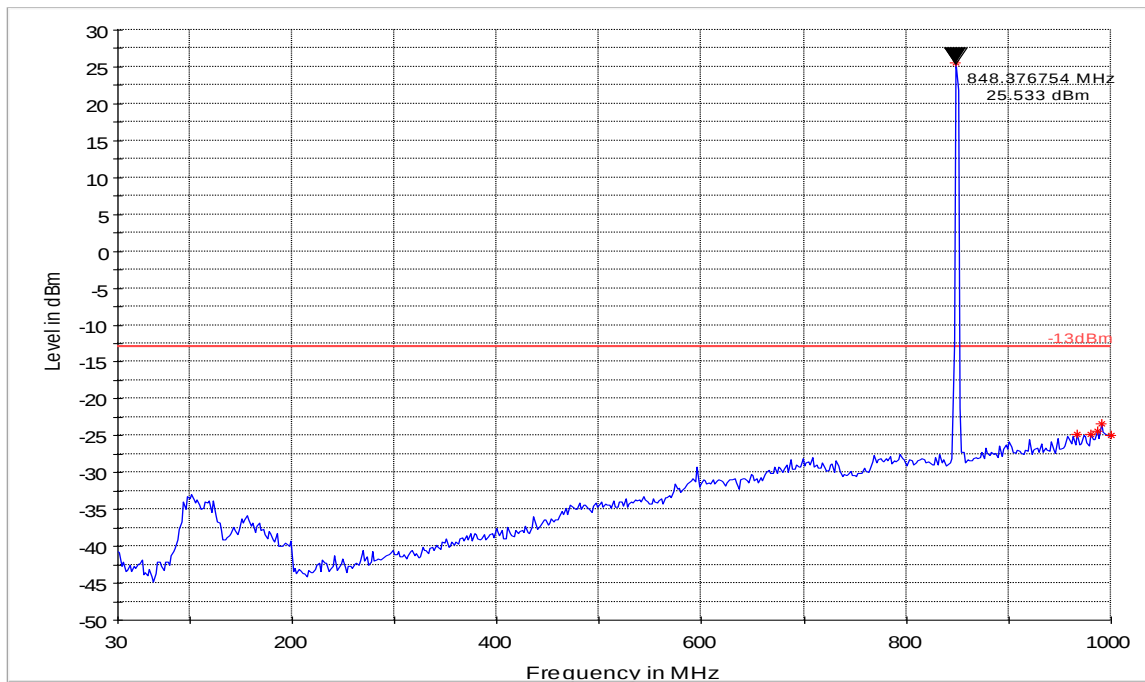


1GHz-9GHz

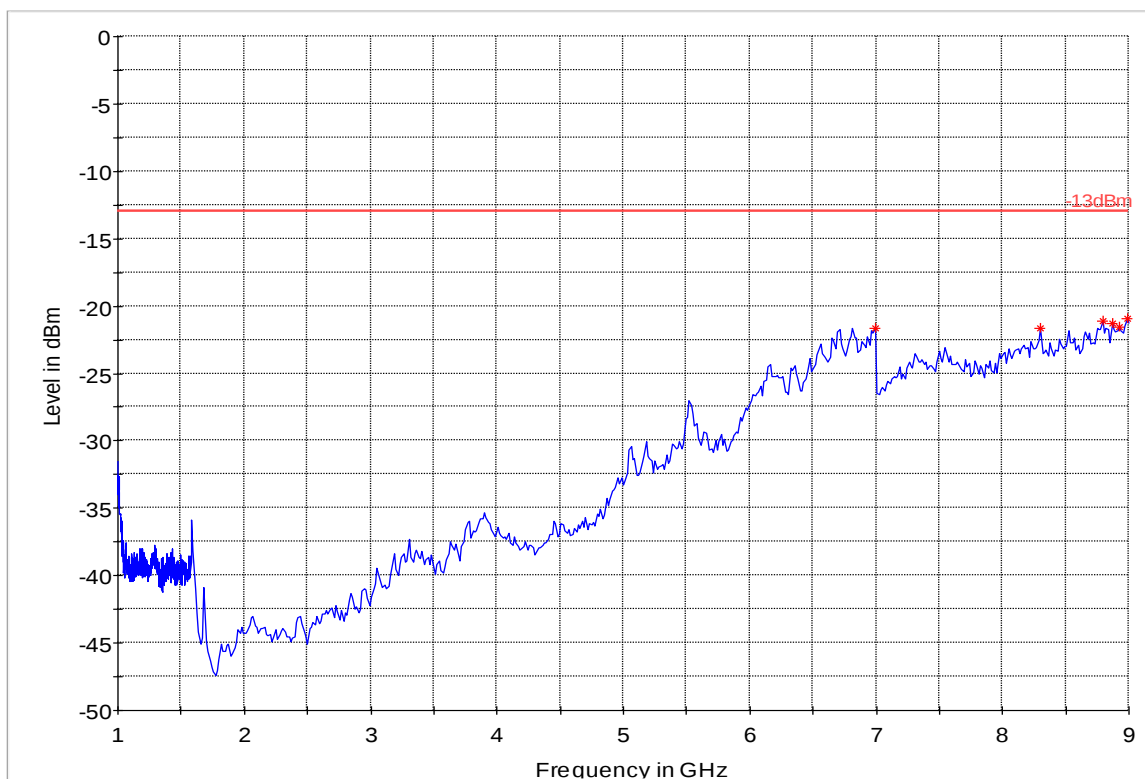
— -13dBm.LimitLine — Preview Result 1 * Data Reduction Result 1 [2]

Radiated Spurious Emissions (CDMA-850) Tx: High Channel
30MHz-1GHz

Marker placed at the Transmit signal



— -13dBm.LimitLine — Preview Result 1 * Data Reduction Result 1 [1]

1GHz-9GHz

— -13dBm.LimitLine — Preview Result 1 * Data Reduction Result 1 [2]

6.2.6.3 Test Results Transmitter Spurious Emission CDMA-1900:

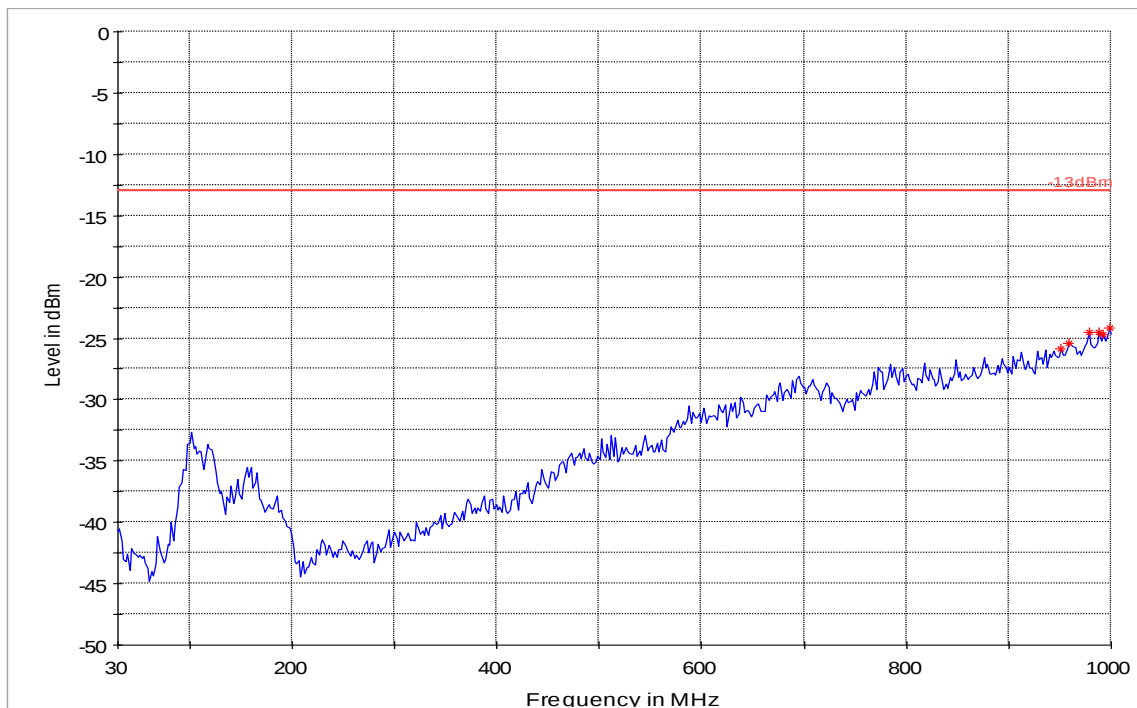
Harmonic	Tx ch-25 Freq.(MHz)	Level (dBm)	Tx ch-600 Freq. (MHz)	Level (dBm)	Tx ch-1175 Freq. (MHz)	Level (dBm)
1	1851.25	-	1880.0	-	1908.75	-
2	3702.5	-45	3760	-35	3817.5	-28
3	5553.75	NF	5640	NF	5726.25	NF
4	7405	NF	7520	NF	7635	NF
5	9256.25	NF	9400	NF	9543.75	NF
6	11107.5	NF	11280	NF	11452.5	NF
7	12958.75	NF	13160	NF	13361.25	NF
8	14810	NF	15040	NF	15270	NF
9	16661.25	NF	16920	NF	17178.75	NF
10	18512.5	NF	18800	NF	19087.5	NF
NF = Noise Floor						
Measurement Uncertainty: $\pm 3\text{dB}$						

6.2.6.4 Measurement Result

Pass.

Legend for the plots:

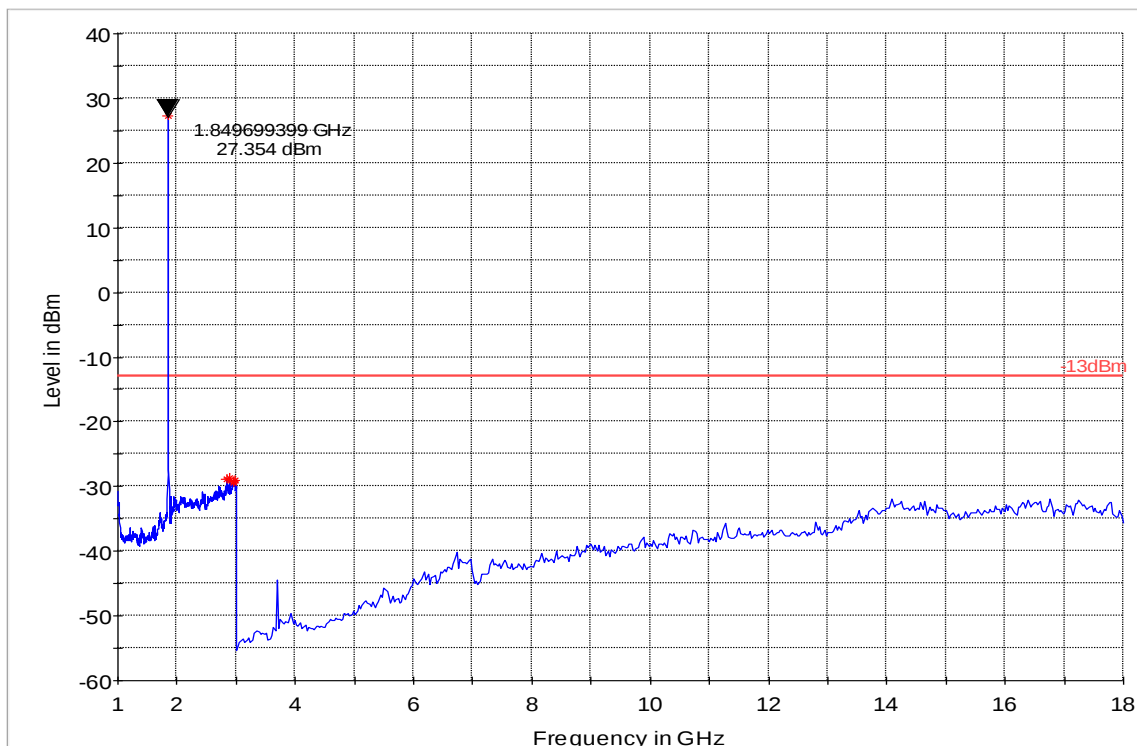
-  -13dBm.LimitLine
-  Preview Result
-  Data Reduction Result
-  Final Measurement Result

Radiated Spurious Emissions (CDMA-1900) Tx: Low Channel
30MHz-1GHz

— -13dBm.LimitLine — Preview Result 1 * Data Reduction Result 1 [1]

1GHz-18GHz

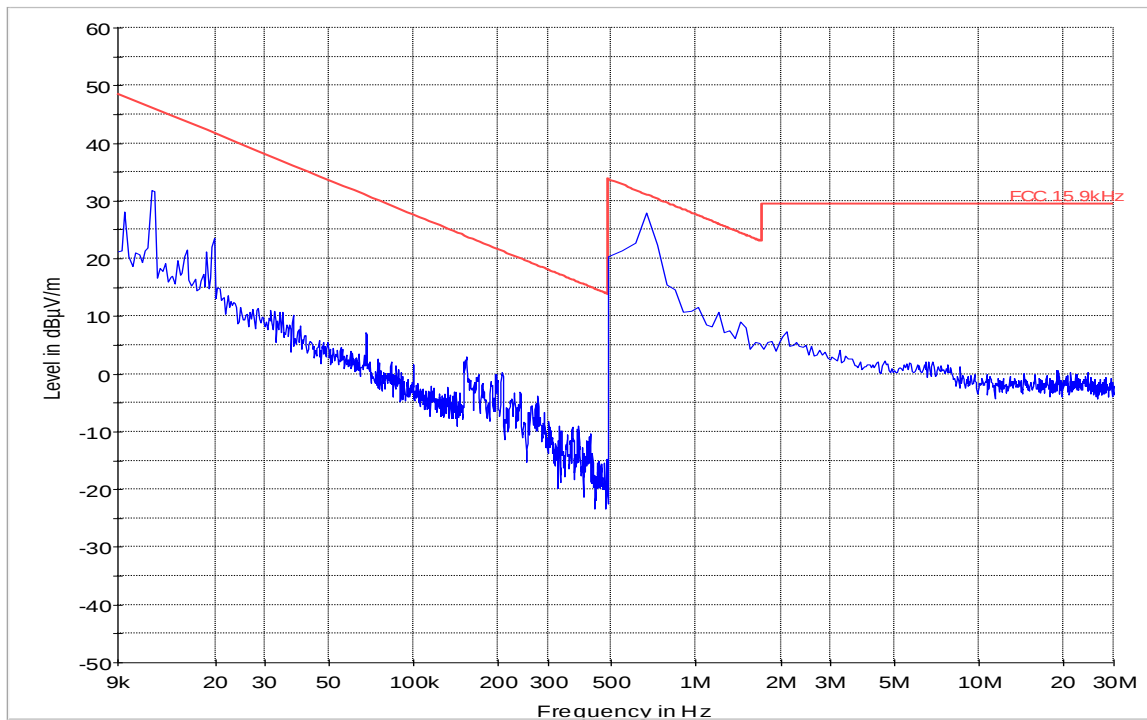
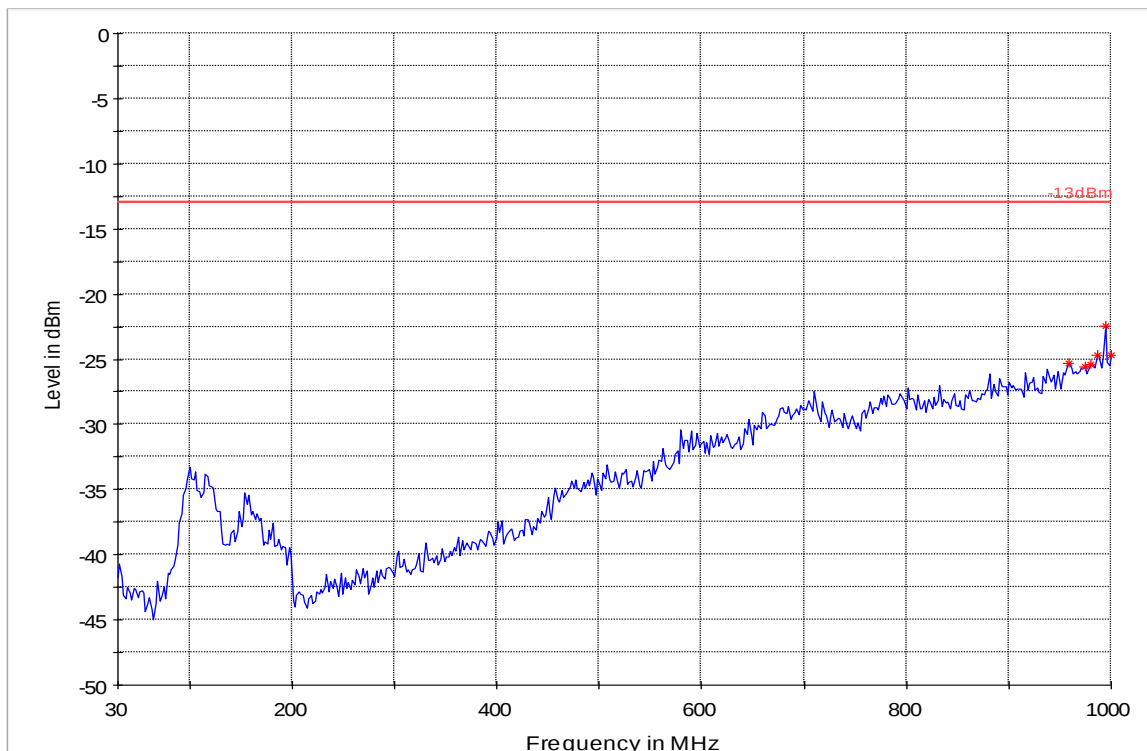
Marker on transmit signal

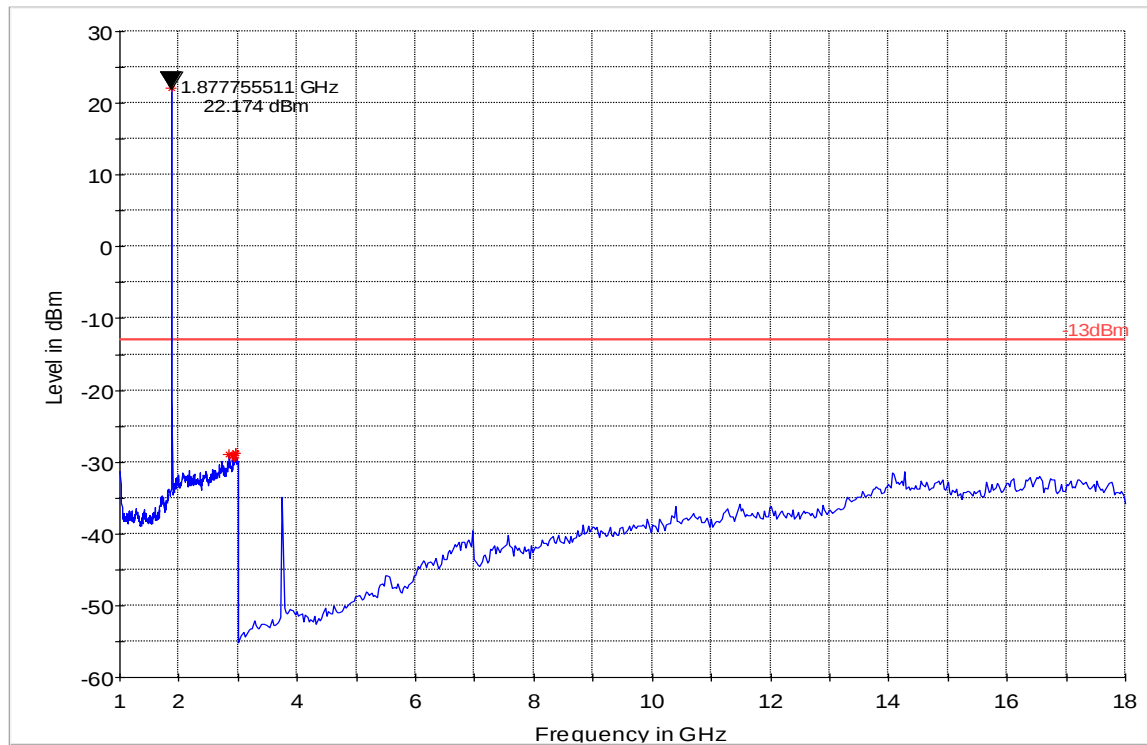


— -13dBm.LimitLine — Preview Result 1 * Data Reduction Result 1 [2]

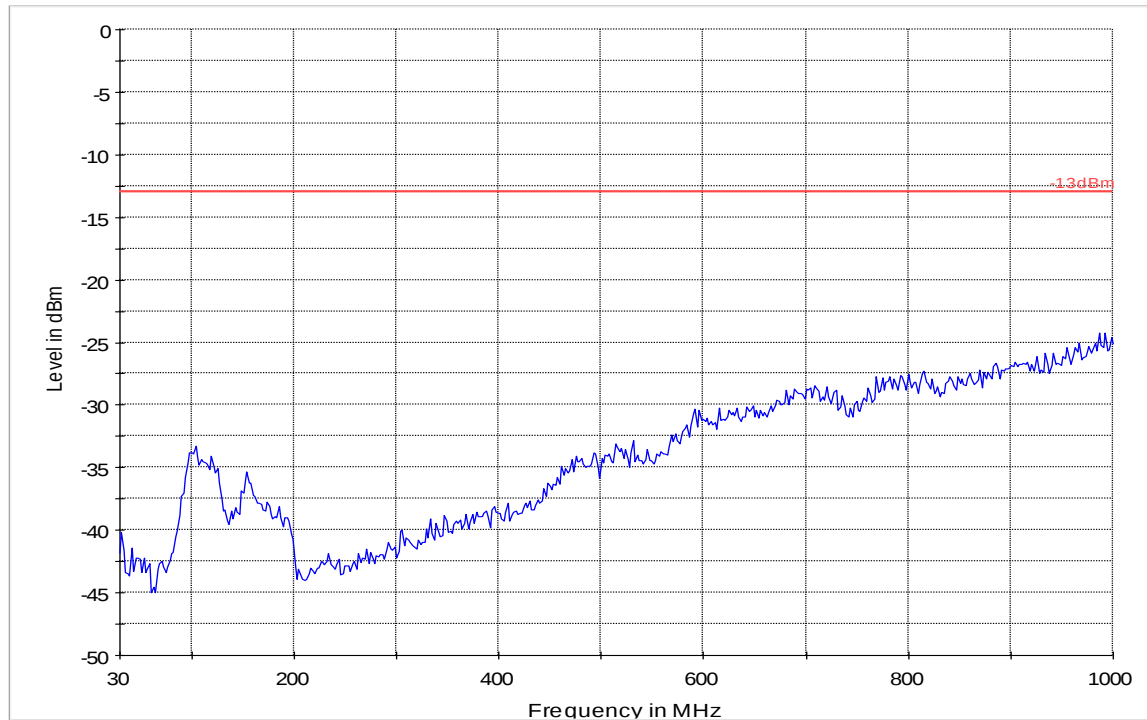
Radiated Spurious Emissions (CDMA-1900) Tx: Mid Channel
Below 30MHz

Worst case representation for all channels

**30MHz-1GHz**

1GHz-18GHz**Marker on transmit signal**

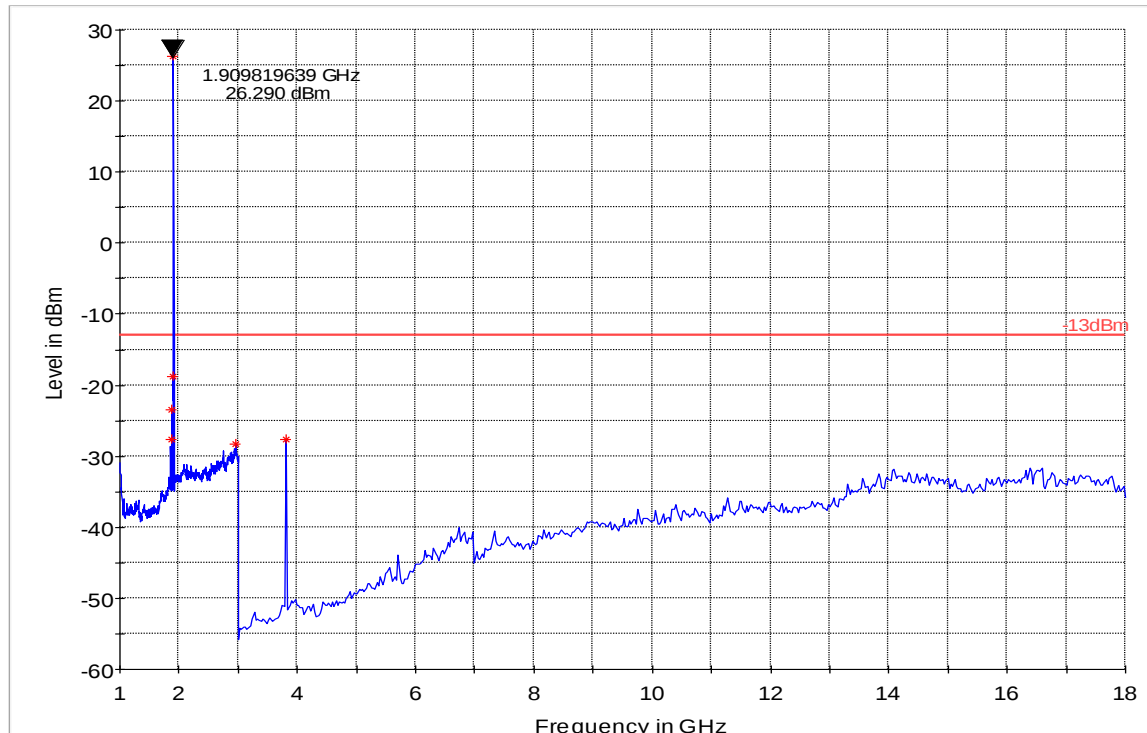
— -13dBm.LimitLine — Preview Result 1 * Data Reduction Result 1 [2]

Radiated Spurious Emissions (CDMA-1900) Tx: High Channel
30MHz-1GHz

— -13dBm.LimitLine — Preview Result 1

1GHz-18GHz

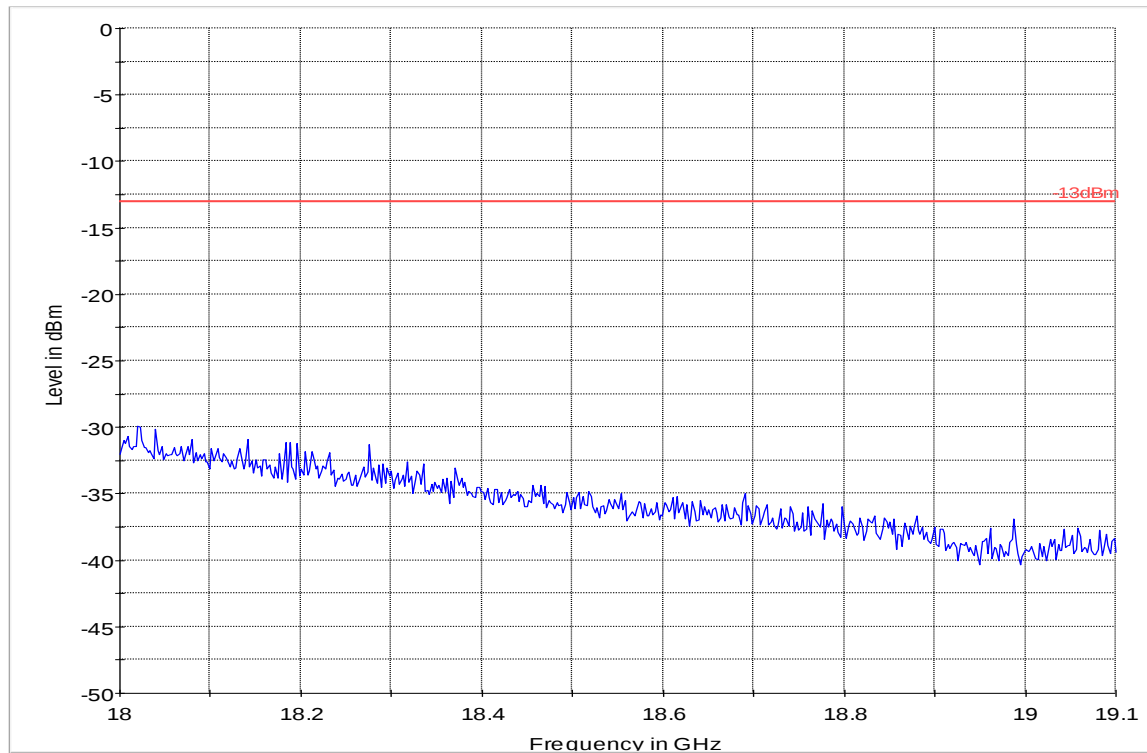
Marker on transmit signal



— -13dBm.LimitLine — Preview Result 1 * Data Reduction Result 1 [2]

Test results 18GHz-19.1GHz

Note: Worst case representation of all channels



— -13dBm.LimitLine — Preview Result 1

6.2.7 Radiated out of band emissions results on EUT- Receive Mode:**6.2.8 References**

FCC: CFR Part 15.109, 2.1053

6.2.9 Limits**6.2.9.1 §15.109 Radiated emission limits- Unintentional Radiators:**

If a radiated measurement is made, all spurious emissions shall comply with the limits of table (1) as shown.

(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of emission (MHz)	Field strength (µV/m)
30–88	100 (40dBµV/m)
88–216	150 (43.5 dBµV/m)
216–960	200 (46 dBµV/m)
Above 960	500 (54 dBµV/m)

(b) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following:

Frequency of emission (MHz)	Field strength (µV/m)
30–88	90
88–216	150
216–960	210
Above 960	300

6.2.10 Measurement settings:

RBW= 120 kHz below 1GHz and 1MHz above 1GHz.

6.2.11 Results

Plots reported here represent the worse case emissions for all EUT orientations and horizontal/vertical polarizations of the measurement antenna.

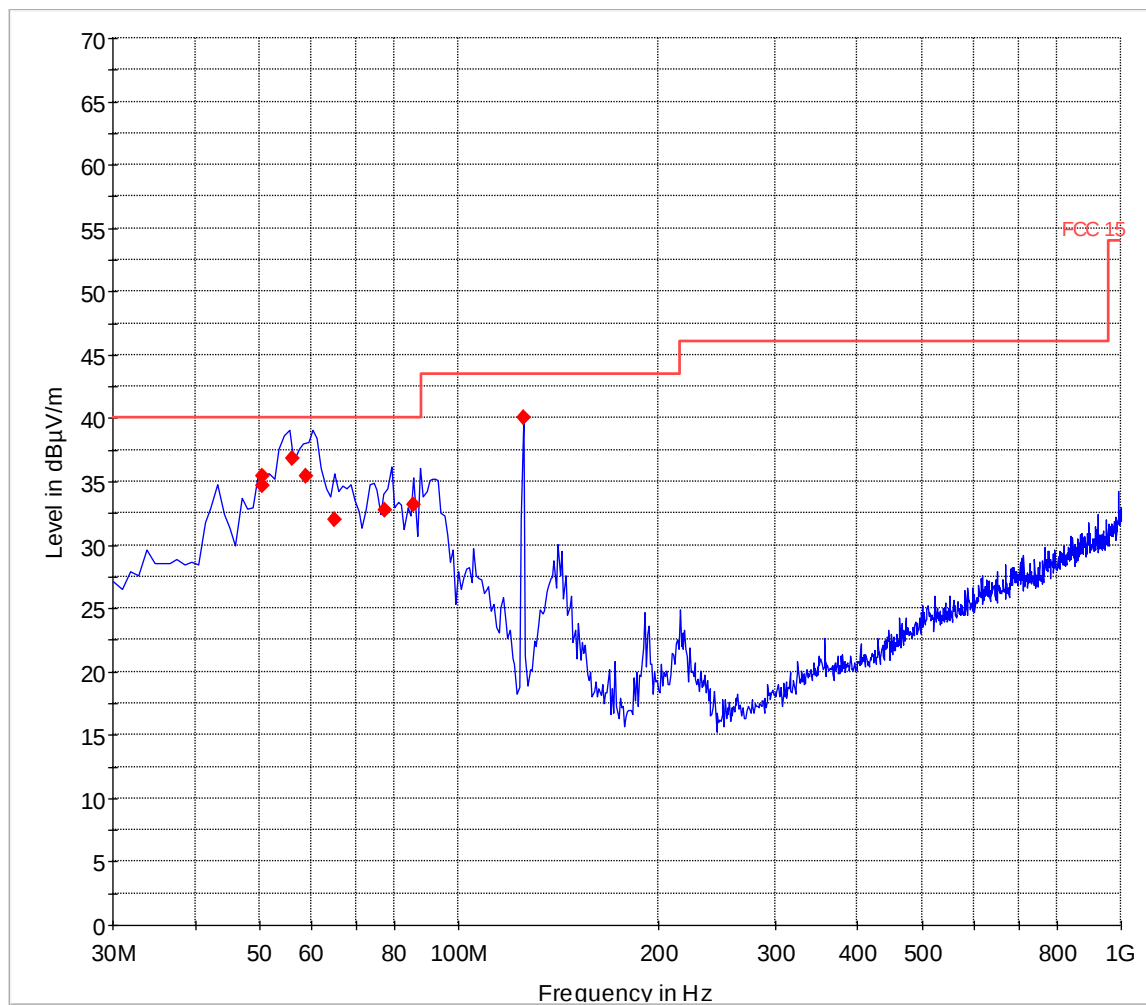
6.2.11.1 Measurement Result

Pass.

6.2.11.2 Test Results Receiver Spurious Emission

Receive Mode: 30MHz-1GHz

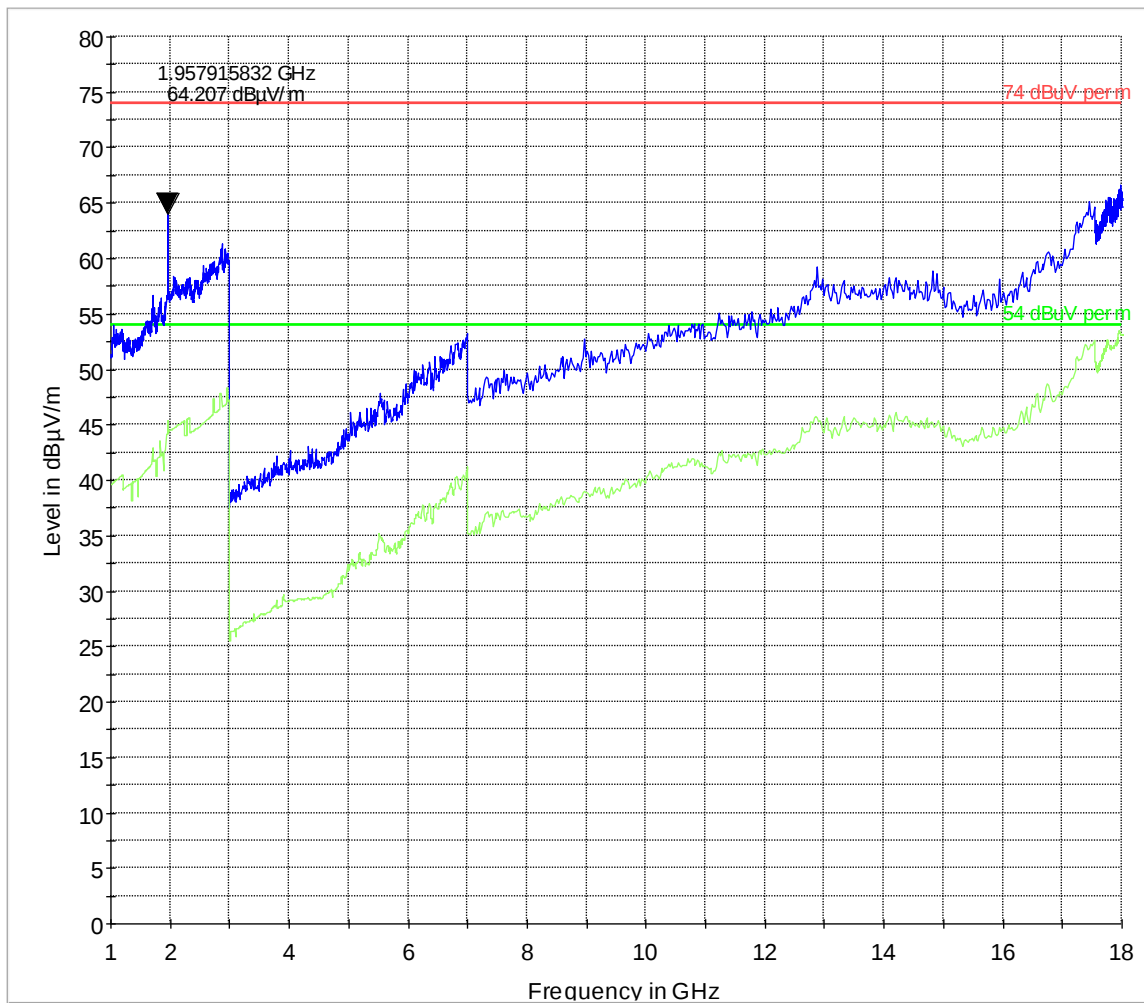
Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
50.435478	35.4	20.0	120.000	120.0	V	225.0	6.8	4.6	40.0
50.439120	34.7	20.0	120.000	120.0	V	225.0	6.8	5.3	40.0
55.978040	36.8	20.0	120.000	219.0	V	157.0	7.4	3.2	40.0
58.666911	35.4	20.0	120.000	150.0	V	250.0	7.7	4.6	40.0
64.813966	32.0	20.0	120.000	120.0	V	160.0	8.5	8.0	40.0
77.185474	32.7	20.0	120.000	120.0	V	168.0	9.4	7.3	40.0
85.505025	33.2	20.0	120.000	120.0	V	201.0	9.9	6.8	40.0
124.998601	40.1	20.0	120.000	120.0	V	248.0	8.2	3.4	43.5



— FCC 15.LimitLine

— Preview Result 1

◆ Final Result 1

Receive Mode: 1GHz-18GHz

74 dBμV perm.LimitLine 54 dBμV perm.LimitLine Preview Result 1 Preview Result 2

Receive Mode: 18GHz-26.0GHz

No spurious emissions measured in this frequency range.

6.3 AC Power Line Conducted Emissions

6.3.1 References:

FCC: CFR Part 15.207

The purpose of this test is to measure unwanted radio frequency currents induced in any AC conductor external to the equipment which could conduct interference to other equipment via the AC electrical network.

6.3.2 Limits:

6.3.2.1 §15.207 Conducted limits- Intentional Radiators:

(a) Except as shown in paragraphs (b) and (c) of this section of the CFR, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table (1), as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Table 1:

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

6.3.3 Measurement settings:

RBW= 9kHz

6.3.4 Results

All lines were measured individually and plots are shown in the subsequent sections.

6.3.4.1 Measurement Result

Pass.

6.3.5 Test Results:

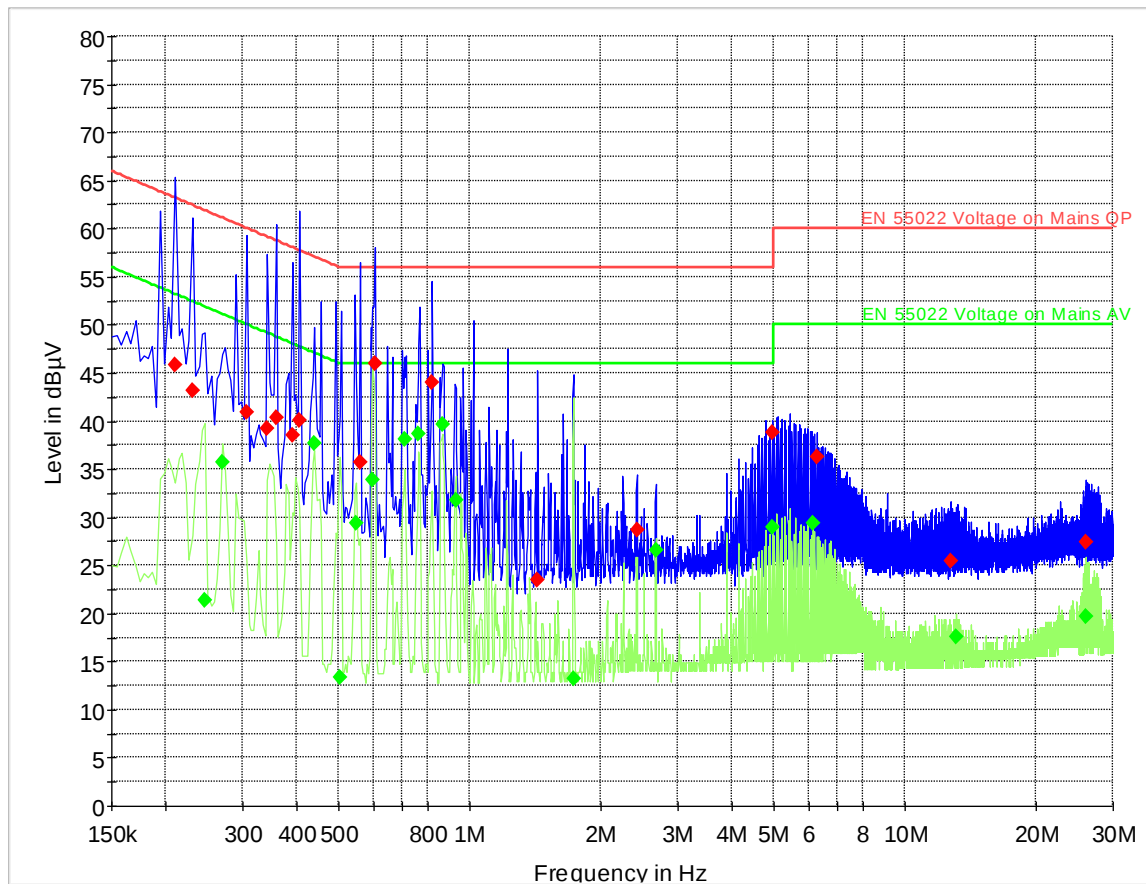
850 TX Mode: L1

Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.210000	45.8	20.0	9.000	GN	20.3	17.4	63.2	
0.230000	43.2	20.0	9.000	GN	20.3	19.2	62.4	
0.306000	40.9	20.0	9.000	GN	20.3	19.2	60.1	
0.342000	39.2	20.0	9.000	GN	20.3	20.0	59.2	
0.358000	40.3	20.0	9.000	GN	20.3	18.5	58.8	
0.390000	38.5	20.0	9.000	GN	20.3	19.6	58.1	
0.406000	40.0	20.0	9.000	GN	20.4	17.7	57.7	
0.558000	35.7	20.0	9.000	GN	20.3	20.3	56.0	
0.606000	46.0	20.0	9.000	GN	20.3	10.0	56.0	
0.818000	44.0	20.0	9.000	GN	20.3	12.0	56.0	
1.430000	23.5	20.0	9.000	GN	20.4	32.5	56.0	
2.414000	28.7	20.0	9.000	GN	20.5	27.3	56.0	
4.946000	38.8	20.0	9.000	GN	20.6	17.2	56.0	
6.250000	36.3	20.0	9.000	GN	20.6	23.7	60.0	
12.718000	25.4	20.0	9.000	GN	20.8	34.6	60.0	
26.030000	27.4	20.0	9.000	GN	21.4	32.6	60.0	

Final Result 2

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.246000	21.4	20.0	9.000	GN	20.3	30.5	51.9	
0.270000	35.8	20.0	9.000	GN	20.3	15.3	51.1	
0.438000	37.6	20.0	9.000	GN	20.3	9.5	47.1	
0.502000	13.4	20.0	9.000	GN	20.4	32.6	46.0	
0.546000	29.4	20.0	9.000	GN	20.3	16.6	46.0	
0.598000	33.9	20.0	9.000	GN	20.3	12.1	46.0	
0.706000	38.2	20.0	9.000	GN	20.3	7.8	46.0	
0.762000	38.7	20.0	9.000	GN	20.3	7.3	46.0	
0.862000	39.7	20.0	9.000	GN	20.3	6.3	46.0	
0.926000	31.8	20.0	9.000	GN	20.3	14.2	46.0	
1.726000	13.2	20.0	9.000	GN	20.4	32.8	46.0	
2.670000	26.6	20.0	9.000	GN	20.5	19.4	46.0	
4.946000	29.0	20.0	9.000	GN	20.6	17.0	46.0	
6.142000	29.4	20.0	9.000	GN	20.6	20.6	50.0	
13.098000	17.6	20.0	9.000	GN	20.9	32.4	50.0	
26.030000	19.6	20.0	9.000	GN	21.4	30.4	50.0	



— EN 55022 Voltage on Mains QP.LimitLine	— EN 55022 Voltage on Mains AV.LimitLine
— Preview Result 1	— Preview Result 2
◆ Final Result 1	◆ Final Result 2

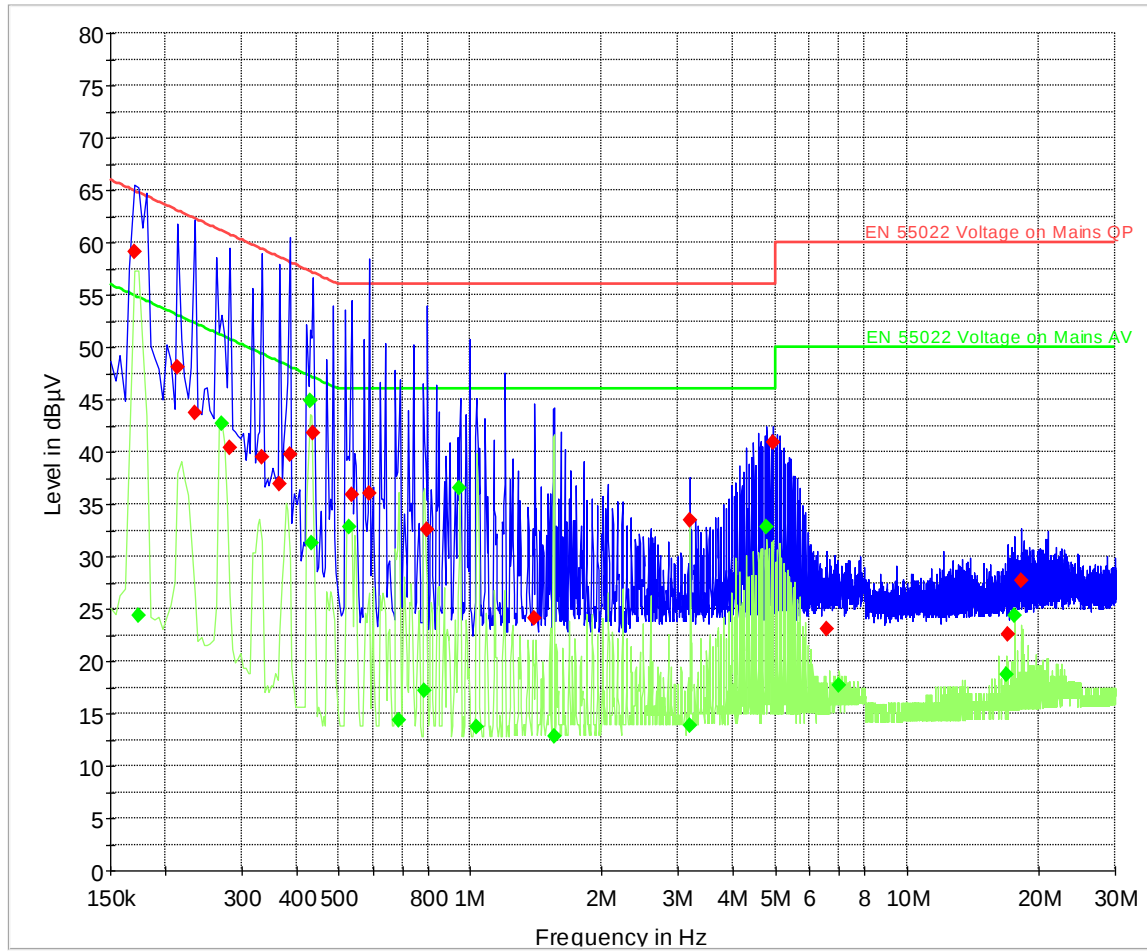
850 TX Mode: L2

Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.170000	59.1	20.0	9.000	GN	20.3	5.9	65.0	
0.214000	48.1	20.0	9.000	GN	20.3	14.9	63.0	
0.234000	43.7	20.0	9.000	GN	20.3	18.6	62.3	
0.282000	40.3	20.0	9.000	GN	20.3	20.5	60.8	
0.334000	39.5	20.0	9.000	GN	20.3	19.9	59.4	
0.366000	36.9	20.0	9.000	GN	20.3	21.7	58.6	
0.386000	39.7	20.0	9.000	GN	20.3	18.4	58.1	
0.438000	41.8	20.0	9.000	GN	20.3	15.3	57.1	
0.534000	35.9	20.0	9.000	GN	20.3	20.1	56.0	
0.586000	36.0	20.0	9.000	GN	20.3	20.0	56.0	
0.798000	32.6	20.0	9.000	GN	20.3	23.4	56.0	
1.406000	24.1	20.0	9.000	GN	20.4	31.9	56.0	
3.190000	33.4	20.0	9.000	GN	20.5	22.6	56.0	
4.946000	40.9	20.0	9.000	GN	20.6	15.1	56.0	
6.574000	23.0	20.0	9.000	GN	20.6	37.0	60.0	
17.010000	22.6	20.0	9.000	GN	21.0	37.4	60.0	
18.242000	27.7	20.0	9.000	GN	21.0	32.3	60.0	

Final Result 2

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.174000	24.4	20.0	9.000	GN	20.3	30.4	54.8	
0.270000	42.7	20.0	9.000	GN	20.3	8.4	51.1	
0.430000	44.8	20.0	9.000	GN	20.3	2.5	47.3	
0.434000	31.2	20.0	9.000	GN	20.3	16.0	47.2	
0.530000	32.8	20.0	9.000	GN	20.3	13.2	46.0	
0.686000	14.4	20.0	9.000	GN	20.3	31.6	46.0	
0.786000	17.1	20.0	9.000	GN	20.3	28.9	46.0	
0.946000	36.5	20.0	9.000	GN	20.3	9.5	46.0	
1.038000	13.8	20.0	9.000	GN	20.4	32.2	46.0	
1.554000	12.8	20.0	9.000	GN	20.4	33.2	46.0	
3.190000	13.8	20.0	9.000	GN	20.5	32.2	46.0	
4.782000	32.9	20.0	9.000	GN	20.6	13.1	46.0	
7.010000	17.7	20.0	9.000	GN	20.6	32.3	50.0	
16.902000	18.7	20.0	9.000	GN	21.0	31.3	50.0	
17.694000	24.4	20.0	9.000	GN	21.0	25.6	50.0	



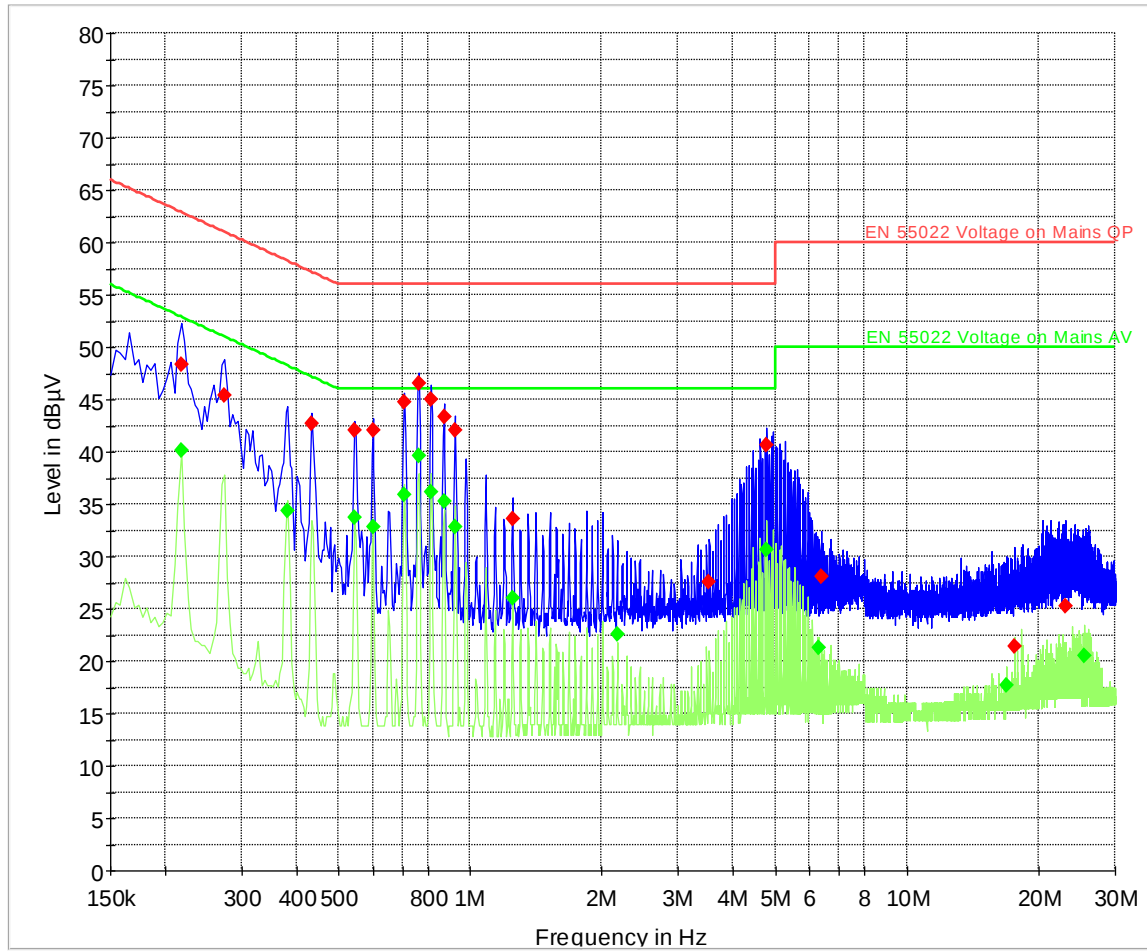
— EN 55022 Voltage on Mains QP.LimitLine	— EN 55022 Voltage on Mains AV.LimitLine
— Preview Result 1	— Preview Result 2
◆ Final Result 1	◆ Final Result 2

850 TX Mode: Neutral**Final Result 1**

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.218000	48.3	20.0	9.000	GN	20.3	14.6	62.9	
0.274000	45.4	20.0	9.000	GN	20.3	15.6	61.0	
0.434000	42.7	20.0	9.000	GN	20.3	14.5	57.2	
0.542000	42.0	20.0	9.000	GN	20.3	14.0	56.0	
0.598000	42.0	20.0	9.000	GN	20.3	14.0	56.0	
0.706000	44.7	20.0	9.000	GN	20.3	11.3	56.0	
0.762000	46.5	20.0	9.000	GN	20.3	9.5	56.0	
0.814000	45.0	20.0	9.000	GN	20.3	11.0	56.0	
0.870000	43.3	20.0	9.000	GN	20.3	12.7	56.0	
0.922000	42.1	20.0	9.000	GN	20.3	13.9	56.0	
1.250000	33.6	20.0	9.000	GN	20.4	22.4	56.0	
3.530000	27.6	20.0	9.000	GN	20.5	28.4	56.0	
4.782000	40.7	20.0	9.000	GN	20.6	15.3	56.0	
6.358000	28.1	20.0	9.000	GN	20.6	31.9	60.0	
17.658000	21.4	20.0	9.000	GN	21.0	38.6	60.0	
23.150000	25.3	20.0	9.000	GN	21.3	34.7	60.0	

Final Result 2

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.218000	40.1	20.0	9.000	GN	20.3	12.8	52.9	
0.382000	34.3	20.0	9.000	GN	20.3	13.9	48.2	
0.542000	33.8	20.0	9.000	GN	20.3	12.2	46.0	
0.598000	32.9	20.0	9.000	GN	20.3	13.1	46.0	
0.706000	35.9	20.0	9.000	GN	20.3	10.1	46.0	
0.762000	39.6	20.0	9.000	GN	20.3	6.4	46.0	
0.814000	36.2	20.0	9.000	GN	20.3	9.8	46.0	
0.870000	35.3	20.0	9.000	GN	20.3	10.7	46.0	
0.922000	32.8	20.0	9.000	GN	20.3	13.2	46.0	
1.250000	26.0	20.0	9.000	GN	20.4	20.0	46.0	
2.174000	22.6	20.0	9.000	GN	20.5	23.4	46.0	
4.782000	30.7	20.0	9.000	GN	20.6	15.3	46.0	
6.302000	21.3	20.0	9.000	GN	20.6	28.7	50.0	
16.898000	17.7	20.0	9.000	GN	21.0	32.3	50.0	
25.430000	20.5	20.0	9.000	GN	21.4	29.5	50.0	



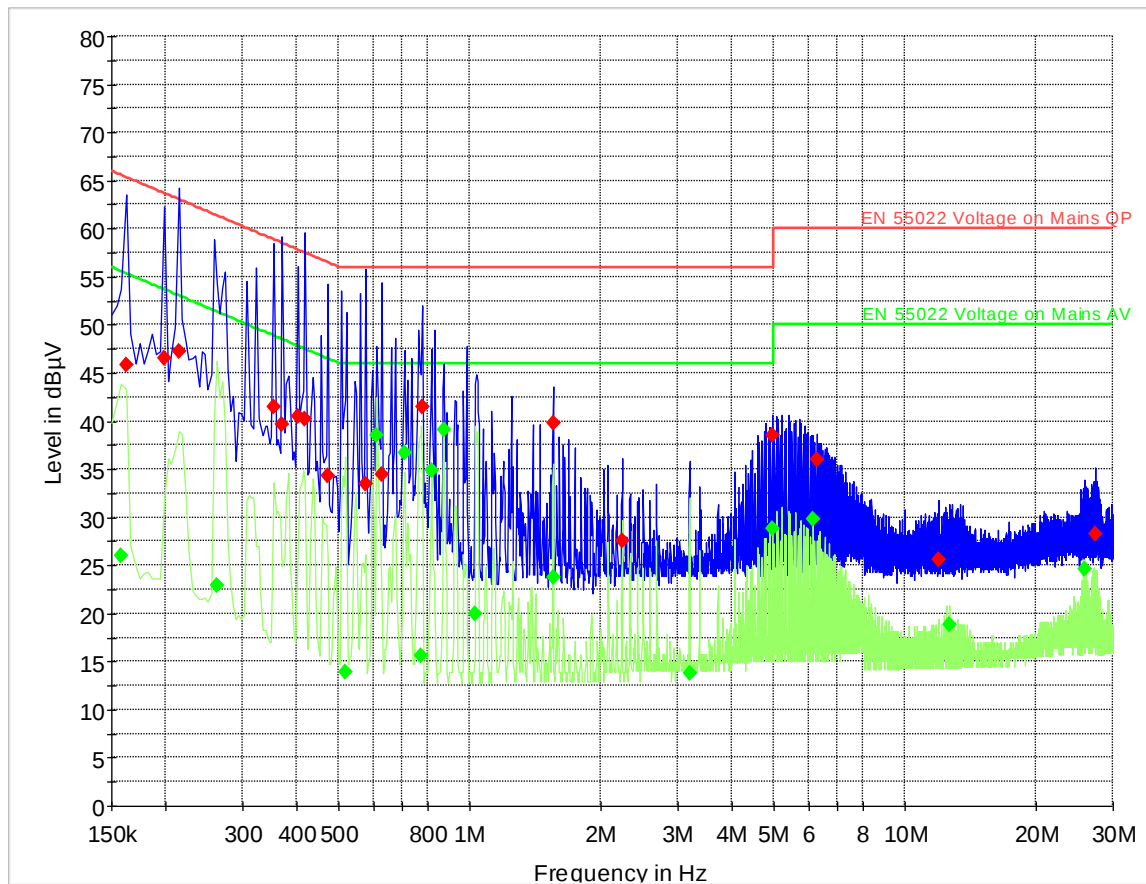
— EN 55022 Voltage on Mains QP.LimitLine	— EN 55022 Voltage on Mains AV.LimitLine
— Preview Result 1	— Preview Result 2
◆ Final Result 1	◆ Final Result 2

1900 TX Mode: L1**Final Result 1**

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.162000	45.8	20.0	9.000	GN	20.3	19.6	65.4	
0.198000	46.6	20.0	9.000	GN	20.3	17.1	63.7	
0.214000	47.3	20.0	9.000	GN	20.3	15.7	63.0	
0.354000	41.5	20.0	9.000	GN	20.3	17.4	58.9	
0.370000	39.6	20.0	9.000	GN	20.3	18.9	58.5	
0.402000	40.5	20.0	9.000	GN	20.4	17.3	57.8	
0.418000	40.2	20.0	9.000	GN	20.3	17.3	57.5	
0.470000	34.3	20.0	9.000	GN	20.4	22.2	56.5	
0.574000	33.5	20.0	9.000	GN	20.3	22.5	56.0	
0.626000	34.5	20.0	9.000	GN	20.3	21.5	56.0	
0.778000	41.4	20.0	9.000	GN	20.3	14.6	56.0	
1.550000	39.8	20.0	9.000	GN	20.4	16.2	56.0	
2.242000	27.6	20.0	9.000	GN	20.5	28.4	56.0	
4.946000	38.6	20.0	9.000	GN	20.6	17.4	56.0	
6.250000	36.0	20.0	9.000	GN	20.6	24.0	60.0	
11.958000	25.6	20.0	9.000	GN	20.8	34.4	60.0	
27.338000	28.3	20.0	9.000	GN	21.4	31.7	60.0	

Final Result 2

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.158000	26.0	20.0	9.000	GN	20.3	29.6	55.6	
0.262000	22.9	20.0	9.000	GN	20.3	28.5	51.4	
0.518000	13.9	20.0	9.000	GN	20.4	32.1	46.0	
0.610000	38.6	20.0	9.000	GN	20.3	7.4	46.0	
0.706000	36.8	20.0	9.000	GN	20.3	9.2	46.0	
0.774000	15.6	20.0	9.000	GN	20.3	30.4	46.0	
0.814000	34.9	20.0	9.000	GN	20.3	11.1	46.0	
0.870000	39.1	20.0	9.000	GN	20.3	6.9	46.0	
1.030000	19.9	20.0	9.000	GN	20.4	26.1	46.0	
1.550000	23.8	20.0	9.000	GN	20.4	22.2	46.0	
3.190000	13.8	20.0	9.000	GN	20.5	32.2	46.0	
4.946000	28.8	20.0	9.000	GN	20.6	17.2	46.0	
6.142000	29.8	20.0	9.000	GN	20.6	20.2	50.0	
12.610000	18.9	20.0	9.000	GN	20.8	31.1	50.0	
25.874000	24.6	20.0	9.000	GN	21.4	25.4	50.0	



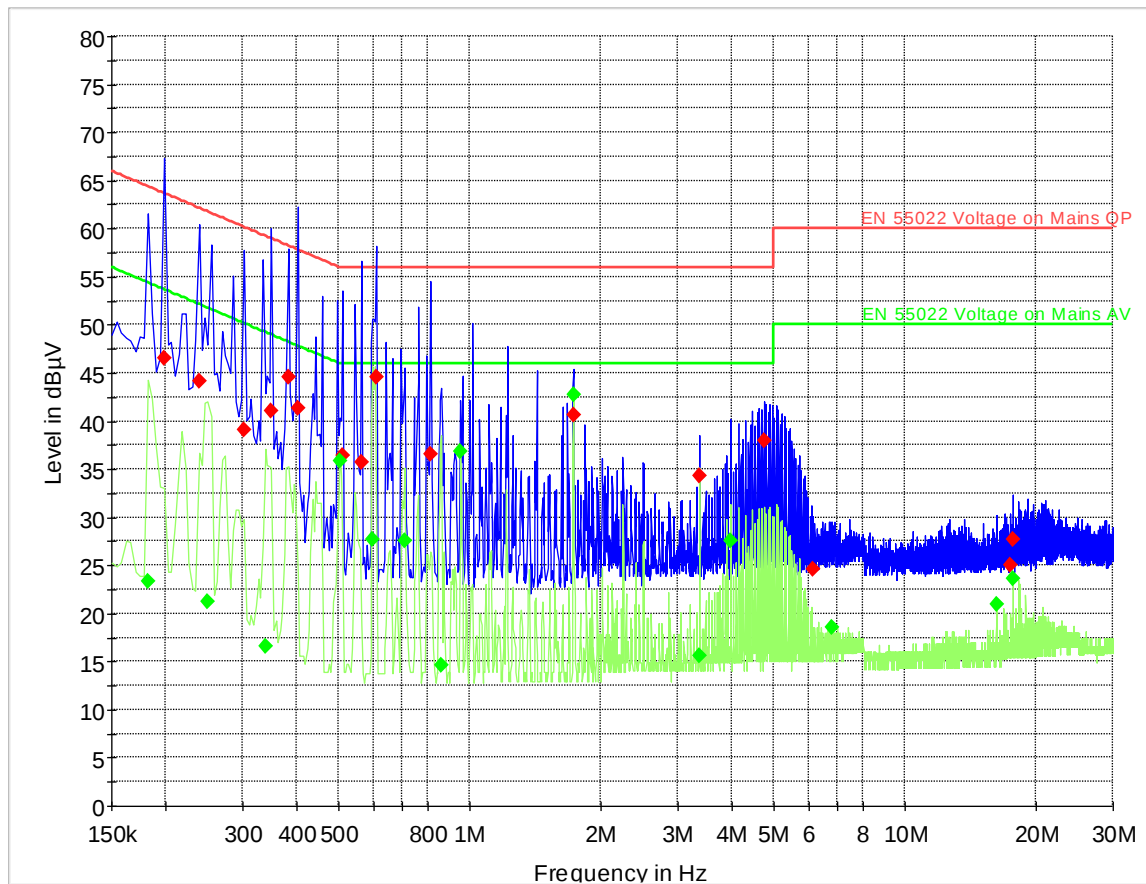
— EN 55022 Voltage on Mains QP.LimitLine — EN 55022 Voltage on Mains AV.LimitLine
— Preview Result 1 — Preview Result 2
◆ Final Result 1 ◆ Final Result 2

1900 TX Mode: L2**Final Result 1**

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.198000	46.5	20.0	9.000	GN	20.3	17.2	63.7	
0.238000	44.1	20.0	9.000	GN	20.3	18.1	62.2	
0.302000	39.1	20.0	9.000	GN	20.3	21.1	60.2	
0.350000	41.0	20.0	9.000	GN	20.3	18.0	59.0	
0.382000	44.6	20.0	9.000	GN	20.3	13.6	58.2	
0.402000	41.3	20.0	9.000	GN	20.4	16.5	57.8	
0.510000	36.4	20.0	9.000	GN	20.4	19.6	56.0	
0.562000	35.6	20.0	9.000	GN	20.3	20.4	56.0	
0.610000	44.6	20.0	9.000	GN	20.3	11.4	56.0	
0.810000	36.5	20.0	9.000	GN	20.3	19.5	56.0	
1.726000	40.7	20.0	9.000	GN	20.4	15.3	56.0	
3.362000	34.3	20.0	9.000	GN	20.5	21.7	56.0	
4.730000	37.9	20.0	9.000	GN	20.6	18.1	56.0	
6.142000	24.6	20.0	9.000	GN	20.6	35.4	60.0	
17.390000	25.0	20.0	9.000	GN	21.0	35.0	60.0	
17.694000	27.7	20.0	9.000	GN	21.0	32.3	60.0	

Final Result 2

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.182000	23.3	20.0	9.000	GN	20.3	31.1	54.4	
0.250000	21.2	20.0	9.000	GN	20.3	30.6	51.8	
0.338000	16.5	20.0	9.000	GN	20.3	32.8	49.3	
0.502000	35.8	20.0	9.000	GN	20.4	10.2	46.0	
0.598000	27.7	20.0	9.000	GN	20.3	18.3	46.0	
0.706000	27.6	20.0	9.000	GN	20.3	18.4	46.0	
0.858000	14.6	20.0	9.000	GN	20.3	31.4	46.0	
0.950000	36.9	20.0	9.000	GN	20.3	9.1	46.0	
1.726000	42.8	20.0	9.000	GN	20.4	3.2	46.0	
3.362000	15.5	20.0	9.000	GN	20.5	30.5	46.0	
3.966000	27.5	20.0	9.000	GN	20.5	18.5	46.0	
6.794000	18.6	20.0	9.000	GN	20.6	31.4	50.0	
16.226000	20.9	20.0	9.000	GN	20.9	29.1	50.0	
17.694000	23.6	20.0	9.000	GN	21.0	26.4	50.0	



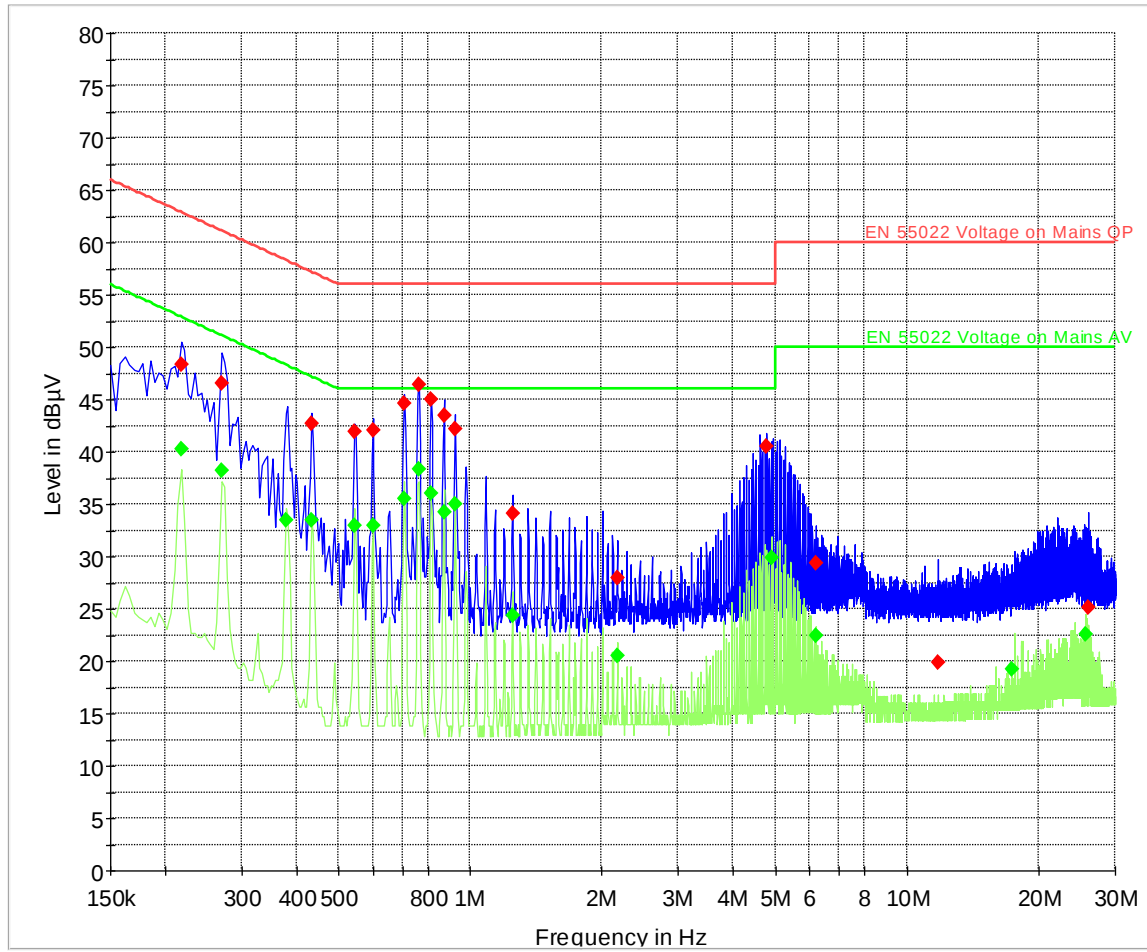
— EN 55022 Voltage on Mains QP.LimitLine	— EN 55022 Voltage on Mains AV.LimitLine
— Preview Result 1	— Preview Result 2
◆ Final Result 1	◆ Final Result 2

1900 TX Mode: Neutral**Final Result 1**

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.218000	48.3	20.0	9.000	GN	20.3	14.6	62.9	
0.270000	46.5	20.0	9.000	GN	20.3	14.6	61.1	
0.434000	42.7	20.0	9.000	GN	20.3	14.5	57.2	
0.542000	41.9	20.0	9.000	GN	20.3	14.1	56.0	
0.598000	42.0	20.0	9.000	GN	20.3	14.0	56.0	
0.706000	44.6	20.0	9.000	GN	20.3	11.4	56.0	
0.762000	46.4	20.0	9.000	GN	20.3	9.6	56.0	
0.814000	45.0	20.0	9.000	GN	20.3	11.0	56.0	
0.870000	43.4	20.0	9.000	GN	20.3	12.6	56.0	
0.922000	42.2	20.0	9.000	GN	20.3	13.8	56.0	
1.250000	34.1	20.0	9.000	GN	20.4	21.9	56.0	
2.174000	28.0	20.0	9.000	GN	20.5	28.0	56.0	
4.782000	40.5	20.0	9.000	GN	20.6	15.5	56.0	
6.194000	29.4	20.0	9.000	GN	20.6	30.6	60.0	
11.790000	19.9	20.0	9.000	GN	20.8	40.1	60.0	
26.086000	25.1	20.0	9.000	GN	21.4	34.9	60.0	

Final Result 2

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.218000	40.2	20.0	9.000	GN	20.3	12.7	52.9	
0.270000	38.2	20.0	9.000	GN	20.3	12.9	51.1	
0.378000	33.5	20.0	9.000	GN	20.3	14.8	48.3	
0.434000	33.4	20.0	9.000	GN	20.3	13.8	47.2	
0.542000	33.0	20.0	9.000	GN	20.3	13.0	46.0	
0.598000	33.0	20.0	9.000	GN	20.3	13.0	46.0	
0.706000	35.6	20.0	9.000	GN	20.3	10.4	46.0	
0.762000	38.3	20.0	9.000	GN	20.3	7.7	46.0	
0.814000	36.0	20.0	9.000	GN	20.3	10.0	46.0	
0.870000	34.2	20.0	9.000	GN	20.3	11.8	46.0	
0.922000	35.0	20.0	9.000	GN	20.3	11.0	46.0	
1.250000	24.4	20.0	9.000	GN	20.4	21.6	46.0	
2.174000	20.5	20.0	9.000	GN	20.5	25.5	46.0	
4.890000	29.8	20.0	9.000	GN	20.6	16.2	46.0	
6.194000	22.4	20.0	9.000	GN	20.6	27.6	50.0	
17.390000	19.3	20.0	9.000	GN	21.0	30.7	50.0	
25.646000	22.5	20.0	9.000	GN	21.4	27.5	50.0	

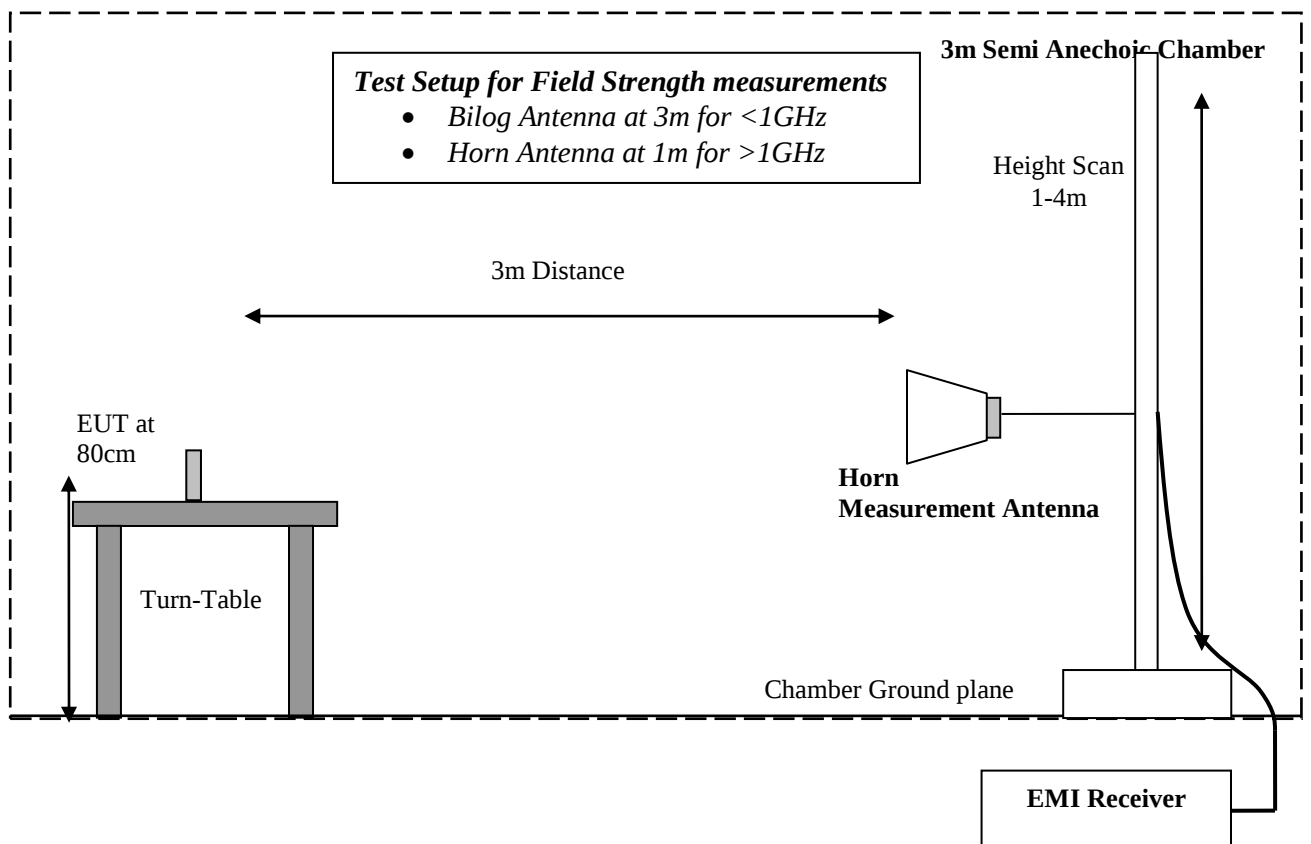
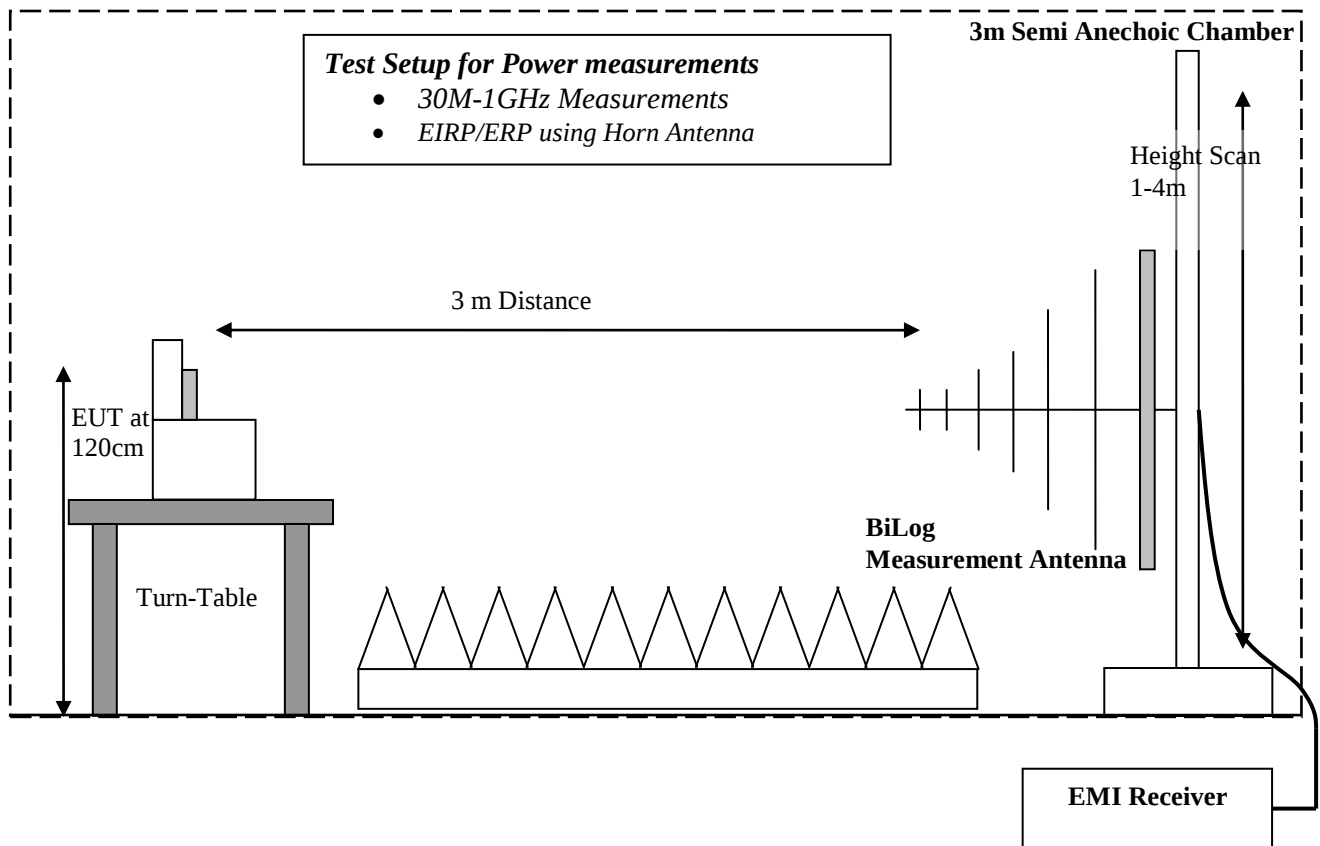


— EN 55022 Voltage on Mains QP.LimitLine	— EN 55022 Voltage on Mains AV.LimitLine
— Preview Result 1	— Preview Result 2
◆ Final Result 1	◆ Final Result 2

7 Test Equipment and Ancillaries used for tests

Instrument/Ancillary	Model	Manufacturer	Serial No.	Cal Date	Cal Interval
Radio Communication Tester	CMU 200	Rohde & Schwarz	111629	Sept 2010	1 year
EMI Receiver/Analyzer	ESIB 40	Rohde & Schwarz	100107	May 2010	1 year
Spectrum Analyzer	FSU	Rohde & Schwarz	200302	Jul 2010	1 year
Loop Antenna	6512	EMCO	00049838	April 2009	2 years
Biconilog Antenna	3141	EMCO	0005-1186	June 2009	2 years
Horn Antenna (1-18GHz)	3115	ETS	00035111	Jan 2009	3 years
Horn Antenna (18-40GHz)	3116	ETS	00070497	Jan 2009	3 years
Communication Antenna	IBP5-900/1940	Kathrein	n/a	n/a	n/a
High Pass Filter	5HC2700	Trilithic Inc.	9926013	Part of system calibration	
High Pass Filter	4HC1600	Trilithic Inc.	9922307	Part of system calibration	
6GHz High Pass Filter	HPM50106	Microtronics	001	Part of system calibration	
Pre-Amplifier	JS4-00102600	Miteq	00616	Part of system calibration	
LISN	50/250-32-4	FCC	05005	Oct 2010	1 year
Power Smart Sensor	R&S	NRP-Z81	100161	June 2010	1 Year
DC Power Supply	E3610A	Hewlett Packard	KR83021224	n/a	n/a
Multimeter	179	Fluke	N/A	Feb 2010	1 Year
Temp Hum Logger	TM320	Dickson	03280063	Feb 2010	1 Year
Temp Hum Logger	TM325	Dickson	5285354	Feb 2010	1 Year

8 Block Diagrams



9 Revision History

Date	Report Name	Changes to report	Report prepared by
2010-12-06	EMC_ECHEL_002_10001_FCC22_24	First Version	S Jose
2010-12-09	EMC_ECHEL_002_10001_FCC22_24_Rev1	Retest ERP//EIRP	S Jose